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# ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

## ಗಣಕ ವಿಜ್ಞಾನ ಅಧ್ಯಯನ ವಿಭಾಗ

Shivagangotri, Davangere-07, Karnataka

ಡಾ. ಚಂದ್ರಕಾಂತ್ ನಾಯ್ಕೋಡಿ
BOS ಅಧ್ಯಕ್ಷರು
Mob: 9901452550

ಸಂಖ್ಯೆ:ದಾವಿವಿ/ಗವಿ/2024-25/ 1860

ದಿನಾಂಕ: 20-09-2024

ಗೆ,
ಮಾನ್ಯ ಕುಲಸಚಿವರು
ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ,
ಶಿವಗಂಗೋತ್ರಿ, ದಾವಣಗೆರೆ–577 007.

ಮಾನ್ಯರೆ,

ವಿಷಯ: M.Sc(CS) ಮತ್ತು Ph.D(CS)ಗಳ ಪರಿಷ್ಕೃತ ಪಠ್ಯಕ್ರಮಗಳು, ಪರೀಕ್ಷೆಗೆ ಸಂಬಂಧಿಸಿದ ಪ್ರಾಧ್ಯಾಪಕರುಗಳ ಪಟ್ಟಿ, PGCET ಪರೀಷ್ಕೃತ ಪಠ್ಯಕ್ರಮಗಳು ಹಾಗೂ BOS(PG) ಸಭೆಯ ನಡಾವಳಿಗಳನ್ನು ಕಳುಹಿಸುತ್ತಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: ಸಂಖ್ಯೆ:ದಾವಿವಿ/ಅ.ಮಂ./466/2024–25/1781, ದಿನಾಂಕ:16.08.2024

ಈ ಮೇಲ್ಕಂಡ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ, ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಗಣಕ ವಿಜ್ಞಾನ ಅಧ್ಯಯನ ವಿಭಾಗದಲ್ಲಿ ದಿನಾಂಕ:18/09/2024ರಂದು ಜರುಗಿದ BOS ಸಭೆಯಲ್ಲಿ ಅಧ್ಯಕ್ಷರು ಮತ್ತು BOS(PG) ಸಭೆಯ ಸದಸ್ಯರೊಂದಿಗೆ 2024–25ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನ M.Sc(CS) ಸ್ನಾತಕೋತ್ತರ ಪದವಿ ಮತ್ತು Ph.D(CS)ಗಳ ಪರಿಷ್ಕೃತ ಪಠ್ಯಕ್ರಮಗಳು ಹಾಗೂ PG(M.Sc(CS)) ಮತ್ತು Ph.D(CS) ಪ್ರವೇಶ ಪರೀಕ್ಷೆಯ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಪರಿಶೀಲಿಸಿದ್ದು, ಸದರಿ ಪಠ್ಯಕ್ರಮಗಳೊಂದಿಗೆ, Examiners ಪಟ್ಟಿ, BOS(PG) ಸಭೆಯ ನಡಾವಳಿಗಳನ್ನು ಈ ಮೂಲಕ ಕಳುಹಿಸಿಕೊಡುತ್ತಿದ್ದೇವೆ.

ವಂದನೆಗಳೊಂದಿಗೆ,

ತಮ್ಮ ವಿಶ್ವಾಸಿ,
BOS Chairman
Dept. of Computer Science
Davangere University
Shivagangotri, Davangere

ಅಡಕಗಳು :

1. BOS Meeting Proceedings
2. Updated M.Sc(PG) & Ph.D(CS) Course Structure and Syllabus (Soft & Hard copy)
3. Updated M.Sc(CS) & Ph.D(CS) Entrance Examination Syllabus (Soft & Hard copy)
4. Updated Panel of Examiners.

# DAVANGERE UNIVERSITY

## Department of Studies in Computer Science
## Shivagangotri, Davangere-577 007

**Dr.ChandrakantNaikodi**
BoS Chairman (UG and PG) and Professor

Ref. No. 1860 Date: 18-Sept-2024

## Proceedings of Board of Studies (PG-BOS) Meeting

The BoS meeting of Computer Science(PG) was held on **18th Sept 2024** in the Department of Studies in Computer Science, Davangere University, Davangere-07 and following resolutions were made.

**Item-1:** Discussion and Approval of MSc(CS) and PhD(CS) Syllabus from the academic year 2024-25.
**Resolution-1:** Reviewed, Discussed and Approved MSc(CS) and PhD(CS) Course Structure and Syllabus.
**Item-2:** Discussion and Approval of UpdatedPanel of Examiners for PG (MSc and MCA) from the academic year 2024-25.
**Resolution-2:** Reviewed, Discussed and Approved Updated Panel of Examiners for PG (MSc and MCA) from the academic year 2024-25.
**Item-3:** Discussion and Approval of MSc(CS)and PhD(CS) Entrance Test Syllabus from the academic year 2024-25.
**Resolution-3:** Reviewed, Discussed and Approved PG and PhD Entrance Test Syllabus from the academic year 2024-25.

### Members of PG-BoS Committee:

| S No. | BoS Member Details | Internal/External | Signatures |
|---|---|---|---|
| 1. | Dr. ChandrakantNaikodi<br>Professor and Chairman, DoS in Computer Science, Davangere University. | Chairman | |
| 2. | Dr. Basavanna M<br>Professor,<br>DoS in Computer Science, Davangere University. | Member | 18/9 |
| 3. | Dr. Vinay S<br>Assistant Professor,DoS in Computer Science, Davangere University,Davangere-577007 | Member | |
| 4. | Prof. Mallikarjuna S B ,<br>Professor, Department of Computer Science and Engineering,<br>Bapuji Institute of Engineering and Technology , Davangere-577004 | Member | 18/9/24 |
| 5. | Prof. Shivashankar S ,<br>Professor, Department of Computer Science,<br>Karnatak University, Dharwad - 580 003 | Member | 18/9/24 |

Dr. ChandrakantNaikodi
BOS Chairman
Dept. of Computer Science
Davangere University
Shivagangotri, Davangere

# ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
# DAVANGERE UNIVERSITY

*Revised Syllabus for*

## M.Sc. in COMPUTER SCIENCE

W.E.F 2024-25 and onwards

DEPARTMENT OF STUDIES IN COMPUTER SCIENCE

DAVANGERE UNIVERSITY, DAVANGERE-07

BOS Chairman
Dept. of Computer Science
Davangere University
Shivagangotri, Davangere

2024-25

# M.Sc. in COMPUTER SCIENCE

## Course Structure- W.E.F 2024-2025

| Semester | Subject/Paper Code | Title of the Paper | Instruction Hrs./week | Type | Marks | | | Credits | Examatination duration (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Examination | Internal Assessment | Total Marks | | |
| SEMESTER-I | CORE PAPERS | | | | | | | | |
| | 24CSCA01 | Advanced Data Structures | 4 | DSC | 70 | 30 | 100 | 4 | 3 |
| | 24CSCA02 | Analysis & Design of Algorithms | 4 | DSC | 70 | 30 | 100 | 4 | 3 |
| | 24CSCA03 | Advanced Data Structures Lab using C | 8 | DSC | 80 | 20 | 100 | 4 | 3 |
| | 24CSCA04 | 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) | | | | | | | | |
| | 24CSCA05 | Discrete Mathematics | 4 | DSE | 70 | 30 | 100 | 4 | 3 |
| | 24CSCA06 | Computer Architecture | 4 | DSE | 70 | 30 | 100 | 4 | 3 |
| | 24CSCA07 | Information Security and Cyber Laws | 4 | DSE | 70 | 30 | 100 | 4 | 3 |
| | 24CSCA08 | 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

Dr. U.S. MAHABALESHWAR
M.Sc., M.Phil., Ph.D.
Professor & Dean, Science & Technology
Davangere University, Shivagangotri,
Davangere-577 007, Karnataka, India.

Registrar
Davangere University
Shivagangotri, Davangere

| 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 | | | | | | | | |
| | 24CSCB01 | Python Programming | 4 | DSC | 70 | 30 | 100 | 4 | 3 |
| | 24CSCB02 | RDBMS | 4 | DSC | 70 | 30 | 100 | 4 | 3 |
| | 24CSCB03 | Python Programming Lab | 8 | DSC | 80 | 20 | 100 | 4 | 3 |
| | 24CSCB04 | RDBMS Lab | 8 | DSC | 80 | 20 | 100 | 4 | 3 |
| | Skills- Mandatory Credits: Linux Operating System | | 2 | -- | -- | -- | | 2 | -- |
| | ELECTIVE PAPERS (Students are permitted to choose any **two** of the following) | | | | | | | | |
| | 24CSCB05 | Computer Networks | 4 | DSE | 70 | 30 | 100 | 4 | 3 |
| | 24CSCB06 | Internet of Things | 4 | DSE | 70 | 30 | 100 | 4 | 3 |
| | 24CSCB07 | Artificial Intelligence | 4 | DSE | 70 | 30 | 100 | 4 | 3 |
| | 24CSCB08 | 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 | Type | Marks | | | Credits | Examatination duration (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Examination | Internal Assessment | Total Marks | | |
| SEMESTER-III | | CORE PAPERS | | | | | | | |
| | 24CSCC01 | Advanced Java Programming | 4 | DSC | 70 | 30 | 100 | 4 | 3 |
| | 24CSCC02 | Bigdata Analytics | 4 | DSC | 70 | 30 | 100 | 4 | 3 |
| | 24CSCC03 | Advanced Java Lab | 8 | DSC | 80 | 20 | 100 | 4 | 3 |
| | 24CSCC04 | Project –I: Minor Project | 8 | DSC | 80 | 20 | 100 | 4 | 3 |
| | 24CSCC05 | Interdisciplinary/Elective Computer Fundamentals | 2 | DSC | 40 | 10 | 50 | 2 | 2 |
| | | Personality Development | 2 | | -- | -- | -- | 2 | -- |
| | | ELECTIVE PAPERS (Students are permitted to choose any **two** of the following) | | | | | | | |
| | 24CSCC06 | Advanced Software Engineering | 4 | DSE | 70 | 30 | 100 | 4 | 3 |
| | 24CSCC07 | Web Technology | 4 | DSE | 70 | 30 | 100 | 4 | 3 |
| | 24CSCC08 | Advanced Operating Systems | 4 | DSE | 70 | 30 | 100 | 4 | 3 |
| | 24CSCC09 | Data Science | 4 | DSE | 70 | 30 | 100 | 4 | 3 |

NOTE: Total number of credits for the semester: 24 + 2(IE)+2(PD) =28

| 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 | | | | | | | |
| | 24CSCD01 | Digital Image Processing | 4 | DSC | 70 | 30 | 100 | 4 | 3 |
| | 24CSCD02 | Machine Learning | 4 | DSC | 70 | 30 | 100 | 4 | 3 |
| | 24CSCD03 | Digital Image Processing Lab | 8 | DSC | 80 | 20 | 100 | 4 | 3 |
| | 24CSCD04 | Project -II: Major Project | 16 | DSC | 120 | 30 | 150 | 8 | 3 |
| | | ELECTIVE PAPERS (Students are permitted to choose any **one** of the following) | | | | | | | |
| | 24CSCD05 | Theory of Computation | 4 | DSE | 70 | 30 | 100 | 4 | 3 |
| | 24CSCD06 | Research Methodology | 4 | DSE | 70 | 30 | 100 | 4 | 3 |
| | 24CSCD07 | Deep Learning | 4 | DSE | 70 | 30 | 100 | 4 | 3 |
| NOTE: Total number of credits for the semester: 24 | | | | | | | | | |
| | Total Credits for the Course | | 140 | - | - | - | 2400 | 104 | - |

# Total Credits Per Course: 104

# Programme 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.

# Programme Specific Outcome (PSO):

- 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.

## The Courses in the 2024-25 (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 | 24CSCA01: 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 | 24CSCA02: 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 | 24CSCA06:Computer Architecture | Employability and Entrepreneurship | After completion of *Computer Architecture* course, the students will have sustainable employability and entrepreneurship knowledge on software applications. |
| 4 | 24CSCA08: 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 | 24CSCB01 : Python Progrmming | Skill development | After completion of Python Progrmming course, the students will have complete knowledge on Software coding using the Python Language. |
| 6 | 24CSCB02: 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 | 24CSCB06:Internet of Things | Skill development and Employability | After completion of ***IoT*** course, the students will have sustainable employability and entrepreneurship knowledge on IoT hardware cum software applications. |
| 8 | 24CSCB07:Artificial Intelligence | Skill development and Employability | Post learning of AI course, the students will have sustainable employability and entrepreneurship knowledge on AI Technology cum software applications. |
| 9 | 24CSCC01: 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/Deskto p apps). |
| 10 | 24CSCC02:Big Data Analytics | Skill development and Employability | After completion of Big Data Analytics course, the students will have Knowledge about the Data Science and its Applications |
| 11 | 24CSCC07: Web Technology | Skill development and Employability | Enables students to have employability skill to develop or implement We based projects and tools. |

| | | | |
|---|---|---|---|
| 12 | 24CSCC09:Data Science | Skill development and Employability | Data Science gives AI oriented implementation and this fetches lot of job opportunities. |
| 13 | 24CSCD01: 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. |
| 14 | 24CSD02: Machine Learning | Skill development and Employability | After completion of *Machine Learning* course, the students will have Data Science/Machine Learning skills and opportunities. |
| 15 | 24CSCD07: Deep Learning | Skill development and Employability | After completion of *Deep Learning* course, the students will have Deep Learning skills and opportunities. |

# SYLLABUS

(w.e.f. 2024-25 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:** 24CSCA01 | | 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. 2024-25 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: 24CSCA02 | | 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. 2024-25 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: 24CSCA03 | | Max Marks: 100 |
| Subject Name: Advanced 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: 24CSCA04 | | 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. 2024-25 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: 24CSCA05 | | 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. 2024-25 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: 24CSCA06 | | 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. 2024-25 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:** 24CSCA07 | | 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

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.

UNIT II 16Hrs

Strategic Attacks, Types of Attacks, Authentication Service Security, Attacks on mobile phones, Methods & tools used in Cyber Line:, Password Cracking, Malware, DoS & DDoS Attacks, SQL injection , Buffer overflow, Phishing & identity theft, Attacks on wireless network. Security Technology: Firewalls and VPNs: Introduction, Physical design, Firewalls, Protecting Remote Connections.

UNIT III 16Hrs

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. Diffie hellman Key exchange, Digital Signature Technique, Digital Certificates and PKI, User Authentication & Kerberos.

UNIT IV 16Hrs

Cryptography: Concepts & Techniques: Transposition Techniques, Substitution Techniques, Symmetric & Asymmetric Key Cryptography , Advanced Encryption Standard, Data Encryption Standard, DES, RSA algorithm.

Text Books:

1. Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication McGraw Hill. (Chapters: 2, 7, 8, 11)
2. Cryptography & Network Security, Authul Kahate. McGrew-Hill Publication, 2nd Edition. Chapter-1 to 7, 9
3. Cyber Security & Cyber Laws, Nilakshi Jain, Ramesh Menon, Wiley Publications, Chapter 1 to 3, 5.
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. 2024-25 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:** 24CSCA08 | | 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. 2024-25 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: 24CSCB01 | | Max Marks: 100 |
| Subject Name: Python Programming | | |

**Course Prerequisite:**

- Basic Knowledge of C Programming, OOPs Concepts.

**Course Outcome:**

- Describe the semantics of Python programming language and illustrate the process of structuring the data using lists, dictionaries, tuples, strings and sets.
- Illustrate the Object-oriented Programming concepts in Python.
- Demonstrate the basic database design for storing data as part of a multi-step data gathering, analysis, and processing.
- Familiarize the basics of machine learning using an approachable, and also understand the advantage of using Python libraries for implementing Machine Learning models.

**UNIT I** 16Hrs

Introduction to Python, use IDLE to develop programs, Basic coding skills, working with data types and variables, working with numeric data, working with string data, Python functions, Boolean expressions, selection structure, iteration structure, working with lists, work with a list of lists, work with tuples, work with dates and times, get started with dictionaries.

**UNIT II** 16Hrs

Classes in Python: OOPS Concepts, Classes and objects , Classes in Python, Constructors, Data hiding, Creating Classes, Instance Methods, Special Methods, Class Variables, Inheritance, Polymorphism, Type Identification, Custom Exception Classes, Iterators, generators and dec- orators. I/O and Error Handling In Python :Introduction, Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, Reading Data From a File, Additional File Methods, Handling IO Exceptions, Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions, Working with Directories.

**UNIT III** 16Hrs

An Introduction to relational databases: SQL statements for data manipulation, Using SQLite Manager to work with a database, Using Python to work with a database, creating a GUI that handles an event, working with components. Implement Machine Learning algorithms: Usage of Numpy for numerical Data, Usage of Pandas for Data Analysis, Matplotlib for Python plotting, Seaborn for Statical plots, interactive Dynamic visualizations, SciKit for Machine learning.

**UNIT IV** 16Hrs

Advanced Topics: Network Programming, SMTP, Magic Functions, Decorators, Descriptors, date and time, Regular Expression, Threads, Accessing API, DJango

Text/Reference Books:

1. Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016
2. Haltermanpython
3. Mark Lutz, Programming Python, O'Reilly, 4th Edition, 2010

# SYLLABUS

(w.e.f. 2024-25 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:** 24CSCB02 | | 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. PL-SQL, procedures, triggers,etc.

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. 2024-25 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: 24CSCB03 | | Max Marks: 100 |
| Subject Name: Python-Programming Lab | | |

Course Prerequisite:

- Fundamental computer knowledge that includes concepts of C and problem solving skills.

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

- Understand Python and identify its features.
- Basic Programming in Python.
- Problem solving using Python.
- Skill development and Employability: After completion of Python Programming Lab course, the students will have enhanced server-end skills to implement any software applications.

INSTRUCTION-1. Laboratory programs should be conducted as per the respective theory syllabus.
INSTRUCTION-2. Minimum 10 programs from PART- A and Minimum 10 programs from PART- B.

Text/Reference Books:

1. Refer respective theory's Text/Reference books.

## SYLLABUS

(w.e.f. 2024-25 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: 24CSCB04 | | 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.

Note:

1. Laboratory programs should be conducted as per the respective theory's syllabus.
2. Minimum number of programs should cover entire theory syllabus.

# SYLLABUS

(w.e.f. 2024-25 and onwards)

## M.Sc in Computer Science

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|---|---|---|
| Course : M.Sc(CS) | Teaching: 2 hrs./week | Exam Marks: |
| II Semester | Credits: 02 Hrs.: 32 | I. A. Marks: |
| Subject Code: | | Max Marks: |

Subject Name: **Mandatory Skill Program Syllabus : Linux Operating System (For Computer Science Students only)**

### Course Outcomes:

- Understand the theory of Linux design and operation.
- Ability to be productive in a Linux environment. Text editing in the Linux environment.
- Implement basic Linux tools.

**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

**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:** ls – 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:**

1. 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.
2. "Unix Shell Programming", Yashwant Kanetkar.
3. "Beginning Shell Scripting", Eric Foster -Johnson, John C Welch, Micah Anderson, Wrox publication.
4. "Introduction to UNIX" by M G Venkatesh Murthy.

# SYLLABUS

(w.e.f. 2024-25 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: 24CSCB05 | | Max Marks: 100 |
| Subject Name: Computer Networks | | |

### Course Outcomes:

- Understand the data communications system and its components.
- The course introduces main concepts of networking; application areas; classification; reference models; transmission environment; technologies; routing algorithms; IP, UDP and TCP protocols; reliable data transferring methods; application protocols; network security; management systems; perspectives of communication networks. The course structure consists of lectures, tutorials, laboratory works in computer classroom and individual work.

UNIT - I 16Hrs

INTRODUCTION: Network applications, network hardware, network software, reference models: OSI, TCP/IP, THE PHYSICAL LAYER: Theoretical basis for communication, Transmission Media - Guided Media, Twisted Pair Cable, Coaxial Cable, and Fiber-Optic Cable, wireless transmission, Radio Wave Transmission Systems, Microwave Transmission Systems, Infrared Transmission Systems and Satellite Communication System.

UNIT - II 16Hrs

THE DATA LINK LAYER: Design issues, framing, error control, flow control, error detection and correction, data link layer protocols, Pocket over a SONET, Asymmetric digital subscriber loop (ADSL),
THE MEDIUM ACCESS SUBLAYER: Channel allocations problem, Static channel allocation, Dynamic channel allocation, multiple access protocols, ALOHA, Wireless LAN Protocol.

UNIT - III 16Hrs

THE NETWORK LAYER: Network layer design issues, Store and Forward packet switching, Services provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection-Oriented service, Connection-less vs Connection-Oriented.
THE TRANSPORT LAYER: Transport service, Functions of Transport Layer, Characteristics of Transport Layer Protocol, Transport Layer Protocols, User Datagram Protocol (UDP), UDP Segment, Transmission Control Protocol (TCP), and TCP Segment.

UNIT - IV 16Hrs

THE APPLICATION LAYER: Domain name system, electronic mail, architecture and services, User agents, Message formats, Message Transfer. World Wide Web: architectural overview,
APPLICATION LAYER PROTOCOLS: Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet.

TEXT BOOKS:

1. A. S. Tanenbaum (2003), Computer Networks, 4th edition, Pearson Education/ PHI, New Delhi, India.

REFERENCE BOOKS:

1. Behrouz A. Forouzan (2006), Data communication and Networking, 4th Edition, Mc Graw-Hill, India.
2. Kurose, Ross (2010), Computer Networking: A top down approach, Pearson Education, India.

# SYLLABUS

(w.e.f. 2024-25 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: 24CSCB06 | | 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

**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.

UNIT IV 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.

### 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. 2024-25 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: 24CSCB07 | | Max Marks: 100 |
| Subject Name: Artificial Intelligence | | |

**Course Prerequisite:**

- You must have a good catch on statistics, linear algebra, matrix, calculus, probability, programming languages and data modeling.

**Course Outcome:** On completion of this course, successful participants will be able to:

- AI can help businesses and organizations better understand customer behavior, market trends, and other important factors. This information can be used to make better decisions and improve business outcomes.
- Enhanced productivity, improved healthcare, and increased access to education. AI-powered technologies can also help solve complex problems and make our daily lives easier and more convenient.
- Skill Development and Employability: After completion of AI course, the students will have enhanced carrier in AI, development and Implementation of Automatic Systems.

**UNIT-I** 16Hrs

AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation. Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing- Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha- Beta pruning, Evaluation functions.

**UNIT-II** 16Hrs

Knowledge representation issues, predicate logic- logic programming, semantic nets-frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Baye's probabilistic interferences and dempster Shafer theory. First order logic. Inference in first order logic, propositional vs. first order inference, unification and lifts forward chaining, Backward chaining, Resolution, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

**UNIT-III** 16Hrs

Expert systems: Introduction, basic concepts, structure of expert systems, the human element in expert systems how expert systems works, problem areas addressed by expert systems, expert systems success factors, types of expert systems, expert systems and the internet interacts web, knowledge engineering, scope of knowledge, difficulties, in knowledge acquisition methods of knowledge acquisition, machine learning, intelligent agents, selecting an appropriate knowledge acquisition method, societal impacts reasoning in artificial intelligence, inference with rules, with frames: model based reasoning, case based reasoning, explanation and meta knowledge inference with uncertainty representing uncertainty.

**UNIT-IV** 16Hrs

Explainable Artificial Intelligence (XAI):introduction and motivation, removal-based explanations, propagation-based explanations, evaluation metrics, inherently interpretable models, concept explanations, counter factual explanations, instance explanations, neuron interpretation. Human-AI collaboration. Applications in industry. Ensemble Learning: Introduction, Basic Ensemble Learning Techniques, Advanced Ensemble Learning, Techniques, Advanced Ensemble Learning: Bagging, Advanced Ensemble Learning: Boosting. Significance of Artificial Intelligence in Cyber Security, AI Conversational System – Attack Surface Areas and Effective Defense Techniques.

**Text/Reference Books:**

1. Better to not use a textbook because there isn't one that covers enough content (although Christoph Molnar's

online (https://christophm.github.io/interpretable-ml-book/) book is quite good). Instead, we'll directly reference recent research papers.
2. S. Russel and P. Norvig,"Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education
3. David Poole, Alan Mackworth, Randy Goebel,"Computational Intelligence: a logical approach", Oxford University Press.
4. G. Luger,"Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education.
5. J. Nilsson,"Artificial Intelligence: A new Synthesis", Elsevier Publishers.

# SYLLABUS

(w.e.f. 2024-25 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: 24CSCB08 | | 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.

UNIT-I 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.

UNIT-II 16Hrs

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

UNIT-III 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

UNIT-IV 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. 2024-25 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:** 24CSCC01 | | Max Marks: 100 |

**Subject Name: Advanced Java Programming**

**Course Prerequisite:**

- Knowledge of C programming language.

**Course Outcome:**

- Use an integrated development environment to write, compile, run, and test simple object- oriented Java programs.
- Read and make elementary modifications to Java programs that solve real-world problems.
- Validate input in a Java program, Identify and fix defects and common security issues in code.
- Document a Java program using Javadoc.
- Use a version control system to track source code in a project.

**UNIT-I:** 16Hrs

Java-Core: Java Virtual machine, Command Line Parameters, Java Variables and Data Types, Operators, Decision Making, Branching and looping statements. Classes, Objects and Methods used in Java: Class fundamentals, Methods, Constructors, Overloading, Inheritance, Interfaces, One and two dimensional arrays. Java Packages: API pack- ages, system packages, naming conventions. The Collections Framework (java.util) - Collections overview, Collection Interfaces, The Col- lection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Accessing a Collection via an Iterator, Using an Iterator, The For-Each alternative, Map. Multi-threads Programming: Java thread Model, Main Thread, creating a Thread, Creating Multiple Threads, Extending the thread class, Stopping and blocking a thread, Life cycle of a thread. Managing Input/output Files in Java: Stream Classes, Byte Stream Classes, Character Stream Classes, Creation of Files, Reading/Writing characters. Networking: Internet Address, TCP/IP Client Sockets, TCP/IP Server Sockets, URL, URL Connection, JDBC connectivity.

**UNIT II:** 16Hrs

Introduction to JFC and Swing, Features of the Java Foundation Classes, Swing API Components, JComponent Class, Windows, Dialog Boxes, and Panels, Labels, Buttons, Check Boxes, Menus, Toolbars, Implementing Action interface, Pane, JScrollPane, Desktop pane, Scrollbars, Lists and Combo Boxes, Text-Entry Components, Colors and File Choosers, Tables and Trees, Printing with 2D API and Java Print Service API.

JDBC Introduction, JDBC Architecture, Types of JDBC Drivers, The Connectivity Model, The java.sql package, Navigating the ResultSet object's contents, Manipulating records of a ResultSet object through User Interface , The JDBC Exception classes, Database Connectivity, Data Manipulation (using Prepared Statements, Joins, Transactions, Stored Procedures), Data navigation.

**UNIT III:** 16Hrs

Threads and Multithreading, The Lifecycle of a thread, Creating and running threads, Creating the Service Threads, Schedules Tasks using JVM, Thread-safe variables, Synchronizing threads, Communication between threads. Overview of Networking, Working with URL, Connecting to a Server, Implementing Servers, Serving multiple Clients, Sending EMail, Socket Programming, Internet Addresses, URL Connections, Accessing Network interface parameters, Posting Form Data, Cookies, Overview of Understanding the Sockets Direct Protocol. Introduction to distributed object system, Distributed Object Technologies, RMI for distributed computing, RMI Architecture, RMI Registry Service, Parameter Passing in Remote Methods, Creating RMI application, Steps

involved in running the RMI application, Using RMI with Applets.

**UNIT IV:** **16Hrs**

What Is a Servlet? The Example Servlets, Servlet Life Cycle, Sharing Information, Initializing a Servlet, Writing Service Methods, Filtering Requests and Responses, Invoking Other Web Resources, Accessing the Web Context, Maintaining Client State, Finalizing a Servlet. What Is a JSP Page?, The Example JSP Pages, The Life Cycle of a JSP Page, Creating Static Content, Creating Dynamic Content, Unified Expression Language, JavaBeans Components, JavaBeans Concepts, Using NetBeans GUI Builder Writing a Simple Bean, Properties: Simple Properties, Using Custom tags Reusing content in JSP Pages, Transferring Control to Another Web Component.

**Text/Reference Books:**

1. The Java Tutorials of Sun Microsystems Inc.
2. The Java EE 5 Tutorial, Pearson Education, Third Edition, 2003, Eric Jendrock, Jennifer Ball, D Carson
3. Java2: The Complete Reference, Herbert Schildt

# SYLLABUS

(w.e.f. 2024-25 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:** 24CSCC02 | | 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. 2024-25 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: 24CSCC03 | | 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 20 among that 10 programs from PART- A & 10 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: 24CSCC04 | | Max Marks: 100 |
| Subject Name: Project –I: Minor Project | | |

Course Outcomes:

- Literature Review
- Preparation for Paper Publications
- Mini project/Department/University Usable Projects prepferable using Advanced Java Programming, JDBC, JSP or latest Technologies.

**Objectives:**

i. To define the problem of the proposed research work
ii. To apply the concepts of Computer Science in solving the research problem
iii. To demonstrate and validate the results of the design concept
iv. Awareness on Journals/Conference
v. Presentation on planned work

**Course Outcomes:** Able to identify and formulate research problem

- Able to design and develop solution to the problem , Able to analyze and solve the complex problems ,Able to plan, implement and execute the project
- Able to write effective technical report and demonstrate through presentation.

# SYLLABUS

(w.e.f. 2024-25 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:** 24CSCC05 | | Max Marks: 50 |
| **Subject Name:** COMPUTER FUNDAMENTALS (Inter disciplinary) | | |

**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 I 16 Hours

**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. **Office tools.**

UNIT II 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. 2024-25 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: 24CSCC06 | | Max Marks: 100 |
| Subject Name: Advanced Software Engineering | | |

**COURSE OBJECTIVES:**

To understand the rationale for software development process models

- To understand why the architectural design of software is important;
- To understand the five important dimensions of dependability, namely, availability,reliability, safety, security, and resilience.

**COURSE OUTCOMES**:The Students will be able to

CO1:Identify appropriate process models based on the Project requirements

CO2:Understand the importance of having a good Software Architecture.

CO3:Understand the five important dimensions of dependability, namely, availability, reliability,safety, security, and resilience.

CO4:Understand the basic notions of a web service, web service standards, and service-orientedarchitecture;

CO5: Be familiar with various levels of Software testing

**UNIT I:** 16Hours

SOFTWARE PROCESS &MODELING : Prescriptive Process Models – Agility and Process – Scrum – XP – Kanban – DevOps – Prototype Construction – Prototype Evaluation – Prototype Evolution – Modelling – Principles –Requirements Engineering – Scenario-based Modelling – Class-based Modelling – Functional Modelling – Behavioural Modelling. SOFTWARE DESIGN : Design Concepts – Design Model – Software Architecture – Architectural Styles – Architectural Design – Component-Level Design – User Experience Design – Design for Mobility – Pattern Based Design.

**UNIT II :** 16Hours

SYSTEM DEPENDABILITY AND SECURITY :Dependable Systems – Dependability Properties – Sociotechnical Systems – Redundancy and Diversity – Dependable Processes – Formal Methods and Dependability – Reliability Engineering – Availability and Reliability – Reliability Requirements – Fault-tolerant Architectures – Programming for Reliability – Reliability Measurement – Safety Engineering – Safety-critical Systems – Safety Requirements – Safety Engineering Processes – Safety Cases – Security Engineering – Security and Dependability – Safety and Organizations – Security Requirements – Secure System Design –Security Testing and Assurance – Resilience Engineering – Cyber security – Socio technical Resilience – Resilient Systems Design.

**UNIT III:** 16Hours

SOFTWARE TESTING AND SOFTWARE CONFIGURATION MANAGEMENT : Software Testing Strategy – Unit Testing – Integration Testing – Validation Testing – System Testing Debugging – White-Box Testing – Basis Path Testing – Control Structure Testing –Black-Box Testing – Software Configuration Management (SCM) – SCM Repository – SCM Process – Configuration Management for Web and Mobile Apps.

**UNIT IV:** 16Hours

SOFTWARE TESTING AND SOFTWARE CONFIGURATION MANAGEMENT 9Software Testing Strategy – Unit Testing – Integration Testing – Validation Testing – System Testing– Debugging – White-Box Testing – Basis Path Testing – Control Structure Testing –Black-BoxTesting – Software Configuration Management (SCM) – SCM Repository – SCM Process –Configuration Management for Web and Mobile Apps

**References:**

1. Software Engineering: A Practitioner's Approach, 9th Edition. Roger Pressman and BruceMaxim, McGraw-Hill 2019.
2. Software Engineering, 10th Edition, Ian Somerville, Pearson Education Asia 2016.
3. Software Architecture In Practice, 3rd Edition, Len Bass, Paul Clements and Rick Kazman,Pearson India 2018
4. An integrated approach to Software Engineering, 3rd Edition, Pankaj Jalote, NarosaPublishing House, 2018
5. Fundamentals of Software Engineering, 5th Edition, Rajib Mall, PHI Learning Private Ltd,2018

# SYLLABUS

(w.e.f. 2024-25 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: 24CSCC07 | | Max Marks: 100 |
| Subject Name: 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. 2024-25 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: 24CSCC08 | | Max Marks: 100 |

Subject Name: Advanced Operating Systems

Course Prerequisite:

- Knowledge of C, Computer Organization and Architecture, x86 Assembly level programming.

Course Outcome:

- Understand the principles and methods for resource-analysis for embedded- and real- time systems.
- Acquire good knowledge of the relevant mechanisms and methods in operating systems and hardware that have influence on real-time aspects, principles and methods for design and construction of embedded- and real-time systems.

**UNIT-I:** 16Hours

Introduction to Operating System, Process concepts, process state, process control block, multithreaded programming, Deadlock: Deadlock Characterization, prevention, detection, avoidance, Recovery from Deadlock Synchronization. Critical section problem, Semaphores, Classical problems of synchronization: Dinning Philosopher's problem, Bounded buffer problem, Reader's- Writers problem.

**UNIT-II :** 16Hours

Paging-Segmentation Virtual Memory, Demand paging, Page Replacement, Thrashing, Disk Structures: Disk Scheduling, Free Space management, Distributed File systems, Naming and Transparency File Systems Interface: File concepts, Access methods, Directory Structures. File System Implementation.

**UNIT - III:** 16Hours

DEVICES AND DEVICE DRIVERS Devices and Types of Devices; Terminal, Disk, SCSI, Tape and CD devices; Unification of Files and Devices; Device Drivers: Concepts and Implementation Details.

**UNIT - IV:** 16Hours

RESOURCE MANAGEMENT AND SECURITY Resource Management Issues; Types of Resources; Integrated Resource Scheduling; Queuing Models of Scheduling; Protection of Resources – hardware, software, and attacks; Security Policies.

**Text/Reference Books:**


1. Operating Systems Concepts Abraham Silberschalz Peter B Galvin, G.Gagne, Addision Wesley Pub-lishing Co. 7th 2010
2. Modern operating Systems Andrew S.Tanenbaum, PHI Learning Pvt.Ltd. 3rd 2008
3. Operating Systems: Internals and Design Principles William Stallings Prentice Hall 7th 2011
4. Operating Systems H M Deital, P J Deital and D R Choffnes, Pearson Education 3rd 2011
5. Operating Systems: A Concept-based Approach. D M Dhamdhere Tata McGraw-Hill Education 2nd 2007
6. Charles Crowley. Operating Systems: A Design-Oriented Approach, Tata McGraw-Hill (2001 or later)
7. Richard Stevens, Stephen Rago. Advanced Programming in the Unix Environment, Addison-Wesley (2013). Available for free download in PDF.

# SYLLABUS

(w.e.f. 2024-25 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:** 24CSCC09 | | Max Marks: 100 |
| Subject Name:Data Science | | |

**Course Learning Objectives:**

- Progarrming data science concepts and Big Data, modelling using R language.
- Analyze Basic tools of EDA, Data science process with case studies and Different algorithms.
- Optimize & solve real life problems with different spam filter.
- Explore Feature Generation and Feature Selection

**UNIT-I:** 16Hours

Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, A data Science Profile, Skill sets. Statistical Inference, Populations and samples, Big Data, new kinds of data, modelling, statistical modeling probability distributions, fitting a model, - Introduction to R, Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: RealDirect (online real estate firm).

**UNIT-II:** 16Hours

Algorithms, machine Learning Algorithms, Three Basic Algorithms: Linear Regression, k-Nearest Neighbours (kNN), k-means, R Programs for the algorithms Spam Filter, Linear Regression and Spam Filter, K-NN and spam Filter,, Naïve Bayes Algorithm, Spam Filter using Naïve Bayes, Laplace Smoothing,, Comparing Naïve Bayes to K-NN, Scraping the Web, introduction to Logical Regression and M6D case study.

**UNIT-III:** 16Hours

Feature Generation and Feature Selection (Extracting Meaning from Data): Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system.

**UNIT-IV:** 16Hours

Data Engineering, Map reduce, Word Frequency Problem,, Map Reduce Solution, Other Examples of Map Reduce,Pregel-An Introduction. Data Visualization: Basic principles, ideas and tools for data visualization. Mining SocialNetwork Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs.

**Text Books :**

1. Cathy O Neil, Rachel Schutt, 2014, "Doing Data Science-Straight Talk from the Frontline", Orielly
2. Jure Leskovek, Anand Rajaraman, Jeffrey Ullman, 2014 Mining of Massive Data Sets, Cambridge University Press

**Reference Books**

1. Kevin Murphy, 2013, Machine learning: A Probabalistic Perspective,
2. Peter Bruce, Andre Bruce, Practical Statistics for Data Scientists, Orielly Series

# SYLLABUS

(w.e.f. 2024-25 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: 24CSCD01 | | 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, Object Recognition: Patterns and patterns classes, matching, classifiersObject Recognation.

Text Books:

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

# SYLLABUS

(w.e.f. 2024-25 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:** 24CSD02 | | Max Marks: 100 |
| **Subject Name: Machine Learning** | | |

**Course Prerequisite:**

- Basics of Algebra, Linear algebra, Trigonometry, Statistics, Calculus, Python Programming.

**Course Outcome:**

- 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, Machine learning definition, importance of machine learning, machine learning framework, types of machine learning, relation to other fields, examples of machine learning applications, designing a learning system, issues in machine learning.

**UNIT II** 16Hrs

Introduction to Supervised Learning, Decision tree based classifier, Bayesian theory based classifier, and neural network based classifier, nearest neighbor classifier, Support vector classifier, performance evaluation.

**UNIT III** 16Hrs

Introduction to Unsupervised Learning, Clustering methods, Criteria functions for clustering, Similarity measures, Component analysis, Low dimensional analysis and multidimensional scaling.

**UNIT IV** 16Hrs

Additional topics, Reinforcement learning, Genetic algorithms, Analytical learning, Ensemble of classifiers, Design and analysis of machine learning experiments

**Text/Reference Books:**

1. Machine Learning: a Probabilistic Perspective by Kevin Patrick Murphy, MIT Press, March 2014.
2. Introduction to Machine Learning by Alex Smola and S.V.N. Vishwanathan, Cambridge University Press.
3. Understanding Machine Learning: From Theory to Algorithms by Shai Shalev-Shwartz and Shai Ben-David
4. Published 2014 by Cambridge University Press.

## SYLLABUS

(w.e.f. 2024-25 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: 24CSCD03 | | 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. 2024-25 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: 24CSCD04 | | Max Marks: 150 |
| Subject Name: Project -II: 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. If required students can develop Department/University /Govt. usable projects.

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. 2024-25 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:** 24CSCD05 | | 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. 2024-25 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: 24CSCD06 | | 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. 2024-25 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: 24CSCD07 | | Max Marks: 100 |
| Subject Name: Deep Learning | | |

**Objective** of the course: To get the students and researchers exposed to the state of the art deep learning techniques, approaches and how to optimize their results to increase its efficiency and get some hands-on on the same to digest the important concepts.

**Outcome** of the course: As deep learning has demonstrated its tremendous ability to solve the learning and recognition problems related to the real world problems, the software industries have accepted it as an effective tool. As a result there is a paradigm shift of learning and recognition process. The students and researchers should acquire knowledge about this important area and must learn how to approach to a problem, whether to deal with deep learning solution or not.

UNIT I 16Hrs

Basic concepts of perceptron, learning and recognition- supervise and unsupervised learning. Fundamentals of delta learning rules and back propagation algorithm, SVM, KNN. Machine Learning, machine learning techniques, challenges motivating deep learning. over fitting and under fitting, bias and variance, Gradient based optimization, Maximum LikelihoodEstimation. Deep Feed-forward network, backpropagation. Some Regularization and Optimization Techniques

UNIT II 16Hrs

Convolutional Neural Network, RNN, methodology and Applications of deep learning

UNIT III 16Hrs

Linear Factor Models and Autoencoders,Monte Carlo Methods, Stochastic Maximum, Likelihood and Contrastive Divergence

UNIT IV 16Hrs

Deep Generative Models: Boltzmann Machine, RBM, Deep Belief Nets, Deep Boltzmann Machine, Convolutional Boltzmann Machine

**Text Books:**

Deep Learning by- Ian Goodfellow, Yoshua Bengio and Aaron Courville

In addition other machine learning books , research papers etc. will be used.

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Internal Test Question Paper Pattern

First Semester MSc(CS) Degree Examinations -2025

**MASTER OF COMPUTER SCIENCE**

# FORMAT of Test Paper: <Subject>

**Time: 1.30 Hours** **Max. Marks: 35**

**PART-A**

Answer **any Five of** the following: **(5×2= 10)**

1.

a.
b.
c.
d.
e.
f.
g.

**PART-B**

Answer **any Three of** the following: **(3×5= 15)**

2.
3.
4.
5.
6

**PART-C**

Answer **any One of** the following: **(10×1= 10)**

7.
8.

Main Examination Question Paper Pattern

## First Semester MSc(CS) Degree Examinations-2025

### MASTER OF COMPUTER SCIENCE

# Paper :< Subject>

**Time: 3 Hours** **Max. Marks: 70**

**PART-A**

Answer **any Five** of the following: **(2×5= 10)**

1.

a.
b.
c.
d.
e.
f.
g.

**PART-B**

Answer **any Four** of the following*: **(5×4= 20)**

2.
3.
4.
5.
6.
7.

**PART-C**

Answer **any Four** of the following*: **(10×4= 40)**

8.
9.
10.
11.
12.
13.

*PART-B questions can be partitioned into ***A*** and ***B*** sub-questions.

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