ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
Davangere University

ಗಣಕ ವಿಜ್ಞಾನ ವಿಭಾಗ
DEPARTMENT OF STUDIES IN COMPUTER SCIENCE

Course Structure and Syllabus(CBCS) of

M.Sc in Computer Science

(W.E.F 2020-21 and onwards)

2020-21

(Online) Date: 15-09-2020

Proceedings of the Bos Meeting

The Bos Meeting in computer science (P.G) for the academic year 2020-2021 was held on 15.09.2020 and the following resolutions were made.

1. The course structre and syllabus of M.Voc in cyber Security, M.Sc in computer Science, and Master in computer Application (MCA) was discused and approved. The Question Paper Pattern are finalized as Per the regulations of the University and resolved to accpt the same. Feedbacks on curriculum: were incorporated

2. Panel of BOE for M.Voc, M.Sc and MCA has been approved.

3. The list of Examiners (M.Voc, M.Sc & MCA) has been updated and approved.

4. As for the Ph.D regulations of our University Ph.d in computer science course structre and syllabus were discused and approved the same.

5. The board has decided to introduce an value Added course for PG computer Science, and course name is "IOT: challenges Advances and Applications." The Subject code is IOTCAA1

6. Detoled feedback discussion done on curriculum: Elective and terending subjects like AI, IOT, has to be incorporated.

Members Present

Sl No	Name and Address	composition of BoS	signature
01.	Dr. Basavanna. M. Associate Professor and research in computer Science Davangere University Davangere	chairman.	
02.	Dr. chandrakant Naikodi, Associate Professor Dept of Studies and research in computer Science Davangere University Davangere.	Member.	Naikodi
03.	Dr. Parashuram Bani gidad, Department of computer science RCU Belagavi	Member.	online Present
04	Dr. M. Bavikumar Associate Professor Dept of computer Science Kuvempu University Jnanasahadri: Shankara gatta. Shivamoga-577451	Member.	online Present

05	Mr. Kumarsiddamallappa.V. Assistant Professor Dept of Studies and Research in computer science Davangere University Davangere	Member.	
06.	Mr. Vinay. S. Assistant Professor Dept of Studies & Research in computer Science Davangere University Davangere	Member.	16/09/2020
07.	Dr. Harish omkarappa. Technology analist Boeing India Private Ltd Bangalore.	corporate Sector Representative	online present
08.	Sr: Prashanth G.R. Team lead KLAVE IT solutions Private Ltd. #07.	Postgraduate Meritorious alummus	online present
09.	D.S Maheswara Prasad, Director Info Institute of computer Education. Mysore	Member. (M.CM, B.VOC & M.VOC)	online present

Chairman 15/9/20
DOS in Computer Science
Davangere University,
Shivagangotri, Davangere-07.

M.Sc in COMPUTER SCIENCE
Course Structure- W.E.F 2020-2021

Semester	Subject/Paper Code	Title of the Paper	Instruction Hrs./week	Marks				Credits	Examatination duration (Hrs.)
				Type	Examination	Internal Assessment	Total Marks		
SEMESTER-I	CORE PAPERS								
	20CSCA01	Advanced Data Structures	4	DSC	70	30	100	4	3
	20CSCA02	Analysis & Design of Algorithms	4	DSC	70	30	100	4	3
	20CSCA03	Data Structures Lab using C	8	DSC	80	20	100	4	3
	20CSCA04	Analysis & Design of Algorithms Lab using C++	8	DSC	80	20	100	4	3
	ELECTIVE PAPERS (Students are permitted to choose any **two** of the following)								
	20CSCA05	Discrete Mathematics	4	DSE	70	30	100	4	3
	20CSCA06	Computer Architecture	4	DSE	70	30	100	4	3
	20CSCA07	Information Secutity and Cyber Laws	4	DSE	70	30	100	4	3
	20CSCA08	Computer Graphics	4	DSE	70	30	100	4	3
	Mandatory Credits: English Language Communication Skill		2		--	--	--	2	--

NOTE: Total number of credits for the semester: 24+ 2(MC)=26

Semester	Subject/Paper Code	Title of the Paper	Instruction Hrs./week	Type	Marks			Credits	Examatination duration (Hrs.)
					Examination	Internal Assessment	Total Marks		
SEMESTER-II	CORE PAPERS								
	20CSCB01	Operating Systems	4	DSC	70	30	100	4	3
	20CSCB02	RDBMS	4	DSC	70	30	100	4	3
	20CSCB03	Operating System and Shell Programming Lab	8	DSC	80	20	100	4	3
	20CSCB04	RDBMS Lab	8	DSC	80	20	100	4	3
	Mandatory Credits: Computer Skill		2	--	--	--		2	--
	ELECTIVE PAPERS (Students are permitted to choose any **two** of the following)								
	20CSCB05	Digital Communication and Computer Networks	4	DSE	70	30	100	4	3
	20CSCB06	Internet of Things	4	DSE	70	30	100	4	3
	20CSCB07	Artificial Nueral Network	4	DSE	70	30	100	4	3
	20CSCB08	Mobile Computing	4	DSE	70	30	100	4	3

NOTE: Total number of credits for the semester: 24+ 2(MC)=26

Semester	Subject/Paper Code	Title of the Paper	Instruction Hrs./week	Marks				Credits	Examatination duration (Hrs.)
				Type	Examination	Internal Assessment	Total Marks		
SEMESTER-III		CORE PAPERS							
	20CSCC01	Advanced Java Programming	4	DSC	70	30	100	4	3
	20CSCC02	Bigdata Analytics	4	DSC	70	30	100	4	3
	20CSCC03	Advanced Java Lab	8	DSC	80	20	100	4	3
	20CSCC04	Bigdata Analytics Lab	8	DSC	80	20	100	4	3
	20CSCC05	Interdisciplinary/Elective Computer Fundamentals	2	DSC	40	10	50	2	2
		ELECTIVE PAPERS (Students are permitted to choose any **two** of the following)							
	20CSCC06	Software Engineering	4	DSE	70	30	100	4	3
	20CSCC07	Multimedia and Web Technology	4	DSE	70	30	100	4	3
	20CSCC08	R-Programming	4	DSE	70	30	100	4	3
	20CSCC09	Internet-Technologies	4	DSE	70	30	100	4	3

NOTE: Total number of credits for the semester: 24 + 2(IE) =26

Semester	Subject/Paper Code	Title of the Paper	Instruction Hrs./week	Marks				Credits	Examatination duration (Hrs.)
				Type	Examination	Internal Assessment	Total Marks		
SEMESTER-IV		**CORE PAPERS**							
	20CSCD01	Digital Image Processing	4	DSC	70	30	100	4	3
	20CSCD02	Research Methodology	4	DSC	70	30	100	4	3
	20CSCD03	Digital Image Processing Lab	8	DSC	80	20	100	4	3
	20CSCD04	Major Project	16	DSC	120	30	150	8	3
		ELECTIVE PAPERS (Students are permitted to choose any **one** of the following)							
	20CSCD05	Theory of Computation	4	DSE	70	30	100	4	3
	20CSCD06	Machine Learning	4	DSE	70	30	100	4	3
	20CSCD07	Pattern Recognition	4	DSE	70	30	100	4	3
		Industrial Visit	-	-	-	-	-	-	-
	Mondatory Credits: Personality Development		2	--	--	--	--	2	--
	Total Credits for the Course		140	-	-	-	2400	104	-

NOTE: Total number of credits for the semester: : 24 + 2(MC) =26

Total Credits Per Course: 104

Davangere University
Department of Studies in Computer Science
The Courses in the 2020-21 (CBCS) syllabus based on Skill Sets, Employability and Entrepreneurship.
Program Name: MSc in Computer Science

S. No.	Course	Is it skill based / Employability / Entrepreneurship?	Outcome of the course for potential skills, employability and entrepreneurship
1	20CSCA01: Advanced Data Structures	Skill development	After completion of ***Advanced Data Structures*** course, the students will have enhanced programming knowledge to implement efficient software applications.
2	20CSCA02: Analysis and Design of Algorithms	Skill development and Employability	After completion of ***Analysis and Design of Algorithms*** course, the students will have enhanced Analysis skills of Algorithms to implement any software applications.
3	20CSCA06:Computer Architecture	Employability and Entrepreneurship	After completion of ***Computer Architecture*** course, the students will have sustainable employability and entrepreneurship knowledge on software applications.
4	20CSCA08: Computer Graphics	Skill development	After completion of ***Computer Graphics*** course, the students will have graphical skills using a computer language to implement UI software applications.
5	20CSCB01 : Operating Systems	Skill development	After completion of ***Operating Systems*** course, the students will have complete knowledge on OS and its working principles.
6	20CSCB02: RDBMS	Skill development and Employability	After completion of ***RDBMS*** course, the students will have DBA opportunities and data base skills to implement back end repositories.

7	20CSCB06:Internet of Things	Employability and Entrepreneurship	After completion of ***IoT*** course, the students will have sustainable employability and entrepreneurship knowledge on IoT hardware cum software applications.
8	20CSCC06: Advanced Java Programming	Skill development and Employability	After completion of ***Advanced Java Programming*** course, the students will have enhanced skill son Java Programming to implement software applications(Mobile/Desktop apps).
9	20CSCC07:Multimedia and Web Technology	Skill development and Employability	After completion of ***Multimedia and Web Technology*** course, the students will have web design and implementation skills and self employability.
10	20CSCC08: R-Programming	Skill development and Employability	After completion of ***R-Programming*** course, the students will have enhanced skills on R-Programming to implement software applications.
11	20CSCD01: Digital Image Processing	Skill development	After completion of ***Digital Image Processing*** course, the students will have Image Processing and research skills to work on Images/figures.
12	20CSD06: Machine Learning	Skill development	After completion of ***Machine Learning*** course, the students will have Data Science/Machine Learning skills and opportunities.

COURSE OBJECTIVES:

M.Sc. in **Computer Science** is a two-year post-graduate programme with the **objective** to develop human resources with core competence in various thrust areas of **Computer Science**. The programme includes software engineering, system development, natural computation, mathematical foundations and artificial intelligence.

- Graduates will acquire the knowledge about the current technology, trends, tools, theory of Computer Science and software development concepts to develop applications and to identify the potential problems where creative computer-based solutions can be applied to solve the problems.
- Graduates will be successful software professionals in IT industry capable of assimilating new information and understanding newer technology and its application domain to provide efficient and effective software solutions wherever possible.
- Graduates will inculcate the skills of communicating proficiently and collaborate successfully with peers, colleagues and organizations for higher studies, research and entrepreneurship to create new applications for the betterment of the society and their better future.

OUTCOME BASED LEARNING:

PROFESSIONAL DEVELOPMENT: To train the students to acquire knowledge in their chosen programme and apply professionally and ethically with responsibility towards the need of the society

CORE PROFICIENCY: To expertise the students to organize, understand, evaluate, and solve problems by providing hands on experience through modern tools necessary for practice.

TECHNICAL ACCOMPLISHMENTS: To equip the students with the talent to interpret in core applications by building up a multidisciplinary concept.

PROFESSIONALISM: Inculcating professional behavior, strong ethical values, innovative research capabilities and leadership abilities.

LEARNING ENVIRONMENT: To provide quality learning experiences through effective classroom practices, active learning styles of teaching, and opportunities for meaningful interaction between students and faculty.

COURSE OUTCOME:

After successful completion of M.Sc. Computer Science degree, the graduates will be able to:

- Apply the knowledge of Computer Science, Mathematics, Statistics and computing fundamentals to design and develop applications to provide creative solutions to various real life applications.
- Integrate and apply efficiently the contemporary IT tools and design applications with appropriate considerations for any specific need on societal and environmental aspects.
- Involve in perennial learning for a continued career development and progress as a computer professional upholding the ethics, social, cultural and cyber regulations.

- Function effectively both as a team leader and team member on multi-disciplinary projects to demonstrate computing and management skills and also to effectively present technical information in oral and written reports.
- Apply the inherent skills with absolute focus to function as a successful entrepreneur.

SPECIFIC OBJECTIVES OF THE PROGRAMME:

- Understand the concepts and applications in the field of Computing Sciences like Web designing and development, Mobile application development, and Network and communication technologies.
- Apply the learning from the courses and develop applications for real world problems.
- Understand the technological developments in the usage of modern design and development tools to analyze and design for a variety of applications.
- Communicate in both oral and written forms, demonstrating the practice of professional ethics and the concerns for social welfare.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
I Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCA01		**Max Marks: 100**
Subject Name:Advanced Data Structures		

Course Outcome:

- Understand the importance of various types of data structures in solving a problem through programming.
- Able to identify the suitability of a particular data structure to solve a problem.
- Critically evaluate the efficient representation of data structures in the memory.
- Elucidate the various operations performed on a particular data structure.
- Understand the importance of indexing and how it is achieved through a particular data structure.

UNIT I **16Hrs**

Data Structures: Arrays and their Applications; Sparse Matrix, Stacks, Queues, Priority Queues, Linked Lists, Trees, Forest, Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree, B Tree, B+ Tree, B* Tree, Data Structure for Sets, Graphs, Sorting and Searching Algorithms; Hashing.

UNIT II **16Hrs**

Performance Analysis of Algorithms and Recurrences: Time and Space Complexities; Asymptotic Notation, Recurrence Relations.

Design Techniques: Divide and Conquer; Dynamic Programming, Greedy Algorithms, Backtracking, Branch and Bound.

UNIT III **16Hrs**

Lower Bound Theory: Comparison Trees, Lower Bounds through Reductions.

Graph Algorithms: Breadth-First Search, Depth-First Search, Shortest Paths, Maximum Flow, Minimum Spanning Trees.

Complexity Theory: P and NP Class Problems; NP-completeness and Reducibility.

UNIT IV **16Hrs**

Selected Topics: Number Theoretic Algorithms, Polynomial Arithmetic, Fast Fourier Transform, String Matching Algorithms.

Advanced Algorithms: Parallel Algorithms for Sorting, Searching and Merging, Approximation Algorithms, Randomized Algorithms.

Text Books:

1. Andrew Tanenbaum: Data Structures and Algorithms, 2nd Edition, 2006
2. Trembley and Sorenson: “An Introduction to Data Structures, with Applications” McGraw Hill

References:

1. Horowitz and Sahni: “Data Structures” SBCS Publication.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
I Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCA02		**Max Marks: 100**

Subject Name: Analysis and Design of Algorithms

Course Outcome:

- Understand the importance of various types of Algorithms in solving a problem through programming.
- Describe computational solution to well known problems like searching, sorting etc.
- Estimate the computational complexity of different algorithms.
- Develop an algorithm using appropriate design strategies for problem solving.
- Understand the Dynamic Programming and Backtracking.

UNIT I **16Hrs**

Algorithms: Algorithms, Structured algorithms, analysis of algorithms, time and space complexity, Trade off, Asymptotic complexity, Review of Stack, queues, recursion, Heap and Heap sort, Hashing.

UNIT II **16Hrs**

Divide and Conquer and Greedy Method:General method, binary search, maximum and minim. Merge sort, quick sort. General method, optimal storage on tapes, knapsack problems, job sequencing, optimal merge pattern, single source shortest paths.

UNIT III **16Hrs**

Dynamic Programming: The General Method, Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths Problem, Single-Source Shortest Paths: General Weights, 0/1 Knapsack, The Traveling Salesperson problem.

UNIT IV **16Hrs**

Backtracking and Branch-and-Bound: 8-Queens problem, Hamiltonian Circuit Problem, Subset – Sum Problem. Assignment Problem, Knapsack Problem, Traveling Salesperson Problem. Approximation Algorithms for NP-Hard Problems – Traveling Salesperson Problem, Knapsack Problem.

Text Books:

1.Horrowitz sahani, "Fundamentals of Computer Algorithms", Golgotia publications 1985.

References:

1.Coremen T. H., Leiserson C.E., and Revest R. L.: "Introduction to Algorithgms", PHI,1998

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 8 hrs./week**	**Exam Marks: 80**
I Semester	**Credits: 04 Hrs.:128**	**I. A. Marks: 20**
Subject Code: 20CSCA03		**Max Marks: 100**
Subject Name: Data Structures Lab using C		

Course outcomes:

On the completion of this laboratory course, the students will be able to:

- Analyze and Compare various linear and non-linear data structures.
- Demonstrate the working nature of different types of data structures and their applications.
- Develop, analyze and evaluate the searching and sorting algorithms.
- Choose the appropriate data structure for solving real world problems.

Note:

1. **Laboratory programs should be conducted as per the respective theory syllabus.**
2. **Minimum number of programs should be 24 among that 12 programs from PART- A & 12 progrms from PART-B.**

Course : M.Sc(CS)	**Teaching: 8 hrs./week**	**Exam Marks: 80**
I Semester	**Credits: 04 Hrs.:128**	**I. A. Marks: 20**
Subject Code: 20CSCA04		**Max Marks: 100**
Subject Name: Analysis And Design Of Algorithms lab using C++		

Course outcomes:

On the completion of this laboratory course, the students will be able to:

- Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
- Develop variety of algorithms such as sorting, graph related, combinatorial, etc., in a high level language.
- Analyze and compare the performance of algorithms using language features.
- Apply and implement learned algorithm design techniques and data structuresto solve realworld problems.

Note:

1. **Laboratory programs should be conducted as per the respective theory syllabus.**
2. **Minimum number of programs should be 24 among that 12 programs from PART- A & 12 progrms from PART-B.**

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
I Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCA05		**Max Marks: 100**
Subject Name: Discrete Mathematics		

Course outcomes:

- Make use of propositional and predicate logic in knowledge representation and truth verification.
- Demonstrate the application of discrete structures in different fields of computer science.
- Solve problems using recurrence relations and generating functions.
- Apply different mathematical proofs, techniques in proving theorems.
- Compare graphs, trees and their applications.

UNIT I **16Hrs**

Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. Fundamentals of Logic contd.: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems.

UNIT II **16Hrs**

Properties of the Integers:The Well Ordering Principle – Mathematical Induction, Fundamental**..**Principles of Counting:The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition

UNIT III **16Hrs**

Relations and Functions:Cartesian Products and Relations, Functions – Plain and One-toOne, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions

Relations:Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.

UNIT IV **16Hrs**

Recurrence Relations**:**First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients.

Introduction to Graph Theory:Definitions and Examples, Sub graphs, Complements, and Graph Isomorphism.

Text Books:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education. 2004.
2. Kenneth H. Rosen, Discrete Mathematics and its Applications, 5/e, Tata McGraw Hill.

References:

1. Basavaraj S Anami and Venakanna S Madalli: Discrete Mathematics – A Concept based approach, Universities Press, 2016
2. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010.
3. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Thomson, 2004.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
I Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCA06		**Max Marks: 100**
Subject Name: Computer Architecture		

Course outcomes:

- Explain the basic organization of a computer system.
- Demonstrate functioning of different sub systems, such as processor, Input/output, and memory.
- Illustrate hardwired control and micro programmed control. pipelining, embedded and other computing systems.
- Build simple arithmetic and logical units.

UNIT I **16Hrs**

I/O Processors, Arithmetic Processors and BUS architecture.

Input and Output port, serial Data transfers Schemes, signal chip micro Computers and Embedded microprocessors, digital signal processors, I/O processors, Arithmetic processors. Introductions to BUS, ISA bus, EISA bus, PCI bus, AGP, USB

UNIT II **16Hrs**

PROCESSORS AND MEMORY HIERARCHY

Processor technology-processors and co-processors, instruction set architectures, representative CISC processor, representative RISC processor, super scalar processor. Memory technology-Inclusion-coherence and locality, cache memory organization, cache addressing modes, direct mapping and associative caches, set-associative caches shared memory organization-intellectual memory.

UNIT III **16Hrs**

INTRODUCTION TO PARALLEL PROCESSING AND PIPELINING

Trends towards parallel processing, parallelism in uniprocessor system, linear pipeline processors synchronous and asynchronous models, instruction pipeline design-mechanisms for instruction pipelining.

UNIT IV **16Hrs**

Parallel computer structures-pipeline computers, array processor, multiprocessor system, Flynn's computer architectural classification, parallel processing applications

Text Books:

1. Computer system architecture -Morris Mano
2. Computer Architecture and Parallel Processing – Kai Hwang

Reference:

1. Parallel computers – Architecture and Programming – V. Rajaraman.
2. Parallel computers Architecture. A Hardware/Software Approach-David E. Culler, J P Singh, A Gupta

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
I Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCA07		**Max Marks: 100**
Subject Name: Information Secutity and Cyber Laws		

Course outcomes:

- Understand the Cyber Security concepts and it's applications in the field of computer science. Understand the crime issues and study about the secured communication.
- Discuss the cryptography and its need to various applications
- Design and Develop simple cryptography algorithms
- Understand the cyber security and need cyber Law.

UNIT I **16Hrs**

Introduction to Cybercrime and Laws Introduction, Cybercrime: Definition and Origins of the word, Cybercrime andinformation Security, Who are Cybercriminals? Classifications of Cybercrimes.How Criminals Plan Them – Introduction, How Criminals Plan the Attacks, Cybercafeand Cybercrimes, Botnets, Attack Vector, The Indian IT ACT 2000. Tools and Methods used in Cybercrime Introduction, Proxy Server and Anonymizers, Password Cracking, Keyloggers and Spyware,Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQLinjection, Buffer Overflow.

UNIT II **16Hrs**

Introduction to Information Security: Introduction; security, Critical characteristics of information; NSTISSC security model; Approaches to information security implementation; The Security System Development Life Cycle; Information Security Terminology. Planning for Security: Introduction; Information Security Policy, Standards, and Practices; The Information Security Blue Print.

UNIT III **16Hrs**

Security Technology: Firewalls and VPNs: Introduction, Physical design, Firewalls, Protecting Remote Connections. Intrusion Detection, Access control and Other Security Tools: Introduction; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools; Access Control Devices. Information Security maintenance: Introduction; Security Management Models; The Maintenance Model.

UNIT IV **16Hrs**

Evolution of the IT Act, Genesis and Necessity, Various authorities under IT Act and their, powers. ; Penalties & Offences, amendments. Impact on other related Acts (Amendments), Cyber Space Jurisdiction, E – commerce and Laws in India, Intellectual Property Rights, Domain Names and Trademark Disputes.

Text Books:

1. **Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication McGraw Hill. (Chapters: 2, 7, 8, 11)**
2. **Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and SunitBelpure, Publication Wiley.**
3. **Michael E. Whitman and Herbert J. Mattord: "Principles of Information Security", 4th Edition, Thomson, 2012.**
4. **William Stallings: "Network Security Essentials Applications and Standards", 4th edition, Person Education, 2012.**

References:

1. Marjie T. Britz - Computer Forensics and Cyber Crime: An Introduction - Pearson
2. Chwan-Hwa (John) Wu,J. David Irwin - Introduction to Computer Networks and Cyber security - CRC Pres
3. Behrouz a Forouzan, Debdeep Mukhopadhyay: "Cryptography and Network Security", 2nd edition, Tata McGraw-Hill, 2011.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 80**
I Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 20**
Subject Code: 20CSCA08		**Max Marks: 100**

Subject Name: Computer Graphics

Course Outcomes:

- Understand the basic concepts of computer graphics.
- Learn the implementation of algorithms to draw a line, circle, polygon, colour the objects, clipping the text and the object.
- Understand and implement the algorithms for 2D and 3D transformations.
- Learn the importance of viewing and projections.
- Understand the fundamentals of animation, virtual reality and its related technologies.

UNIT I **16Hrs**

Introduction:

Video Display devices, Refresh Cathode ray tubes, Raster scan display, random scan displays, CRT, Flat panel displays, plasma panel, Input devices.

UNIT II **16Hrs**

Output primitives

Points & lines, line drawing algorithms, loading the frame buffer, line function, Circle generating algorithms. Two dimensional transformations Basic & other transformations, Matrix representations, Homogeneous coordinates Composite transformations. Three dimensional transformations, composite transformation, modeling & co-ordinate transformations, projections.

UNIT III **16Hrs**

Graphical User interface & interactive input methods

The user dialogue, Windows & icons, feedback, Interactive picture Construction techniques, Basic positioning methods, Constraints, grids, Gravity field, Rubber band methods, Dragging, Painting & drawing.

UNIT IV **16Hrs**

Curves & Surfaces

Properties, Bezier curves properties, Design techniques, Bezier surfaces, Displaying curves & surfaces. Hidden line removal algorithms, Introduction to fractals. Windowing & Clipping operations, Line clipping algorithms, point clipping, text clipping, polygon clipping algorithms, Exterior clipping.

References:

1. W.M.Newman and Robert Sproull" Principles of Interactive Computer Graphics" McGraw Hill 1989 Edward Angel
2. "Interactive Computer Graphics", Pearson education Steven Harrington.
3. "Computer Graphics a Programming Approach" McGraw Hill 1987.
4. Roy A Plastock and Gardon Kelley." Schaums outline of theory and problems of Computer Graphics" 2nd printing 1987, 1986 Edition.
5. David F Frogers and J Alan Adams " Procedural Elements of Computer Graphics" McGraw Hill 2nd edition 1990.
6. James.D.Foley, A Vandam etal "Computer Graphics" Addison Wesley 1997

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
II Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCB01		**Max Marks: 100**
Subject Name: Operating Systems		

Course outcomes:

- Demonstrate need for OS and different types of OS.
- Discuss suitable techniques for management of different resources .
- Illustrate processor, memory, storage and file system commands.
- Explain the different concepts of OS in platform of usage through case studies .

UNIT I **16Hrs**

Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. Process Management Process concept; Process scheduling; Operations on processes; Inter process communication.

UNIT II **16Hrs**

Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.
Deadlocks : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

UNIT III **16Hrs**

Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.
Secondary Storage Structures, Protection: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems.

UNIT IV **16Hrs**

Introduction of UNIX : Introduction, Architecture, Experience the Unix environment, Basic commands ls, cat, cal, date, calendar, who, printf, tty, sty, uname, passwd, echo, tput, bc, script, spell and ispell. The parent-child relationship, pwd, the Home directory, absolute pathnames, using absolute pathnames for a command, cd, mkdir, rmdir, Relative pathnames, The UNIX file system.

Introduction to the Shell: Introduction to Shell Scripting, Shell Scripts, read, Command Line Arguments, Exit Status of a Command, The Logical Operators && and ||, exit, if, and case conditions, expr, sleep and wait, while, until, for, $, @, redirection. The here document, set, trap, Sample Validation and Data Entry Scripts.

Basic File Attributes: Is – l, the –d option, File Permissions, chmod, Security and File Permission, users and groups, security level, changing permission, user masks, changing ownership and group, File Attributes, More file attributes: hard link, symbolic link, umask, find.

Text Books:

1.Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006
2.Your UNIX-The Ultimate Guide, Sumitabha Das, Tata McGraw Hill,

References:

7. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition 2. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013. 3. P.C.P. Bhatt.
8. "Unix Shell Programming", Yashwant Kanetkar.
9. "Beginning Shell Scripting", Eric Foster -Johnson, John C Welch, Micah Anderson, Wrox publication.
10. "Introduction to UNIX" by M G Venkatesh Murthy.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
II Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCB02		**Max Marks: 100**
Subject Name: RDBMS		

Course Outcome

- Understand the significance of databases, types of databases, merits and limitations of different DBMS.
- Explain and apply the concept of normalization for database design.
- Understand and apply concurrency control and transaction processing mechanisms.
- Learn the characteristics implementation of object oriented and distributed database management systems and their architecture.
- Understand the design techniques used in RDBMS, extension techniques in RDBMS, standards for OODBMS, products and applications.

UNIT I **16Hrs**

Introduction and data models: Problem with File-based systems. Introduction to Database and Database Management systems, objectives of database management, Overview of DBMS, Database administrator, Database Designers, End users. Data modelling for a database, abstraction, data integration and data independence. The three-level architecture, components of DBMS, advantages and disadvantages of DBMS. Data associations, data model classification, Entity-Relationship model. Different types of keys(Primary key, Secondary key, Candidate key, Foreign key and Alternate key).

UNIT II **16Hrs**

Rdbms and normalization: The Relational Model: Relational database, relational algebra, relational calculus SQL- Data definition, relational database manipulation using SQL, DDL, DML, DCL, TCL, DQL, views, embedded data manipulation.

Relational Database Design: Anomalies in a database, functional dependency, normalization – 1NF, 2NF, 3NF, BCNF and 4NF. Limitations of 4NF and BCNF. Canonical cover, lossless joins, dependency preservation, multi value dependency and higher normal forms.

UNIT III **16Hrs**

Files, indexing and transaction management: File organization and storage, secondary storage devices, RAID technology, operations in file, heap files and sorted files, hashing techniques, type of single level ordered index, multi-level indexes, B-trees and B+trees, indexes on multiple keys, other types of indexes. Transaction processing, desirable properties of transaction,

UNIT IV **16Hrs**

Recovery management and concurrency control**:** Schedules and recoverability, serializability of schedules concurrency control, locking techniques, time stamp ordering multi version concurrency control, granularity of data items. Database recovery techniques based on deferred up data and immediate updating, shadow pages, ARIES recovery algorithm, database security and authorization, security issue access control based on granting/revoking of privileges, introduction of statistical database security.

Text Books:

1. Bipin C Desai, An Introduction to Database Systems, Galgotia Publications.
2. Elmasri and Navathe, Fundamentals of Database Systems, Addison Wesley

References:

1. Silberschatz A, Korth H.F and Sudarshan S, Database System Concepts, Tata McGraw Hill
2. S K Singh, Database Systems-Concepts, Design and Applications, Pearson Education.
3. Date, C. J., An Introduction to Database Systems, Addison-Wesley.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 8 hrs./week**	**Exam Marks: 80**
II Semester	**Credits: 04 Hrs.: 128**	**I. A. Marks: 20**
Subject Code: 20CSCB03		**Max Marks: 100**

Subject Name: Operating System & Shell Programming Lab

Course outcomes:

On the completion of this laboratory course, the students will be able to:

- Implement different algorithms required for management, scheduling, allocation and communication used in operating system.
- Implement different shell scripts and Unix operating system API's.

Note:

1. **Laboratory programs should be conducted as per the respective theory syllabus.**
2. **Minimum number of programs should be 24 among that 12 programs from PART- A & 12 progrms from PART-B.**

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 8 hrs./week**	**Exam Marks:80**
II Semester	**Credits: 04 Hrs.:128**	**I. A. Marks: 20**
Subject Code: 20CSCB04		**Max Marks: 100**
Subject Name: RDBMS Lab		

Course outcomes:

On the completion of this laboratory course, the students will be able to:

- Use Structured Query Language (SQL) for database Creation and manipulation.
- Demonstrate the working of different concepts of DBMS.
- Implement and test the project developed for an application.

Programs List

PART-A: SQL Programming (Max. Exam Mks. 50)

•Design, develop, and implement the specified queries for the following problems using Oracle/MySQL/MS SQL Server, or any other DBMS under LINUX/Windows environment.
•Create Schema and insert needed records into each table. Add appropriate database constraints.

Program 1: Consider the data base to manage the insurance of a vehicle. The relations with their respective attributes are shown below.

PERSON (DRIVER ID, NAME, ADDRESS)
CAR (REGNO, MODEL, YEAR)
ACCIDENT (REPORTNO,DATE,LOCATION)
OWNS(DRIVERID,REGNO)
PARTICIPATED(DRIVERID,REGNO,REPORTNO,DAMAGEAMOUNT)

Write a query for the following:
A. Create the above tables by properly specifying the primary keys and the foreign key
B. Enter at least five tuples for each relation.
C. Update the damage amount that should be increased by 10%
D. Add a DOB column to Person table.
Query to update the damage amount for the car with a specific register number in the accident with report number between l & 200
F. Query to find the total number of people who owned the cars that were involved in accidents in 2002.
G. Query to find the number of accidents in which cars belonging to a specific model were involved.

Program 2: Consider the following relations for an order processing database application in company.

CUSTOMER (Cust#: int, Cname: siring, City: string)
ORDER (Order #: int, Odate: date, Cust #: int, Ord-Amt: İnt)
ORDER_ITEM (Order#: int, Item#: int, qty: int)

ITEM (Item #: int, Unit Price: int)
SHIPMENT (Order #: int, Warehouse #: int, Ship-Date: date)
WAREHOUSE (Warehouse #: int, City: siring)

Write a query for the following:
A. Create the above tables by properly specifying the primary keys and the foreign key
B. Enter at least five tuples for each relation
C. List the names of all customers having 'n' as the second character.
D. Display the customer name, customer no, city, Odate and Order no who doesnot reside in Bangalore.
E. Display the products details which are ordered from 10-June-2015 to 10-July-2015.
F. Produce a listing: CUSTNAME, NO_OF_ORDERS, AvG_ORDER_AMT, where the middle column is the total number of orders by the customer and the last column is the average order amount for that customer
G. List the Order Number for the orders that were shipped from all the warehouses that the company has in a specific city.
H. Display the products details which are shipped from Davanagere on 10-June-2015.

Program 3: Consider the following database of student enrolment in courses and books adopted for each cours
STUDENT (REGNO:STRING,NAME: STRING, MAJOR: STRING, BDATE: INT)
COURSE (COURSE#: INT , CNAME : STRING , DEPT : STRING)
ENROLL (REGNO: STRING , COURSE#: INT , SEM : INT, MARKS : INT)
BOOK_ADAPTION (COURSE#: INT, SEM: INT, BOOK_ISBN: INT)
TEXT (BOOKISBN: INT, BOOK_TITLE: STRING , PUBLISHER : STRING, AUTHOR: STRING)

Write a query for the following:
A. Create the above tables by properly specifying the primary keys and the foreign key
B. Enter at least five tuples for each relation
C. Add a new text book to the database and make this book to be adopted by some department
D. Produce a list of textbooks in the alphabetic order for courses offered by the 'CS' department that use m than two books
E. List any department that has all its adopted books published by a specific Publisher.
F. Find the number of students for each course
G. List the names and usn of the students of a specific course

Program 4: Implement below programs using procedures, assume required table's data suitably.
A. Write PLSQL program to fetch the name and salary of an employee using explicit cursor
B. Write PLSQL program to fetch employee name and salary of 3 employees
C. Create a cursor which updates the salaries of an employee as follows:
i. If salary<25000 then update the salary to 25000
ii. If salary>=25000 and <50000 then update the salary to 55000
iii. If salary>=50000 and <65000 then update the salary to 70000 and also count the number of records have be updated.

Program 5: Implement below programs using Exceptions, assume required table's data suitably.
i. Write PLSQL program to find the details of an employee and if not found raise user defined exception.
ii. Write PLSQL program to raise an exception when multiple rows selected.

Program 6: Implement below programs using Triggers, assume required table's data suitably.
A. Write PLSQL program to create trigger and raise an error if employee salary is negative.
B. Write PLSQL program on triggers to update the salary.

Program 7: Implement below programs using Cursors, assume required table's data suitably.

A. Write PLSQL program to count total number of company using function.
B. Write PLSQL program to find factorial using recursive function

PART-B: Mini Project (Max. Exam Marks. 30)

- Use Database as backend and Java, PHP, Python, HTML, CSS or any Web technologies or any other similar technologies for front-end.
- All applications must be demonstrated on desktop/laptop as a stand-alone or web based application or Mobile apps on Android/IOS.
- Able to explain and able to add/alter code/tables in the front-end and back-end modules.

Examples of Mini projects are listed below.

1. Library information system for MSc(CS)/MCA.
2. Inventory control system for College Store.
3. Student information system for Academic.
4. Time table development system for Computer Science Department
5. Internal Marks Management System for MSc(CS)/MCA.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
II Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCB05		**Max Marks: 100**
Subject Name:Digital Communication and Computer Networks		

Course Outcomes:

- Understand the data communications system and its components.
- Summarize signal conversions techniques for digital communication.
- Identify and categorize various types of transmission media.
- Understand various analog and digital services for data communication.
- Evaluate bandwidth utilization using multiplexing techniques.
- Implement advanced technique such as Data encoding and Compression for Image processing Applications.

UNIT I **16Hrs**

Introduction: Data Communications, Networks, the internet, protocols and standards, network models – OSI model, TCP/IP protocol suite, addressing.

UNIT II **16Hrs**

Data and Signals: Periodic analog signals, digital signals, transmission impairment, data rate limits, performance. Digital transmission: Digital to digital conversion, analog-to-digital conversion, transmission modes.

UNIT III **16Hrs**

Physical Layer and Media: Analog transmission: Digital-to-analog conversion, analog-to-analog conversion. Multiplexing Spread spectrum. Transmission media – Guided media and unguided media.

UNIT IV **16Hrs**

Switching: Circuit-switched networks, datagram networks, virtual-circuit networks, structure of a switch. Telephone networks, dialup modems, digital subscriber line, cable-tv networks.

Text Books:

1. Behrouza A Forouzan, Data Communications and Networking, McGrawHill.
2. Computer Networks - Andrew s. Tanenbaum, Pearson Education.

References:

1. Data and Computer Communications, William Stallings, Pearson education
2. Data Communications, Computer Networks and Open Systems, fourth edition- Fred Halsall, Addison Wesley.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
II Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCB06		**Max Marks: 100**
Subject Name: Internet of Things		

Course Outcomes:

- Understand the key technologies in internet of things, wireless sensor network architecture and its framework along with WSN applications.
- Understand the resource management and business models for the internet of things.
- Understand Design and development of IoT aoftwares.

UNIT I **16Hrs**

FUNDAMENTALS OF IoT: Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II **16Hrs**

IoT PROTOCOLS: IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

UNIT III **16Hrs**

DESIGN AND DEVELOPMENT: Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

UNIT IV **16Hrs**

DATA ANALYTICS AND SUPPORTING SERVICES: Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG.

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.
2. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015 2. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols‖, Wiley, 2012 (for Unit 2).

References:

1. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.
3. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
II Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCB07		**Max Marks: 100**
Subject Name: Artificial Nueral Network		

Course outcomes:

- Explain what constitutes "Artificial" Intelligence and how to identify systems with Artificial Intelligence.
- Explain how Artificial Intelligence enables capabilities that are beyond conventional technology, for example, chess-playing computers, self-driving cars, robotic vacuum cleaners.
- Use classical Artificial Intelligence techniques, such as search algorithms, minimax algorithm, neural networks, tracking, robot localization.
- Ability to apply Artificial Intelligence techniques for problem solving.
- Explain the limitations of current Artificial Intelligence techniques.

UNIT I **16Hrs**

Introduction: Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks.

Learning: Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem.

UNIT II **16Hrs**

Supervised Learning: Perceptron learning and Non Separable sets, α-Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Backpropagation Learning Algorithm, Practical consideration of BP algorithm.

UNIT III **16Hrs**

Support Vector Machines and Radial Basis Function: Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.

UNIT IV **16Hrs**

Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.

Text Books:

1. Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/ Pearson Education.
2. Artificial Neural Networks B. Yagna Narayana, PHI.

References:

1. Artificial Intelligence , 2nd Edition, E.Rich and K.Knight (TMH).
2. Artificial Intelligence and Expert Systems – Patterson PHI.
3. Expert Systems: Principles and Programming- Fourth Edn, Giarrantana/ Riley, Thomson.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
II Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCB08		**Max Marks: 100**
Subject Name: Mobile Computing		

Course outcomes:

- Understand the various mobile communication systems.
- Describe various multiplexing systems used in mobile computing.
- Explain the use and importance of data synchronization in mobile computing .
- Understand broadcasting and its models.

Module -1: **16Hrs**

Mobile Devices and Systems, Architectures Mobile phones, Digital Music Players, Handheld Pocket Computers, Handheld Devices, Operating Systems, Smart Systems, Limitations of Mobile Devices, Automotive Systems GSM – Services and System Architectures, Radio Interfaces, Protocols, Localization, Calling, Handover.

Module -2: **16Hrs**

Wireless Medium Access Control and CDMA – based Communication Medium Access Control, Introduction to CDMA – based Systems. OFDM

Module – 3: **16Hrs**

Mobile IP Network Layer Mobile Transport Layer and Databases

Packet Delivery and Handover Management, Registration, Tunneling and Encapsulation, Route Optimization, Dynamic Host Configuration Protocol Indirect TCP, Snooping TCP, Mobile TCP, Other Methods of TCP – layer Transmission for Mobile Networks. **Databases** Database Hoarding Techniques, Data Caching, Client – Server Computing and Adaptation, Transactional Models, Query Processing, Data Recovery Process

Module -4: **16Hrs**

Data Dissemination and Broadcasting Systems Communication Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination Broadcast Models, Selective Tuning and Indexing Techniques,Digital Audio Broadcasting. Digital video Broadcasting.

Text Books:

1. Raj Kamal: Mobile Computing, Oxford University Press, 2007.

References:

1. Ashok Talukdar, Roopa R Yavagal: Mobile Computing – Technology, Applications and Service Creation, Tata McGraw Hill, 2005.
2. 2 Reza B'Far: Mobile Computing Principles – Designing and Developing Mobile Applications with UML and XML, 5th Edition, Cambridge University press, 2006.
3. Uwe Hansmann, LothatMerk, Martin S Nicklous and Thomas Stober: Principles of Mobile Computing, 2nd Edition, Springer International Edition, 2003.
4. Schiller: Mobile Communication, Pearson Publication, 2004.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
III Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCC01		**Max Marks: 100**

Subject Name: Software Engineering

Course outcomes:

- Design a software system, component, or process to meet desired needs within realistic constraints.
- Assess professional and ethical responsibility .
- Function on multi-disciplinary teams .
- Make use of techniques, skills, and modern engineering tools necessary for software engineering .

UNIT I **16Hrs**

Introduction: Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies. Software Processes: Models: Waterfall Model, Incremental Model and Spiral Model. Process activities. Requirements Engineering: Requirements Engineering Processes .Requirements Elicitation and Analysis . Functional and non-functional requirements . The software Requirements Document. Requirements Specification . Requirements validation . Requirements Management.

UNIT II **16Hrs**

System Models: Context models . Interaction models . Structural models . Behavioral models . Model-driven engineering .Design and Implementation: Introduction to RUP, Design Principles . Object-oriented design using the UML . Design patterns .Implementation issues . Open source development .

UNIT III **16Hrs**

Software Testing: Development testing , Test-driven development ,Release testing , User testing . Test Automation .Software Evolution: Evolution processes . Program evolution dynamics . Software maintenance . Legacy system management.

UNIT IV **16Hrs**

Project Planning: Software pricing. Plan-driven development. Project scheduling. Estimation techniques . Quality management:Software quality . Reviews and inspections . Software measurement and metrics . Software standards.

Text Books:

1. Ian Sommerville : Software Engineering, 9th edition, Person Education Ltd, 2011.
2. Pankaj Jalote: Software Engineering, Wiley India Pvt Ltd (2010)

References:

1. Roger S Pressman: Software Engineering-A Practitioners approach, 6th Edition, McGraw-Hill, 2010.
2. Hans Van Vliet: Software Engineering Principles and Practices, 3rd Edition, Wiley–India, 2010

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
III Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCC02		**Max Marks: 100**

Subject Name: Big Data Analytics

Course outcomes:

- Explain the importance of data and data analysis.
- Interpret the probabilistic models for data.
- Illustrate hypothesis, uncertainty principle.
- Demonstrate the regression analysis .

UNIT I **16Hrs**

Overview Of Big Data: History of big data, its elements, career related knowledge, advantages, disadvantages. Using Big Data in Businesses: Focus on the application perspective of Big Data covering, using big data in marketing, analytics, retail, hospitality, consumer good, defense etc. Technologies for Handling Big Data: Introduction to Hadoop, functioning of Hadoop, Cloud computing (features, advantages, applications) etc.

UNIT II **16Hrs**

Understanding Hadoop Ecosystem: Hadoop and its ecosystem which includes HDFS, Map Reduce, YARN, HBase, Hive, Pig, Sqoop, Zookeeper, Flume, Oozie etc. Dig Deep to understand the fundamental of Map Reduce and HBase: framework of Map Reduce and uses of map reduce. Understanding Big Data Technology Foundations: big data stack i.e. data source layer, ingestion layer, source layer, security layer, visualization layer, visualization approaches etc.

UNIT III **16Hrs**

Databases And Data Warehouses: Databases, polygot persistence and their related introductory knowledge. Using Hadoop to store data: Module of HDFS, HBase and ways to store and manage data along with their commands. Learn to Process Data using Map Reduce: Emphasizes on developing simple map reduce framework and the concept applied.

UNIT IV **16Hrs**

Testing And Debugging Map Reduce Applications: Learn Hadoop YARN Architecture: background of YARN, advantages of YARN, working with YARN, backward compatibility with YARN, YARN Commands, log management etc. Exploring Hive, Exploring PIG, Exploring Oozie, Learn NoSQL Data Management: NoSQL including document databases, relationships, graph databases, schema less databases, CAP Theorem etc. Integrating R and Hadoop and Understanding Hive in Detail.

Text Books:

1. Big Data Now: 2014 Edition by “Raymond I Morrison”
2. Analytics in a Big Data World: The essential guide to data science and its application

References:

1. Hadoop For Dummies, Dirk deRoos, For Dummies, 2014
2. Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning by Raj Kamal Preeti Saxena.
3. Big Data Analytics: A Hands-On Approach Paperback – 7 Sep 2018, by Arshdeep Bahga, Vijay Madisetti.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 8 hrs./week**	**Exam Marks: 80**
III Semester	**Credits: 04 Hrs.: 128**	**I. A. Marks: 20**
Subject Code: 20CSCC03		**Max Marks: 100**
Subject Name: Advanced Java Lab		

Course outcomes:

On the completion of this laboratory course, the students will be able to:

- UnderJava basics, interpret the need for advanced Java concepts like data structure and collections in developing modular and efficient programs.
- Illustrate database access and details for managing information using the JDBC API

Note:

1. **Laboratory programs should be conducted as per the respective theory syllabus.**
2. **Minimum number of programs should be 24 among that 12 programs from PART- A & 12 progrms from PART-B**

Course : M.Sc(CS)	**Teaching: 8 hrs./week**	**Exam Marks: 80**
III Semester	**Credits: 04 Hrs.:128**	**I. A. Marks: 20**
Subject Code: 20CSCC04		**Max Marks: 100**
Subject Name: Big Data Analytics Lab		

Course Outcomes:

- Shoulde be able to analyse case studies in business analytic and intelligence using mathematical models.
- Provide problem solutions for multi-core or distributed, concurrent environments.

Note:

1. **Laboratory programs should be conducted as per the respective theory syllabus.**
2. **Minimum number of programs should be 24 among that 12 programs from PART- A & 12 progrms from PART-B.**

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 40**
III Semester	**Credits: 02 Hrs.: 32**	**I. A. Marks: 10**
Subject Code: 20CSCC05		**Max Marks: 50**

Subject Name: COMPUTER FUNDAMENTALS

Course outcomes:

- To introduce the fundamental concepts of computers and computing environment.
- To acquire the basic knowledge of algorithm design and problem solving using computers.
- To understand the concept of database management system and its importance.

UNIT 1 **16Hours**

Introduction: Introduction to computers, characteristics and limitations of computer, Block diagram of computer, types of computers, uses of computers, computer generations.

Input and output devices: Keyboard and mouse, inputting data in other ways, Types of Software: system software, Application software, commercial, open source, domain and free ware software, Memories: primary, secondary and cache memory. Windows basics: desktop, start menu, icons.

UNIT 2 **16 Hours**

Introduction to Internet : Internet, Growth of Internet, Owners of the Internet, Anatomy of Internet, ARPANET and Internet history of the World Wide Web, basic Internet Terminology, Net etiquette. Internet Applications – Commerce on the Internet, Governance on the Internet, Impact of Internet on Society – Crime on/through the Internet, Introduction to Cyber crime and Cyber laws.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
III Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCC06		**Max Marks: 100**
Subject Name: Advanced Java Programming		

Course outcomes:

- Knowledge of the structure and model of the Java programming language.
- Use the Java programming language for various programming technologies
- Develop software in the Java programming language.
- Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements .
- Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem .
- Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems.

UNIT I **16Hrs**

Java Programming Fundamentals: The Java Language, The Key Attributes of Object-Oriented Programming, The Java Development Kit, A First Simple Program, The Java Keywords, Identifies in Java.
Introducing Data Types and Operators: Java's Primitive Types, Literals, A Closer Look at Variables, The Scope and Lifetime of Variables, operators, Shorthand Assignments, Type conversion in Assignments, Operator Precedence. Program Control Statements: Input characters from the Keyword, Use break, Use continue. Introduction to Classes, Objects and Methods: Class Fundamentals, How Objects are Created, Reference Variables and Assignment, Methods, Constructors, Parameterized Constructors, The new operator Revisited, Garbage Collection and Finalizers,

UNIT II **16Hrs**

String Handling String Fundamentals, The String Constructors, Three String-Related Language Features, The Length() Method, Obtaining the characters within a string, String comparison, using indexOf() and last IndexOf(), Changing the case of characters within a string, String Buffer and String Builder. A Closer Look at Methods and Classes Controlling Access to Class Members, Method Overloading, Overloading Constructors, Recursion, Understanding Static, Introducing Nested and Inner Classes, Varargs: Variable-Length Arguments.

UNIT III **16Hrs**

Inheritance Inheritance Basics, Member Access and Inheritance, Constructors and Inheritance, Using super to Call Super class constructors, Using super to Access Super class Members, Creating a Multilevel Hierarchy, When are Constructors Executed, Superclass References and Subclass Objects, Method Overriding, Overridden Methods support polymorphism, Why Overridden Methods, Using Abstract Classes, Using final, The Object Class. Interfaces :Interface Fundamentals, Creating an Interface, Implementing an Interface, Using Interface References, Implementing Multiple Interfaces, Constants in Interfaces, Interfaces can be extended, Nested Interfaces Packages: Package Fundamentals, Packages and Member Access, Importing Packages, Static Import

UNIT IV **16Hrs**

Enumerations, Auto boxing: Enumerations, Java Enumeration are class types, TheValues() and Valueof() Methods, Constructors, methods, instance variables and enumerations, Autoboxing, Annotations(metadata) Networking with Java.net: Networking fundamentals, The Networking classes and Interfaces, The Inet Address class, The Socket Class, The URL class, The URL Connection Class, The Http URL Connection Class. Exploring Collection Framework: Collections Overview, The Collection Interfaces, The collection Classes. The Arrays Class. Java JDBC Connectivity.

Text Books:

1. Java Fundamentals, A comprehensive Introduction by Herbert Schildt, Dale Skrien. Tata McGraw Hill Edition 2013. (Chapters:1,2,3,4,5,6,7,8,9,10,11,12,13,15,22,23,24,25,26)
References: 1. Java Programming by Hari Mohan Pandey, Pearson Education, 2012. 2. Java 6 Programming, Black Book, KoGenT, Dreamtech Press, 2012. 3. Java 2 Essentials, Cay Hortsmann, second edition, Wiley

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
III Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCC07		**Max Marks: 100**
Subject Name: Multimedia and Web Technology		

Course outcomes:

- Define Multimedia Networking and Network Management.
- Define HTML and CSS syntax and semantics to build web pages.
- Understand the concepts of Construct , visually format tables and forms using HTML using CSS.
- Develop Client-Side Scripts using Java Script and Server-Side Scripts using PHP to generate and display the contents dynamically.
- List the principles of object oriented development using PHP.
- Illustrate JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features.

UNIT I **16Hrs**

Web 2.0 and Web Services:What is Web 2.0?, Folksonomies and Web 2.0, Software As a Service (SaaS), Data and Web 2.0, Convergence, Iterative development, Rich User experience, Multiple Delivery Channels, Social Networking. Web Services: SOAP, RPC Style SOAP, Document style SOAP. WSDL, REST services, JSON format, What is JSON? Array literals, Object literals, Mixing literals, JSON Syntax, JSON Encoding and Decoding, JSON versus XML.

UNIT II **16Hrs**

Rich Internet Applications With Ajax: Limitations of Classic Web application model, AJAX principles, Technologies behind AJAX, Examples of usage of AJAX; Asynchronous communication and AJAX application model.
Ajax with XMLHTTP object: Part 1 Creating Ajax Applications: An example, Analysis of example ajax.html, Creating the JavaScript, Creating and opening the XMLHttpRequest object, Data download, Displaying the fetched data, Connecting to the server, Adding Server-side programming, Sending data to the server using GET and POST.

UNIT III **16Hrs**

Working with XML DOM in Ajax Building XML and working with XML in JavaScript, Getting the document element, Accessing any XML element, Handling whitespace in Firefox, Handling cross-browser whitespace, Accessing XML data directly, Validating XML, Further examples of Rich Internet Applications with Ajax.

UNIT IV **16Hrs**

ntroduction to Bootstrap. What Is Bootstrap? Bootstrap File Structure, Basic HTML Template, Global Styles, Default Grid System, Basic Grid HTML, Offsetting Columns, Nesting Columns, Fluid Grid System, Container Layouts, Responsive Design. Typography, Emphasis Classes, Lists, Code, Tables, Optional Table Classes, Table Row Classes, Forms, Buttons, Images, Icons

Text Books:

1. Professional AJAX – Nicholas C Zakas et al, Wrox publications, 2008.
2. Steven Holzner: Ajax: A Beginner's Guide, Tata McGraw Hill, 2014.
3. Jake Spurlock: "Bootstrap: Responsive Web Development", O'Reilly Media, 2014.

References:
1. Thomas A. Powel: Ajax The Complete reference, McGraw Hill,2008.
2. AravindShenoy, Ulrich Sossou: Learning Bootstrap, Packt, Dec 2014.
3. Dana Moore, Raymond Budd, Edward Benson: Professional Rich Internet Applications: AJAX and Beyond, Wiley 2012.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
III Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCC08		**Max Marks: 100**

Subject Name: R-Programming

Course Outcomes:

- Should be able to programming in R and interpret use of R for effective data analysis.
- Should be able to install and configure software necessary for a statistical programming environment and describe generic programming language concepts as they are implemented in a high level statistical language.

UNIT I **16Hrs**

Introduction: Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations

UNIT II **16Hrs**

Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations

UNIT III **16Hrs**

Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, DATA FRAMES, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations

FACTORS AND TABLES, Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Subtable.

UNIT IV **16Hrs**

OBJECT-ORIENTED PROGRAMMING: Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions

S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation

Text Books:

1. R Programming for Data Science by Roger D. Peng 2. The Art of R Programming by Prashanth singh, Vivek Mourya, Cengage Learning India.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
III Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCC09		**Max Marks: 100**
Subject Name: Internet Technologies		

Course outcomes:

- Understand how computers are connected to the Internet.
- Demonstrate the ability to use the World Wide Web.
- Understand and apply Internet Etiquette.
- Understand routing, networking and internet servers.

UNIT I **16Hrs**

Basic Principles: Evolution of Internet, Internet services, Internet protocols and standardization, TCP/IP, Review of Network technologies. Architectural model, Application level , Network level, Properties of the Internet, Interconnection through IP Gateways or routers, Internet and Intranet.

Addressing Schemes : Introduction, Universal identifiers, Three primary classes of IP addresses, Classless IP address, Network and Broadcast addresses, Mapping internet addresses to physical addresses (ARP), ARP protocol format, Transport Gateways and subnet addressing, Multicast addressing. Protocols : Reliable and unreliable delivery, Connectionless delivery system, Routing direct and indirect delivery, Table driven IP routing, Protocol layering, Reliable stream transport, TCP performance, Bootstrap protocol (BOOTP).

UNIT II **16Hrs**

Routing : The origin of Gateway routing tables, Original Internet Architecture and Cores, Core Gateways, Automatic route propagation, Vector distance (Bellman-Ford), routing, Gateway to Gateway Protocol (GGP), Autonomous system concept, Exterior Gateway Protocol (EGP), Interior Gateway Protocol (RIP, OSPF, HELLO), Routing Information Protocol (RIP), Combining RIP, HELLO, and EGP, Routing with partial information.

UNIT III **16Hrs**

Enterprise Networking : Corporate networking, Broadband at the Metropolitan area level, High speed dedicated WAN services and switched WAN services, ISDN, BISDN and ATM services, Frame relay technology and services, Virtual private network concepts PPTP protocol.

UNIT IV **16Hrs**

Internet Servers : DNS, DHCP Servers, FTP, TELNET, E-Mail. **Firewall & Networking :** Introduction, Implementation of Firewall, Activities of Firewall, Configuration of firewall, Firewalls & SSL, SSL implementation, Bit implementation of SSL, Use of SSL.

References:

1. Computer Networks and Internets - Douglas E. Comer; PE.
2. Communication Networks - Leon-Garcia-Widjaja; TMH.
3. Internetworking with TCP / IP - Douglas E .Comer; PE.
4. TCP/IP protocol suite - Forouzan Behrouz A; TMH.
5. Computer Networks – Andrew S. Tannenbaum; PHI.
6. Data and Computer Communication - William Stallings; PHI.
7. The Complete reference of Networking - Craig Zacker; TMH.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
IV Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCD01		**Max Marks: 100**
Subject Name: Digital Image Processing		

Course outcomes:

- Develop and implement algorithms for digital image processing.
- Apply image processing algorithms for practical object recognition applications.
- Understand the need for image transforms different types of image transforms and their properties.
- Develop any image processing application.
- Understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.

UNIT I **16Hrs**

INTRODUCTION AND SPATIAL FILTERING:

Fundamentals of digital image processing, steps in digital image processing, components of image processing, image formation model, sampling and quantization, image representation techniques. Intensity transformation, point operation, histogram modeling, spatial operations, smoothing and sharpening, combining spatial enhancement methods.

UNIT II **16Hrs**

FILTERING IN THE FREQUENCY DOMAIN:

Fourier series and transform, preliminary concepts, sampling and the Fourier transform of sampled functions, Discrete Fourier Transform of 1-D and 2-D. Properties of 2-D Fourier Transform. Basics of filtering in the frequency domain, Image smoothing and sharpening using frequency domain filters

UNIT III **16Hrs**

IMAGE RESTORATION: Model of image degradation/restoration process, noise models, restoration in the presence of noise only using spatial filtering, periodic noise reduction by frequency domain filtering, Estimating the degradation function by image observation, experimentation and modeling, inverse filtering, Wiener filter, constrained least square filtering and geometric filtering.

UNIT IV **16Hrs**

IMAGE SEGMENTATION: Point, line and edge detection techniques, image thresholding techniques, region based segmentation

Text Books:

1. Digital Image Processing by R C Gonzalez
2. Fundamentals of Digital Image processing by Anil K Jain

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
IV Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCD02		**Max Marks: 100**
Subject Name: Research Methodology		

Course outcomes:

- Discuss research methodology and the technique of defining a research problem.
- Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
- Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections.
- Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports.
- Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR.

UNIT I **16Hrs**

An Introduction: Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method,Importance of Knowing How Research is Done, Research Process, Criteria of Good Research.Defining The Research Problem: What is a Research Problem?, Selecting the Problem, Necessity of Defining the Problem.

UNIT II **16Hrs**

Defining a Problem:Technique Involved in Defining a Problem, An Illustration, Conclusion.Research Design: Meaning of Research Design, Need for Research Design,Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Conclusion.

UNIT III **16Hrs**

Sampling Design: Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs, How to Select a Random Sample?.Methods Of Data Collection: Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Some Other Methods of Data Collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection.

UNIT IV **16Hrs**

Processing And Analysis Of Data: Processing Operations, Some Problems in Processing, Elements/Types of Analysis, Statistics in Research, Measures of Central Tendency, Measures of Dispersion, Measures of Asymmetry (Skewness), Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation, Association in Case of Attributes, Other Measures, ***Appendix***: Summary Chart Concerning Analysis of Data.

Text Books:

1. "Research Methodology-Methods and Techniques"- C.R.Kothari, New Age International Publishers.

References:

2. "Research Methodology: A Step-by-Step Guide for Beginners"-Dr. Ranjit Kumar.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 8 hrs./week**	**Exam Marks: 80**
IV Semester	**Credits: 04 Hrs.:128**	**I. A. Marks: 20**
Subject Code: 20CSCD03		**Max Marks: 100**
Subject Name:Digital Image Processing Lab		

Course outcomes:

- Demonstrate Explain the fundamentals of image processing and computer vision.
- Illustrate the image enhancement techniques.
- Illustrate Image restoration and image compression technique.
- Tell about image segmentation and morphological image processing.
- Summarize computer vision techniques and its uses.

Program List

Note:

1. **Laboratory programs should be conducted as per the respective theory syllabus.**
2. **Minimum number of programs should be 24 among that 12 programs from PART- A & 12 progrms from PART-B.**

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 16 hrs./week**	**Exam Marks: 120**
IV Semester	**Credits: 08 Hrs.:256**	**I. A. Marks: 30**
Subject Code: 20CSCD04		**Max Marks: 150**
Subject Name: Major Project		

Students can implement end-to-end Application Projects, Research Projects or new modules of live projects which will be evaluated through Class Assessments, Reports, Presentations, Models, Thesis, Viva-voce by Project Evaluation Committees.

A thesis can have below sections,

1. Undressing the problem
2. Literature survey
3. Formulation of Ideas
4. Preparing SRS/Algorithm
5. System Design
6. Implementation
7. Testing
8. Documentation

Reference:

1. Project Related text books, Journals, Research articles, Conference proceedings
2. NLIST, Project reports in the Library/Department and Online resources

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
IV Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCD05		**Max Marks: 100**
Subject Name: Theory of Computation		

Course outcomes:

- Tell the core concepts in automata theory and Theory of Computation.
- Explain how to translate between different models of Computation (e.g., Deterministic and Non-deterministic and Software models).
- Interpret Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers.
- Develop skills in formal reasoning and reduction of a problem to a formal model, with an emphasis on semantic precision and conciseness.
- Classify a problem with respect to different models of computation.

UNIT I **16Hrs**

Review of Mathematical Terms and Theory: Basic Mathematical Notations and Set Theory, Logic Functions and Relations, Language Definitions, Mathematical Inductions and Recursive Definitions. Finite Automata: Deterministic and Non Deterministic Finite Automata, U-Transitions, Conversion from NFA to DGA, Kleene's Theorem, Regular and Non Regular Languages.

UNIT II **16Hrs**

Context Free Grammar: Introduction to CFG, CFG and Known Languages, Unions, Concatenations and *'s Notations and CFL, Derivatives of Trees and Ambiguity and Unambiguous CFG and Algebraic Expressions, Normal Forms and Simplified Forms. Pushdown Automata, CFL and NFL: Introduction to PDA, Definition, DPDA, PDA Corresponding to CFG, CFG Corresponding to PDA, Introduction to CFL, Intersections and Complements of CFL, Decisions Problems and CFL. .

UNIT III **16Hrs**

Turing Machines, Recursive Language: Model of Computation and Church Turning Thesis, Definitions of Turing Machine, TM and Language Acceptors, Variations of TM, Non Deterministic TM, Universal TM, Enumerable and Language, Recursive and Non Recursive Enumerable.

UNIT IV **16Hrs**

Computation Functions, Measuring, Classifications And Complexity: Primitive Recursive Functions, Halting Problem, Recursive Predicates and Some Bounded Operations, Unbounded Minimizations and μ-Recursive Functions, Godel Numbering, Computable Functions and μ-Recursive, Numerical Functions. Tractable and Intractable Problems: Growth Rate and Functions, Time and Speed Complexity, Complexity Classes, Tractable and Possibly Intractable Problems, P and Np Completeness, Reduction of Time, Cook's Theorem, Np-Complete Problems.

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, "Introduction to Automata Theory, Languages and Computation", 3rd Edition, Pearson Education, 2011. 2. John C Martin, "Introduction to Languages and Automata Theory", 3rd Edition, Tata McGraw-Hill, 2007.

References:

1. Daniel I.A. Cohen, "Introduction to Computer Theory", 2nd Edition, John Wiley and Sons, 2009.
2. Thomas A. Sudkamp, "An Introduction to the Theory of Computer Science, Languages and Machines", 3rd Edition, Pearson Education, 2006.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
IV Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSD06		**Max Marks: 100**
Subject Name: Machine Learning		

Course outcomes:

- Gain knowledge about basic concepts of Machine Learning.
- Identify machine learning techniques suitable for a given problem.
- Solve the problems using various machine learning techniques.
- Design and implement machine learning solutions to classification, regression, and clustering problems; and be able to evaluate and interpret the results of the algorithms.

UNIT I **16Hrs**

Introduction to Artificial Intelligence: Definition. AI Applications, AI representation. Properties of internal Representation, Heuristic search techniques. Best first search, mean and end analysis, A* and AO* Algorithm. Minimize search procedure, Alpha beta cutoffs, waiting for Quiescence, Secondary search.

UNIT II **16Hrs**

Knowledge representation using predicate logic: Predicate calculus, Predicate and arguments, ISA hierarchy, frame notation, resolution, Natural deduction. Knowledge representation using non monotonic logic: TMS (Truth maintenance system), statistical and probabilistic reasoning, fuzzy logic, structure knowledge representation, semantic net, Frames, Script, Conceptual dependency.

UNIT III **16Hrs**

Machine Learning: Applications of Machine Learning, Supervised vs Unsupervised Learning, Python libraries suitable for Machine Learning, Unsupervised Learning: K-Means Clustering, Hierarchical Clustering, Density-Based Clustering. Semi-supervised learning with EM using labeled and unlabled data.

UNIT IV **16Hrs**

Regression and Classification**:** Linear Regression, Non-linear Regression, Model evaluation methods, K-Nearest Neighbour, Decision Trees, Logistic Regression, Support Vector Machines, Model Evaluation, Neural Networks.

Text Books:

1. E. Charnaik and D. McDermott," Introduction to artificial Intelligence"
2. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”.

References:

1. Machine Learning by Tom M. Mitchell, India Edition 2013, McGraw Hill Education.
2. Introduction to machine learning by Ethem Alpaydın, second edition, MIT press.
3. Machine Learning by Tom M. Mitchell.

SYLLABUS

(w.e.f. 2020-21 and onwards)

M.Sc in Computer Science

Course : M.Sc(CS)	**Teaching: 4 hrs./week**	**Exam Marks: 70**
IV Semester	**Credits: 04 Hrs.: 64**	**I. A. Marks: 30**
Subject Code: 20CSCD07		**Max Marks: 100**
Subject Name: Pattern Recognition		

Course outcomes:

- Explain pattern recognition principals.
- Develop algorithms for Pattern Recognition.
- Develop and analyse decision tress.
- Design the nearest neighbour classifier.
- Apply Decision tree and clustering techniques to various applications.

UNIT I **16Hrs**

Machine perception, an example; Pattern Recognition System; The Design Cycle; Learning and Adaptation; Bayesian Decision Theory: Introduction, Bayesian Decision Theory; Continuous Features, Minimum error rate, classification, classifiers, discriminant functions, and decision surfaces; The normal density; Discriminant functions for the normal density.

UNIT II **16Hrs**

Maximum-likelihood and Bayesian Parameter Estimation: Introduction; Maximum-likelihood estimation; Bayesian Estimation; Bayesian parameter estimation: Gaussian Case, general theory; Hidden Markov Models.

UNIT III **16Hrs**

Non-parametric Techniques: Introduction; Density Estimation; Parzen windows; kn – Nearest- Neighbor Estimation; The Nearest- Neighbor Rule; Metrics and Nearest-Neighbor Classification.

UNIT IV **16Hrs**

Linear Discriminant Functions: Introduction; Linear Discriminant Functions and Decision Surfaces; Generalized Linear Discriminant Functions; Minimum Squared-Error procedures.
Unsupervised Learning and Clustering: Introduction; Mixture Densities and Identifiability; Maximum-Likelihood Estimates; Application to Normal Mixtures; Unsupervised Bayesian Learning. Data Description and Clustering; Criterion Functions for Clustering.

References:

1. Richard O. Duda, Peter E. Hart, and David G.Stork: Pattern Classification, 2nd Edition, Wiley-Interscience, 2001.
2. Earl Gose, Richard Johnsonbaugh, Steve Jost: Pattern Recognition and Image Analysis, PHI, Indian Reprint 2008.

I Semester M.Sc. Examination, December, 2021
(2021-22 CBCS: New Syllabus)
COMPUTER SCIENCE
20CSCA01: Data Structures

Time: 3 Hours Max. Marks: 70

Note: Answer Part-A, four questions from Part-B and four full questions from Part-C

PART— A

I. Answer any five of the following: (2>5 = 10)

a)

b)

c)

d)

e)

PART —B

II. Answer any four of the following: (5x4 = 20)

2.

3.

4.

6.

7.

PART — C

III. Answer any four of the following: (10x4 = 40)

8.

9.

10.

11.

12.

13.