**Rayat Shikshan Sanstha's**

# Sadguru Gadage Maharaj College, Karad

(An Autonomous College)

**Accredited by NAAC with 'A$^{+}$' grade**

**Affiliated to Shivaji University, Kolhapur**

**(NEP-2020)**

## Syllabus for

# M.Sc. (Computer Science)

(Under Faculty of Science and Technology)

# PART I SEMESTER I & II

**(Syllabus to be implemented from Academic year 2023-24)**

## (NEP-2020)
## Program Structure M.Sc. Part – I (Level-6)

| **SEMESTER-I (Duration- Six Month)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sr. No. | Program Code | Teaching Scheme | | | Examination Scheme | | | | | |
| | | Theory and Practical | | | University Assessment (UA) | | | Internal Assessment (IA) | | |
| | | Lectures(Per week) | Hours (Per week) | Credit | Maximum Marks | Minimum Marks | Exam. Hours | Maximum Marks | Minimum Marks | Exam. Hours |
| 1 | **MJ-MCST23-101:** Design and Analysis of algorithm | 4 | 4 | 4 | 80 | 32 | 3 | 20 | 8 | |
| 2 | **MJ-MCST23-102:** Advanced Database Management System | 4 | 4 | 4 | 80 | 32 | 3 | 20 | 8 | |
| 3 | **MCSP23-103:** Practical-I | --- | 6 | 4 | 80 | 32 | 3 | 20 | 8 | |
| 4 | **MJ-MCST23-104:** Web Design | 2 | 2 | 2 | 40 | 16 | 2 | 10 | 4 | |
| 5 | **GE-MCST23-105:** Elective 1**)Cyber Security** 2) Cloud Computing | 4 | 4 | 4 | 80 | 32 | 3 | 20 | 8 | |
| 6 | **RM- MCST23-106:** Research Methodology | 4 | 4 | 4 | 80 | 32 | 3 | 20 | 8 | **--** |
| | Total (A) | --- | ----- | 22 | 440 | ------ | ---------- | 110 | | |

## SEMESTER-II (Duration- Six Month)

| Sr. No. | Program Code | Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Theory and Practical | | | University Assessment (UA) | | | Internal Assessment (IA) | | |
| | | Lectures (Per week) | Hours (Per week) | Credit | Maximum Marks | Minimum Marks | Exam. Hours | Maximum Marks | Minimum Marks | Exam. Hours |
| 1 | **MJ-MCST23-201:** Advanced Java | 4 | 4 | 4 | 80 | 32 | 3 | 20 | 8 | **--** |
| 2 | **MJ-MCST23 -202:** Artificial Intelligence | 4 | 4 | 4 | 80 | 32 | 3 | 20 | 8 | **--** |
| 3 | **MCSP23-203:** Practical-II | --- | 6 | 4 | 80 | 32 | 3 | 20 | 8 | **--** |
| 4 | **MJ-MCST23-204:** Angular JS | 2 | 2 | 2 | 40 | 16 | 2 | 10 | 4 | **--** |
| 5 | **GE-MCST23-205:** 1) Image Processing **2) Bloc k chain Technology** | 4 | 4 | 4 | 80 | 32 | 3 | 20 | 8 | **--** |
| 6 | **OJT/FP-MCSP23-206** Internship | --- | --- | 4 | 80 | 32 | -- | 20 | 8 | **--** |
| | Total (B) | 14 | 20 | 22 | 440 | | | 110 | | |
| | Total (A+B) | | | 44 | 880 | | | 220 | | |

- Student contact hours per week : **24** Hours (Min.)
- Theory and Practical Lectures : **60** Minutes Each
- **MJ-MCST23** Major Core Program
- **GE-MCST23**- General Core Program Specialization
- MCSP23-Core Program Practical
- RM: Research Methodology
- OJT: On job training Internship: Student must complete On job training/ Internship during semester break.

- Total Marks for M.Sc.-I : **1100**
- Total Credits for M.Sc.-I (Semester I & II) : **44**
- Practical Examination is **Semester wise before theory Examination**.
- Examination for MCSP23-103shall be based onSemester-I Practical.
- Examination for MCSP23-203 shall be based onSemester II Practical.
- *Duration of Practical Examination as per respectiveBOS guidelines
- ***Separate passing is mandatory for Theory,Internal and Practical Examination***

- **Requirement for Entry at Level 6: Completed all requirements of the Bachelor's degree (Level 5).**

- **Exit Option at Level 6:** Students can exit after Level 6 with **Post Graduate Diploma in ComputerScience** if he/she completes the Programs equivalent to minimum of 40-**44** credits.

## (NEP-2020)

## M.Sc. Program Structure Part – II (Level-6.5)

| **SEMESTER-III (Duration- Six Month)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sr. No. | Program Code | Teaching Scheme | | | Examination Scheme | | | | | | |
| | | Theory and Practical | | | University Assessment (UA) | | | Internal Assessment (IA) | | | |
| | | Lectures (Per week) | Hours (Per week) | Credit | Maximum Marks | Minimum Marks | Exam. Hours | Maximum Marks | Minimum Marks | Exam. Hours | |
| 1 | **MJ-MCST24-301:** Advanced PHP | 4 | 4 | 4 | 80 | 32 | 3 | 20 | 8 | | |
| 2 | **MJ-MCST24-302:** Data Science | 4 | 4 | 4 | 80 | 32 | 3 | 20 | 8 | | |
| 3 | **MCSP24-303**: Practical-III | --- | 6 | 4 | 80 | 32 | 3 | 20 | 8 | | |
| 4 | **MJ-MCST24-304:** Data Engineering | 2 | 2 | 2 | 40 | 16 | 2 | 10 | 4 | | |
| 5 | **GE-MCST24-305:** 1) Big Data Analytics **GE-MCST24-305A: Machine Learning** | 4 | 4 | 4 | 80 | 32 | 3 | 20 | 8 | | |
| 6 | RP24-306: Research Project | --- | 6 | 4 | 80 | 32 | 3 | 20 | 8 | -- | |
| | Total (C) | 14 | 26 | 22 | 440 | | | 110 | | | |

| **SEMESTER-IV (Duration- Six Month)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sr. No. | Program Code | Teaching Scheme | | | Examination Scheme | | | | | | |
| | | Theory and Practical | | | University Assessment (UA) | | | Internal Assessment (IA) | | | |
| | | Lectures (Per week) | Hours (Per wee) | Credit | Maximum Marks | Minimum Marks | Exam. Hours | Maximum Marks | Minimum Marks | Exam. Hours | |
| 1 | MJ-MCST24--401: Mobile App Development with Flutter | 4 | 4 | 4 | 80 | 32 | 3 | 20 | 8 | | |
| 2 | MJ-MCST24 -402:Full Stack Development | 4 | 4 | 4 | 80 | 32 | 3 | 20 | 8 | | |
| 3 | MCSP24-403: Practical-IV | -- - | 6 | 4 | 80 | 32 | 3 | 20 | 8 | | |
| 4 | GE-MCST24 -404: **1) Natural Language Processing** 2) GE-MCST24 -404A: Agile Project Management | 4 | 4 | 4 | 80 | 32 | 3 | 20 | 8 | | |
| 5 | RP-24-405: Research Project | --- | 10 | 6 | 100 | 40 | 3 | 50 | 20 | -- | |
| | Total (D) | 12 | 28 | 22 | 420 | | | 130 | | | |
| | Total (C +D) | | | 44 | 860 | | | 240 | | | |

| | |
|---|---|
| • Student contact hours per week : **26** Hours (Min.) | • Total Marks for M.Sc.-II : **1100** |
| • Theory and Practical Lectures : **60** Minutes Each | • Total Credits for M.Sc.-II (Semester III & IV) : **44** |

| | |
|---|---|
| • **MJ-MCST24** Major Core Program<br>• **GE-MCST24**- General Core Program Specialization<br>• **MCSP24**-Core Program Practical<br>• **RP**: Research Project | • **Practical Examination is Semester wise before theory examination**.<br>• Examination for MCSP24-303shall is based on Semester III Practical.<br>• Examination for MCSP24-403 shall be based on Semester IV Practical.<br>• ***Duration of Practical Examination as per respective BOS guidelines<br>• ***Separate passing is mandatory for Theory, Internal and Practical Examination*** |
| • **Requirement for Entry at Level 6.5:**<br>**Completed all requirements of the relevant Post Graduate Diploma in Computer Science (Level 6)** | |
| • **Exit at Level 6.5:** Students will exit after Level 6.5 with **Master's Degree in Computer Science** if he/she completes the Programs equivalent to Minimum of 88 credits. | |

| | **M.SC.-I** | **M.SC.-II** | **Total** |
|---|---|---|---|
| **Marks** | **1100** | **1100** | **2200** |
| **Credits** | **44** | **44** | **88** |

## Master of Science (M.Sc.) Computer Science)

(Under faculty of Science & Technology)

## Course outcomes

Upon successful completion of the M.Sc. the student should have met the following Student Learning Outcomes:

1. Students will acquire the ability to identify and formulate research problems, enabling them tocontribute to the advancement of knowledge in the field of computer science

2. Identify, analyze, and synthesize scholarly literature relevant to the field of computer science.

3. Employ software development tools, software systems, and modern computingplatforms.

4. Prepare for academic roles such as NET/SET/PhD.

5. Apply design and development principles when constructing software systems of varying complexities.

6. The program cultivates the ability to effectively communicate and collaborate as part of a team in multidisciplinary projects, utilizing essential skills for seamless coordination and cooperation.

# 1. Introduction

1. The name of the programme shall be **M.Sc. (Computer Science)**.

2. The M.Sc. in Computer Science is a postgraduate degree program that provides in-depth knowledge and expertise in various aspects of computer science. This program is designed for students to make a strong foundation in computer science and wish to further their education and skills in specialized areas. It offers advanced Programwork and research opportunities to explore cutting-edge topics and contribute to the field of computer science.

3. Completing an MSc. in Computer Science equips students with a diverse set of skills and knowledge that can lead to various career opportunities in academia, research, industry, or entrepreneurship. They can pursue roles such as software engineer, data scientist, artificial intelligence specialist, cyber security analyst, research scientist, consultant, or pursue further academic studies such as a Ph.D. in Computer Science.

4. The University Department offering the MSc. program will determine the number of electives based on recent trends in IT industry.

5. The MSc. program in Computer Science is a combination of computer-related Programs that cover programming techniques, software packages, databases, and system analysis and design tools. The program includes projects to enhance students' technical skills, IT understanding, and domain knowledge, preparing them for suCO23essful careers as software professionals. Emphasis is placed on domain knowledge in various areas, enabling students to develop software applications.The curriculum covers Software Engineering, data science, cyber security, block chain technology, and cloud computing, full stack development, mobile technologies and advanced Internet and web technologies. Soft skills development is integrated to enhance students overall personality and employability. The projects in the MSc. program prioritize emerging fields suchas mobile app development, full stack development. The current curriculum emphasizes learning from three perspectives: conceptual learning, skills learning, and practical/hands-on experience.

6. The inclusion of projects at second year ensures the focus on applying the skills learnt at respective levels. It will enhance student’s capability to work on various technologies. It willmake appropriate platform for students to

work in IT Industry. This program aims to enhance student's technical orientation and foster their eagerness to do the research projects as per the IT industry demand.

## 2. Duration of the Program:

The M,SC. programme will be a full-time TWO years i.e. 4 semesters. Patternof examination will be Semester System.

## 3. Medium of Instruction:

The medium of Instruction will be English only.

## 4. Admission Procedure

**Eligibility:**

- B.Sc. Computer Science (Entire/ optional) / B.Sc. IT/ BCA, B.Sc. Mathematics, B.Sc. Statistics, B.Sc. Electronics, B.Sc. Animation, B.Sc. Physics, B.Sc. Chemistry/ BSc. Microbiology.
- Admission through University Entrance exam only.
- Only entrance marks should be considered for admission process.
- Reservation of Seats as per rules of Government of Maharashtra

## 5.Program Structure:

Lectures and Practical should be conducted as per the scheme of lectures and practical indicated in the Program structure.

## 6. Teaching and Practical Scheme

1. Each contact session for teaching or practical should be of 60 minutes each.
2. Minimum 48 periods should be conducted for each subject of 100 Marks.
3. Minimum 24 periods should be conducted for each subject of 50 Marks.
4. One Practical Batch should be of 30 students.
5. Practical evaluation should be conducted before the commencement of University examination.

## 7. Project Work:

i. Project work may be done individually or in groups in case of bigger projects. However, if project is done in groups, each student must be given a

responsibility for a distinct module and care should be taken to see the progress of individual modules is independent of others.

ii. Students should take guidance from assigned guide and prepare a Project Report on "Project Work" in two copies to be submitted to the Director of the Institute/Head of the Department.

iii. The project report will be duly accessed by the assigned guide and internal marks will be communicated by the Director of the Institute/Head of the Department.

iv. The project report should be prepared in a format prescribed by the University. The external viva shall be conducted by a panel of minimum two examiners out of which one will be external and other will be internal examiner.

**OR**

Students will be provided the opportunity to formulate a research project proposal. It requires careful planning, critical thinking, and a thorough understanding of existing literature and technological advancements.

## v. Assessment:

1. The final total assessment of the candidate is made in terms of an internal assessment and an external assessment for each Program.

- For each theory paper, 20% marks will be based on internal assessment and 80% marks for semester examination (external assessment), unless otherwise stated.

- The division of the 20 marks allotted to internal assessment of theory papers is as Follows:

- Two tests should be conducted of MCQ type questions. Each test will be of 10 marks.

- The division of the 10 marks allotted to internal assessment of theory papers is as Follows. Test of 10 marks should be conducted of MCQ type questions.

2. The project will be evaluated by the university appointed examiners both internal as well as external.

3. The final practical examination will be conducted by the university appointed examiners both internal as well as external at the end of semester for

each lab Program and marks will be submittedto the university by the panel. The pattern of final Practical Examination will be as follows;

| | | |
|---|---|---|
| 1 | Coding and Execution of Program | 60 Marks |
| 2 | Viva-voce | 20 Marks |
| 3 | Journal | 20 Marks |
| 4 | Total | 100 Marks |

The practical examination will be conducted semester wise in order to maintain the relevance of therespective theory Program with laboratory Program.

4. The internal marks will be communicated to the University at the end of each semester, but before the semester end examinations. These marks will be considered for the declaration of the results.

5. The final Examinations shall be conducted at the end of the semester.

6. Nature of question paper:

Nature of question paper is as follows for University end semester examination.

**a. Theory Examination (80 marks): For 80 marks:**

1. There will be seven (7) questions of 16 Marks and out of which four (4) to be attempted fromquestion no 2 to 7.

2. Question No.1 is compulsory and is of multiple-choice questions. There will be 8 multiplechoice question each carrying 2 marks.

3. Question No.2 to Question No. 7 should consist of 2 sub questions each carrying 8 marks.

4. Question No. 7 should be a short note, where 4 questions will be given, out of which twoquestions should be attempted.

## For 40 marks:

1. There will be six (6) questions of 10 Marks and out of which three (3) to be attemptedfrom question no 2 to 6.

2. Question No.1 is compulsory and is of multiple choice questions. There will be5 multiple

choice question each carrying 2 marks.

### b. Practical Examination:

1. Duration of Practical Examination: 3 Hrs

2. Nature of Practical Question paper: There will be three questions out of which any twoquestions to be attempted and each question carries 30 Marks.

## 9. Standard of Passing:

Internal as well as external examination will be held at the end of semester. The candidate must score 40% marks in each head of internal as well as external Examination

## 10. Board of Paper Setters /Examiners:

For each Semester end examination there will be a board of Paper setters and examinersfor every Program. While appointing paper setter /examiners, care should be taken to see that there is at least one person specialized in each unit of the Program.

## 11. Award of Class:

There will be numerical marking on each question. At the time of declaration of the resultthe marks obtained by the candidate is converted into grade point as shown below;

## Grade Point Table

| Range of Marks obtained out of 100 or any fractions | Grade Points |
|---|---|
| 0 | 0 To 5 |
| 1 | 6 To 10 |
| 1.5 | 11 To 15 |
| 2 | 16 To 20 |
| 2.5 | 21 To 25 |
| 3 | 26 To 30 |
| 3.5 | 31 To 35 |
| 4 | 36 To 40 |

| | |
|---|---|
| 4.5 | 41 To 45 |
| 5 | 46 To 50 |
| 5.5 | 51 To 55 |
| 6 | 56 To 60 |
| 6.5 | 61 To 65 |
| 7 | 66 To 70 |
| 7.5 | 71 To 75 |
| 8 | 76 To 80 |
| 8.5 | 81 To 85 |
| 9 | 86 To 90 |
| 9.5 | 91 To 95 |
| 10 | 96 To 100 |

**Grading**: Shivaji University has introduced a Seven-point grading system as follows:

| **Grades** | **CGPA Credit Points** |
|---|---|
| O | 8.60 To 10 |
| A+ | 7.00 To 8.59 |
| A | 6.00 To 6.99 |
| B+ | 5.50 To 5.99 |
| B | 4.50 To 5.49 |
| C | 4.00 To 4.49 |
| D | 0.00 To 3.99 |

| **Overall Final Grades** | **Class** | | **Grade** |
|---|---|---|---|
| 8.60 To 10 | Higher Distinction Level | Extraordinary | O |
| 7.00 To 8.59 | Distinction Level | Excellent | A+ |
| 6.00 To 6.99 | First Class | Very Good | A |
| 5.50 To 5.99 | Higher Second Class | Good | B+ |
| 4.50 To 5.49 | Second Class | Satisfactory | B |
| 4.00 To 4.49 | Pass | Fair | C |
| 0.00 To 3.99 | Fail | Unsatisfactory | D |

## 12. Credit system implementation:

As per the University norms and NEP-2020

## 13. Clarification of Syllabus:

The syllabus Committee should meet at least once in a year to study and clarify any difficulties from the Institutes. The Workshop on syllabi should be organized at the beginning of everysemester on request from Institutes.

## 14. Eligibility of Faculty:

A Candidate must possess M. Sc. in Comp. Sci./ MCA (Science) with NET/ SET/SLET or Ph.D.

## 15. Revision of Syllabus:

In light of the aCO23elerated pace at which computer technology renders knowledge obsolete, it is imperative to contemplate revising the syllabus at regular intervals of approximately two to three years.

## 16. Backlog

Students should not have more than FOUR (4) backlogs for second year admission.

**M.Sc. (Computer Science) Part I Semester I(NEP-2020)**

**To be implemented from the academic year 2023-2024**

**Code: MJ-MCST23-101 Title of Program: Design and Analysis of Algorithm**

**Internal Marks: 20** **External Marks: 80** **Theory: 04 hours/week**

**Course outcomes:**

1. Analyze the asymptotic performance of algorithms.
2. Demonstrate a familiarity with data structures and algorithms.
3. Compare algorithms based on time & space complexity.
4. Employ graphs to model real life problems, when appropriate. Develop algorithms that employ graph computations as key components, and analyze them.
5. Mapping of data structures like Stack, Queue and Linked List to real lifeproblems.

6.Master the implementation of linked data structures such as linked lists andbinary trees.

7.Be familiar with advanced data structures such as balanced search trees,hash tables, Red-Black trees, B-trees.

8. Understand Divide & Conquer approach, Greedy algorithm,Backtracking approach for algorithm design.

9. Be familiar with Branch and Bound & Dynamic programming

**UNIT I** **(15 Hours)**

**Algorithm Analysis**: Introduction to algorithms, analyzing and designing algorithms, Growth functions, asymptotic notations, **Divide and conquer**: The maximum sub array problem, matrix multiplication, solving recurrences: Substitution method, recursion tree method, master method. Binary Search, Max-Min problem, Sorting (Merge Sort, Quick Sort).

**Hashing**: Hashing, Direct address tables, Hash tables, Hash functions, collision resolution techniques.

**Unit II** **(15 Hours)**

**Data Structures**: Stacks, Queues, Linked list, Trees, General tree, Binary tree, binary search tree, operations on binary search tree, AVL tree, Red-Black Trees B-trees. **Graphs**: Representations of graph, Traversing Graphs, Breadth-first search, Depth- First Search, topological sort.

**Unit III** **(15 Hours)**

**Greedy Algorithm:** General Characteristics of greedy algorithms, Problem solving using Greedy Algorithm - Activity selection problem, Elements of Greedy Strategy, Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm), Shortest paths, The Knapsack Problem, Job Scheduling Problem,

Huffman code.

**Unit IV** **(15 Hours)**

**Backtracking:** Introduction, N Queen Problem, Subset Sum, Hamiltonian Cycle

**Branch and Bound** – Introduction**,** 0/1 Knapsack, Travelling Salesman problem,

**Dynamic programming**: Introduction, Tabulation, memorization, OptimalSubstructure Property in Dynamic Programming

**References:**


1. Introduction to algorithms, Third Edition. by Thomas H. Cormen, Charles E.Leiserson, Ronald L. Rivest, Clifford Stein, PHI
2. Fundamentals of Computer Algorithms, Second edition. By Ellis Horowitz,SartajSahani, SanguthevarRajasekaran, University Press.
3. Data structures and algorithm analysis in C, Second edition. By Mark
4. Allen weiss
5. Fundamental algorithms by Donald E. Knuth, Pearson Education.


**M. Sc (Computer Science) Part I Semester I(NEP-2020)**

**To be implemented from the academic year 2023-2024**

## Code: MJ-MCST23-102 Title of Program: Advanced Database Management System Internal Marks: 20 External Marks: 80 Theory: 04 hours/week

**Course outcomes:**

1. Demonstrate an understanding of the relational data model.
2. Formulate, using SQL, solutions to a broad range of query and data updateproblems.
3. Use PL/SQL for handing data in a database as per the user's requirement usingprogramming features
4. Define various cursors and its implementation along with procedure andfunctions.
5. To study usage and applications of parallel and distributed

databases, objectrelational database.

6. To acquire knowledge on NoSQL databases.

**UNIT I (15 Hours)**

**Introduction to RDBMS: Introduction to** DBMS & RDBMS. Data constraint- primary key, foreign key, unique key, null, not null, default key etc.

SQL: Introduction to SQL, Features of SQL, Basic data types, SQL statements/commands, Set operations in SQL, order by and group by clause like, between, in, like, create index, view and join command Nested queries, GRANT and REVOKE, Commit, Rollback, Steps for processing a query, Sorting , Join Operation , Hash Join . SQL functions: MAX, MIN SORT, COUNT, AVERAGE, Numeric, String, Date Functions, Type conversion functions.

**UNIT II (15 Hours)**

**Introduction to PL /SQL:** Introduction, Difference between SQL AND PL/SQL, Block definition structure and Data types, Block Functions - %Type, %RowType, Control statements, Looping statements and sequential statement, Exception- handling. Simple PL/SQL blocks.

Cursor management: meaning, types and importance, implicit and explicit

Cursor management using simple example. Trigger: meaning importance and types of trigger, examples using trigger Procedures-Definition, creating procedures, passing parameters. Function -Definition, syntax and calling methods, passing parameters.

**UNIT III (15 Hours)**

**Database System Architectures:** Spatial data management, Web based systems, Centralized and Client-Server Architectures, Server System Architectures, Parallel System, Distributed Systems. **Parallel Databases:** Introduction, Parallel database architecture, I/O parallelism , Inter-query and Intra-query parallelism, Inter operational and Intra-operational parallelism, Design of parallel systems

**Distributed Database Concepts:** Introduction, DDBMS architectures ,Homogeneous and Heterogeneous Databases , Distributed data storage, Distributed transactions, Commit protocols
,Concurrency control & recovery in distributed databases ,Directory systems, Distributed Query Processing, Three tier Client Server Architecture. Object Relational Databases, Multimedia databases, Mobile databases.

**UNIT IV** **(15 Hours)**

**Introduction to NoSQL**: History, concept, Different NoSQL products: MongoDB, CouchDB, Advantages of Mongo over RDBMS, CRUD operations with MongoDB, Querying, Modifying and Managing NoSQL data stores, indexing and ordering datasets, surveying database internals migrating from RDBMS to NoSQL. **Information Retrieval & XML data** Introduction to information retrival , Indexing for Text search Web search engines ,Managing text in DBMS , Data model for XML, XMLDTD's, , Domain specific DTD's ,Querying XML data .

**Reference Books**


1. Henry Korth, Abraham Silberschatz and S.Sudarshan,: Database SystemConcepts" Sixthedition,McGraw Hill,2011.
2. M.Tamer Ozsu and Patrick Valduriez,"Principles of Distributed DatabaseSystem",Third edition,Springer,2011

R.Elmasri,S.B. Navathe," Fundamental of Data Systems",Seventh Edition, 2007

3. Kristina Chodorow,"MongoDB-The Definitive Guide",
4. SecondEdition,O'Reilly,2013
5. ORACLE PL/SQL Programming Scott Ulman TMH 9th


**M.Sc. (Computer Science) Part I Semester I(NEP-2020)**

**To be implemented from the academic year 2023-2024**

**Code: MCSP23-103: Title of Program:** Practical-I

**Internal Marks: 20** **External Marks: 80** **Practical: 06 hours/week**

**Course outcomes:**

1. To become familiar with programming environment.
2. To implement advanced data structures
3. Apply data structures in real life problems.
4. Able to create tables and generate queries
5. To be familiar with different types of databases.

Lab work is based on Advanced Database Management System and Design and Analysis ofalgorithm .This laboratory Program should consist of 10 to 12 programming exercises with focus on covering the hands-on aspects covered in theory Program.

**M.Sc. (Computer Science) Part I Semester I(NEP-2020)**

**To be implemented from the academic year 2023-2024**

## Program Code: MJ-MCST23-104: Title of Program: Web Designing
## Internal Marks: 10 External Marks: 40 Theory: 02 hours/week

**Course outcomes:**

After completion of this Program, student will able to,

1. Understand the basics of web design
2. Gain proficiency in HTML and CSS coding languages
3. Understand the importance CSS
4. Utilize the JavaScript with websites

**Unit I** **(15 Hours)**

Introduction to web design principles, overview of web development technologies and tools, understanding the role of HTML, CSS, and JavaScript, HTML basics, HTML elements, Attributes, heading, paragraphs, Styles, Formatting, Quotations, colors, links, images, table, list tags, Iframe, File paths, HTML layouts, Introduction to CSS syntax and selectors, applying styles to HTML elements, managing layouts using CSS

**Unit II** **(15 Hours)**

Overview of JavaScript and its role in web development, setting up the development environment, Writing and executing JavaScript code, Declaring and assigning variables, working with numbers, strings, booleans, and arrays, Type coercion and type conversion, Conditional statements, Switch statements, Loops, Break and continue

statements, Element ACO23ess in Java scripts, Event and event handling, dialog boxes, Defining and invoking functions, working with arrays, Introduction to objects and properties, Object-oriented programming concepts

**References**


1. Head First HTML and CSS by Elizabeth Robson and Eric Freeman
2. HTML, CSS, and JavaScript All in One by Meloni and Kyrin's
3. HTML5 and CSS3 All-in-One For Dummies – by Andy Harris


**M.Sc. (Computer Science)**

**Part I Semester I(NEP-2020)**

**To be implemented from the academic year 2023-2024**

**Program Code: GE-MCST23-105: Title of Program: Cyber Security**

**Internal Marks: 20** **External Marks: 80** **Theory:**

**04 hours/week**

**Course outcomes:**

1) Realize the need for Cyber Security
2) Understand the need for Security in day to day communications
3) Understand the vulnerabilities in the Network and Computer System
4) Understand the cyber law and Cyber Forensics
5) Understand the mobile forensics.

**Unit-I** **(15 Hours)**

Introduction to Cyber Security: Overview of Cyber Security, Cyber Threats:- Cyber Warfare- Cyber Crime- Cyber terrorism- Cyber Espionage, Cyber Security Vulnerabilities and Cyber Security Safeguards: Cyber Security Vulnerabilities - Overview, vulnerabilities in software, System administration, Weak Authentication, Poor Cyber Security Awareness. Passive attacks: Network Analysis; eavesdropping; Traffic control Active attacks: Phishing, Sniffing, spoofing, Denial of service attack. Hackers, Crackers Authentication, Biometrics, Cryptography.

**Unit II** **(15 Hours)**

Ethical Hacking Introduction Information Gathering an d Scanning, Footprinting through Web Services, Footprinting through Social Networking Sites, Website Footprinting, Email Footprinting, Intrusion detection system: Categories of Intrusion Detection System, Types of Intrusion Detection System, Features and limitations. Intrusion prevention system:. Cryptography and Network Security: Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Digital certificate, Applications of Cryptography. Firewall System: Features, Types of firewall

**Unit–III** **(15 Hours)**

Internet Security: Secure Socket Layer(SSL), Secure Hypertext Transfer Protocol(S/HTTP), IPSec, Secure Multipurpose Internet Mail Extensions(S/MIME), E-mail Security, Encryption for Secure E-Mail, Secure E- Mail System: PGP (Pretty Good Privacy).Cyber crime: Reasons for Cyber Crime ,Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, penetration testing, Stages of Penetration Testing, Computer forensics, Cyber law: Introduction, objective of cyber law, different sections in cyber law, Roles of International Law.

**Unit–IV** **(15 Hours)**

Introduction to Mobile Forensics – Mobile Phone Basics, cellular connected mobile device, Inside Mobile devices, data acquisition procedures for cell phones and mobile devices. Cell Phone Crime, SIM Card, SIM Security ,Mobile forensics ,Mobile forensic & its challenges , Evidences in a mobile device ,Mobile phone evidence extraction process: the evidence intake phase , identification phase, preparation phase, isolation phase, processing phase, verification phase, document and reporting phase. presentation phase.

**References:**


1. Preston Gralla, How Personal and Internet Security Work, Que Publications
2. Alfred Basta and Wolf Halton, Computer Security Concepts, Issues and
3. Implementation, Cengage Learning
4. Digital Defense: A Cybersecurity Primer by Joseph Pelton , Indu B. Singh

5. Cryptography and Network Security: Principles and Practice by William Stallings
6. Computer and Information Security Handbook by John R. VaCO23a .

**M.Sc. (Computer Science) Part I Semester I (NEP-2020)**

**To be implemented from the academic year 2023-2024**

**Code: GE-MCST23-105: Title of Program: Cloud Computing**

**Internal Marks: 20 External Marks: 80 Theory: 04 hours/week**

**Course outcomes:**

After Completion of this Program, students will be able to;

1. Deal with the fundamentals and essentials of Cloud Computing
2. Understand the basic ideas and principles in data center design; cloud managementtechniques and cloud software deployment considerations
3. Understand the impact of emerging technologies on cloud computing
4. Understand cloud storage technologies and relevant distributed file systems
5. Expose the students to frontier areas of Cloud Computing and information systems,while providing sufficient foundations to enable further study and research
6. Anticipate and adapt to future developments in the cloud computing industry

**Unit I (15 Hours)**

Definition, characteristics, and benefits of Cloud Computing, Evolution and history of Cloud Computing, Cloud service providers and their offerings, Overview of cloud architectures and components, Introduction to virtualization, Types of virtualization, Virtualization platforms, Managing virtual machines and virtual networks, Infrastructure as a Service (IaaS) and its components, Platform as a Service (PaaS) and its advantages, Software as a Service (SaaS) and its applications, Comparison and use cases of different service models,

**Unit II (15 Hours)**

Public, private, and hybrid clouds, Pros and cons of each deployment model, Cloud service provider selection criteria, Cloud migration strategies and considerations, Object storage, Block storage e.g. Amazon EBS, Azure Disk Storage, Database as a Service e.g. Amazon RDS, Azure Cosmos DB, Data backup and disaster recovery in the cloud, Cloud security challenges and threats, Identity and aCO23ess management in the cloud, Encryption and data protection mechanisms, Compliance standards and regulations e.g. HIPAA, GDPR, Scaling principles and techniques, Load balancing and auto-scaling

**Unit III** **(15 Hours)**

Designing highly available and fault-tolerant architectures, Monitoring and performance optimization, DevOps principles and practices, Continuous Integration and Continuous Deployment (CI/CD), Edge computing and Internet of Things (IoT), Edge computing architectures and use cases, Deploying applications at the network edge, Edge computing innovations, Artificial Intelligence (AI) and Machine Learning (ML) in the cloud, Future directions and career opportunities in Cloud Computing

**Unit IV** **(15 Hours)**

Serverless Computing, Blockchain, Cloud Security and Resilience, Evolution of Cloud Gaming, Database options in the cloud, Relational and NoSQL databases, Serverless databases and scalability, Cloud-based AI services and frameworks, Latest trends and future directions in cloud computing, Introduction to quantum computing principles, Quantum computing's potential impact on cloud computing, Exploring quantum computing applications in the cloud, Overview of future trends and directions in cloud computing, Evolving cloud computing business models, Anticipating and adapting to future developments

**References**


1. Cloud Computing For Dummies by Judith Hurwitz
2. Cloud Computing: From Beginning to End by Mr Ray J Rafaels
3. Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile,Security and More by Kris Jamsa
4. Virtual Machine in Cloud Computing by Manan Shah, Charusmita Shah

**Code: RM- MCST23-106: , Title of Program: Research Methodology**
**Internal Marks: 20 External Marks: 80 Theory:**

**04 hours/week**

**Course Outcome:**

1. Understand the fundamental concepts and principles of research methodology incomputer science
2. Identify and select appropriate research methodologies based on the research problem
3. Formulate research questions and hypotheses in the context of computer scienceresearch
4. Design and execute research studies using quantitative and qualitative approaches
5. Apply ethical considerations in conducting computer science research
6. Develop critical thinking and problem-solving skills required for computer science research

**Unit I (15 Hours)**

Meaning of Research, objectives of Research, motivation in Research, Types of Research, Significance of Research, Research and Scientific Method, Criteria of good Research, Current trends in Research, Survey research, Data collection techniques, problems encountered by Researchers in Data Collection, Statistical Data analysis and interpretation, Triangulation in research design, Sequential and concurrent mixed methods design, SamplingTechniques in Computer Science Research.

**Unit II (15 Hours)**

Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline, Use of tools / techniques for Research: methods to search required information effectively, study and implementation of various databases like Google scholar, Scopusindex, web of science, research gate etc. Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office.

**Unit III (15 Hours)**

Nature of Intellectual properties like patents, trade and copyright, Common rules of IPR practice, types and features of IPR agreement, Population and sample selection, Probability and non-

probability sampling, Sample size determination, Observation methods, Questionnaire design, Descriptive statistics, Inferential statistics, Qualitative data analysis techniques (thematic analysis, content analysis), Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Impact factor of Journals, H-index of the researcher, various citation styles, Ethical issues related to publishing, Plagiarism and Self-Plagiarism, Software for detection of Plagiarism

**Unit IV** **(15 Hours)**

Research reports: Writing preliminaries, main body of research, references and bibliography; Meaning and importance of workshop, seminar, conference, symposium etc. in research, Report format and style. Review of related literature its implications at various stages of research, Significance of Report Writing, Steps in Writing Report, Layout of the Research Report, Types of Reports. Writing a research proposal.

**References**


1. Research Methodology in Computer Science by Ryhan Ebad, Centrum Press.
2. Research Methodology by C.R.Kothari
3. Research Methods by Rashmi Agrawal
4. Qualitative Research for Education by Bogdan & Biklen
5. Methods of Educational Research by Max Engelhart
6. Business Research Methods by Alan Bryman & Emma Bell, Oxford University Press


**M.Sc. (Computer Science) Part I Semester II(NEP-2020)**

**To be implemented from the academic year 2023-2024**

**Code: MJ-MCST23-201 Title of Program: Advanced Java**

**Internal Marks: 20** **External Marks: 80** **Theory: 04 hours/week**

**Course outcomes:**

1. To become familiar with the features of Java Language.
2. To become comfortable with concepts such as Classes,
3. To understand Database connectivity using JDBC Drivers.
4. To design application using JSP, Servlet and RMI
5. To familiar with hibernate, struts and spring framework

**UNIT I** **(15 Hour)**

Features of Java; Java Magic: Byte Code, OOP in Java ,Objects and classes, Inheritance, Polymorphism ,Interfaces, inner classes, Constructor, Garbage collector , Method Overloading ,Method Overriding, Packages. Understanding Class path, Introduction to Java Utility classes and collection classes -Date, DateFormat and Gregorian calendar classes. A Simple Java Program, Object Creation, Using Java.lang. Object class in program, programs using inheritance, using packages in java program

**UNIT II** **(15 Hours)**

Java Database Connectivity: JDBC overview , Architecture , Steps to create JDBC Application, Drivers, database connection statements , Resultsets, transaction, Metadata and Aggregate functions , callable statements. Connection pooling, Java Servlets: Servlet vs CGI, Servlet life cycle , servlet basics , Generic servlet, HTTPServlet, The Servlets API, request server side –Cookies , session tracking , databases and non-HTML content , request dispatching , shared attributes, resource abstraction

**UNIT III** **(15 Hours)**

RMI: Introduction & Architecture of RMI, Stubs & skeleton, Java RMI classes and interfaces ,Writing simple RMI application , Parameter passing in remote methods (marshalling and unmarshalling) Java Beans: Java Beans Introduction, design pattern, Beans persistence & introspection, writing simple bean. JSP(Java Server Pages: Introduction to JSP, Use of JSP, JSP Architecture, JSP tags, Implicit and Explicit objects, Request forward, Request –time include ,use of Beans in JSP and their scopes. JSF(Java Server Faces):Introduction of JSF, components of JSF, Benefits of JSF

**UNIT IV** **(15 Hours)**

Hibernate framework application, Introduction Working on Hibernate framework, Introduction Hibernate framework, its advantage and disadvantage, Struts framework

Architecture and details, Struts frameworks Components. Overview of the Spring Framework, Spring MVC Architecture Hibernate with Spring, Benefits of using Spring with Hibernate.

**References:**


1.The complete Reference Java- 5th edition – Herbert Schildt- Tata McGraw Hill

2.Inside Java 2 Virtual Machine by Venners Bill, Mcgraw Hill Education

3.Developing Java Servlets James Goodwill, Techmedia Pub.

4.Professional JSP Wrox press

5.JDBC, Servlet and JSP, Black Book, Santosh Kumar K. Dremtech publication


## M.Sc. (Computer Science) Part I Semester II

## (NEP-2020)

**To be implemented from the academic year 2023-2024**

**Code: MJ-MCST23-202 Title of Program: Artificial Intelligence**

**Internal Marks: 20 External Marks: 80 Theory: 04 hours/week**

**Course outcomes:**

1. Apply problem solving by intelligent search approach.
2. Represent knowledge using knowledge representation techniques.
3. Understand working of Artificial Neural Networks.
4. Derive solutions for problems with uncertainty using Fuzzy theory.
5. To develop a good understanding of Natural Language Processing and Genetic algorithm

**UNIT-I (15 Hours)**

**Introduction of AI and Problem Solving:** Artificial Intelligence, AI Problems, AI Techniques, Defining the Problem as a State Space Search, uninformed search and informed search, heuristic search, hill climbing, Best first search, A* algorithm, AO* algorithm, constraint satisfaction, Game playing: Minmax search procedure, refining Minmax, Alpha – Beta pruning,

**UNIT-II (15 Hours)**

**Knowledge Representation:** Introduction, Propositional Logic, Syntax and Semantics, Interpretations, Properties, Predicate logic, WFF, Free and Bound Variables, Normal Forms, Inference Techniques, Resolution, Unification, Modes Pones, Frames, Frame Representation Language, Semantic Net, Forward and Backward Reasoning

**UNIT-III** **(15 Hours)**

**Artificial Neural Networks**: Introduction, Basic Concepts of **A**rtificial Neural Networks, Model of an Artificial Neuron, Activation Functions, Feed forward Network, Recurrent Network, Introduction to deep learning and deep neural network. **Fuzzy Set Theory**, Fuzzy Membership, Fuzzy Operations, Fuzzy Logic Systems.

**UNIT-IV** **(15 Hours)**

**Natural Language Processing**: Introduction, Phases of NLP, advantages, disadvantages, applications. **Genetic Algorithm**: Genetic Algorithm (GA), Genetic Representations,

(Encoding) Initialization and Selection, Different Operators of GA, Analysis of Selection Operations, the Hypothesis of Building Blocks, Schema Theorem and Convergence of Genetic Algorithm, Introduction to Expert System.

**Reference Book**


1. Elaine Rich and Kelvin Knight, Artificial Intelligence, Tata McGraw Hill
2. Nils J Nilson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers,Inc., San Francisco, California, 2000.
3. Saroj Kaushik, Artificial Intelligence, Cengage Learning B. Yegnanarayana, Artificial NeuralNetworks, Prentice-Hall of India
4. Rajasekaran, G. A. Vijayalakshmi Pai, Prentice-Hall of India, 2003
5. Artificial Intelligence: A Modern Approach, 2nd edition, by Russell and Norvig, PrenticeHall


## M.Sc. (Computer Science) Part I Semester II

## (NEP-2020)

**To be implemented from the academic year 2023-2024**

**Code: MCSP23-203 Title of Program: Practical-II**

**Internal Marks: 20 External Marks: 80 Practical: 6 hours/week**

**Course outcomes:**

1. To become acquainted with programming environment.
2. Student will be able to use advanced technology in Java such as remote methodInvocation and JDBC.
3. Student will learn how to work with Java Frameworks.
4. Student will be able to develop web application using Java Servlet and Java ServerPages technology.
5. Design and develop solutions for informed and uninformed search problems in AI.

Lab work is based on Advanced Java and Artificial Intelligence .This laboratory Program should consist of 10 to 12 programming exercises with focus on covering the hands-on aspects covered in theory Program.

**M.Sc. (Computer Science) Part I Semester II(NEP-2020)**

**To be implemented from the academic year 2023-2024**

**Code: MJ-MCST23-204 Title of Program: Angular JS**

**Internal Marks: 10 External Marks: 40 Theory: 02 hours/week**

**Course outcomes:**

After completion of this Program, students will be able to;

1. Understand the fundamental concepts of Angular JS and its role in web development
2. Learn how to set up a development environment for Angular JS projects
3. Gain proficiency in using directives, filters, and expressions to manipulate and display data

**Unit I (15 Hours)**

Introduction to Angular JS and its features, benefits, setting up the development environment, Angular JS application structure and file organization, Creating the first Angular JS application,

Angular JS Expressions, Directives, working with built-in directives, creating custom directives, Controllers, Modules, Scopes, Dependency, Introduction to filters and usage, Implementing custom filters, One-way and two-way data binding, Tables, Select, DOM

**Unit II** **(15 Hours)**

Controllers and scope, Controller as syntax, Understanding dependency injection, Routing and navigation in Angular JS, Creating single-page applications (SPAs), Implementing nested views and routing, Introduction to Services and factories, Communicating with APIs using $http and $resource, Components, Creating reusable and modular components, Component-based architecture, Form validation and handling user input, Integrating external libraries and modules, Testing, debugging,and optimizing Angular JS applications

**References**


1. Angular: Up and Running: Learning Angular, Step by Step by Shyam Seshadri,
2. O′Reilly
3. ANGULARJS Programming, In 8 Hours, For Beginners, Quick Start Guide: Angular JS BookCrash Program Tutorial & Exercises by Ray Yao , Dart R. Swift, Pandas C. Perl
4. Learning Angular JS: A Guide to Angular JS Development by Ken Williamson Angular JS: Angular JS. A Code Like a Pro Guide For Angular JS Beginners Kindle Edition by Jonathan Bates


**M.Sc. (Computer Science) Part I Semester II**
**(NEP-2020)**
**To be implemented from the academic year 2023-2024**

**Code: GE-MCST23-205 Title of Program: Image Processing**
**Internal Marks: 20 External Marks: 80 Theory: 04 hours/weekCourse outcomes:**

1. Understand the basic principles and concepts of digital image processing.
2. Gain knowledge of different image representations and colour models.
3. Learn how to pre-process and enhance images using various techniques.
4. Explore image filtering techniques for noise reduction and feature enhancement.
5. Understand the concept of image segmentation and different segmentation algorithms.

**Unit I** **(15 Hours)**

Definition of digital image, pixels, representation of digital image in spatial domain as well asin matrix form. block diagram of fundamentals steps in digital image processing, application of digital image processing system, Elements of Digital Image, Processing systems, structure of the Human, Image Formation in the Eye, Brightness Adaptation and Discrimination

**Unit II** **(15 Hours)**

Introduction to image processing: basic concepts and applications, Image acquisition and representation, Image file formats and colour models, Image enhancement: contrast stretching, histogram equalization, and spatial domain techniques, Noise reduction: spatial and frequency domain filtering, Image restoration: degradation model, inverse filtering, and Wiener filtering, Image sharpening techniques, Image segmentation: thresholding, region- based segmentation, and edge detection, Contour detection and boundary extraction,

**Unit III** **(15 Hours)**

Image compression: lossless and lossy compression techniques, Transform-based compression: discrete cosine transform (DCT) and wavelet transform, Image recognition and classification: principles and algorithms, Supervised and unsupervised learning techniques for image classification, Advanced topics: image registration and alignment, Super-resolution techniques, Image processing in computer vision applications, Introduction to deep learning for image processing, Similarity and Discontinuity based techniques,

**Unit IV** **(15 Hours)**

Point operations, Contrast stretching, clipping and thresholding, digital negative, intensity level slicing, log transformation, power log transformation, bit plane slicing, Unnormalized and Normalized Histogram, Histogram Equalization, Use of Histogram Statistics for Image Enhancement, Basics of Spatial Filtering, Linear filters, Spatial Low pass smoothing filters, Averaging, Weighted Averaging, Non-Linear filters, Median filter, Maximum and Minimum filters

**References**

1. Digital Image Processing by Rafael C. Gonzalez

2. Principles of Digital Image Processing Core Algorithms by Wilhelm Burger and Mark J. Burge

3. Principles of Digital Image Processing Advanced Methods by Wilhelm Burger, Mark

J. Burge

4. Fundamentals of Digital Image Processing by Annadurai

5. Fundamentals of Digital Image Processing by Jain A K

6. Digital Image Processing by S Sridhar

**M.Sc. (Computer Science) Part I Semester II (NEP-2020)**

**To be implemented from the academic year 2023-2024**

**Code: GE-MCST23-205 Title of Program: Block chain Technology**

**Internal Marks: 20 External Marks: 80 Theory: 04 hours/week**

**Course outcomes:**

1. Understand the concept of Block chain Technology, transactions, block, PoW,Consensus
2. Understand the simulation of block chain technology without any central controllingor trusted agency and how bit coin crypto currency work.
3. Understand the concept of digital currency, how it can be protected against fraud,scam,
4. hacking and devaluation.
5. Understand the concept of bit coin and Etherum

**UNIT-I (15 Hours)**

History of Block chain Technology: Basics of block chain, History, Uses of Block chain, Structure of a block, Transactions, Understand the difference between centralized, decentralized and distributed peer to peer networks, Types of block chains, Objectives of consensus mechanisms, famous hacks, wallet, security and safeguards Public Ledger, Distributed Consensus.

**UNIT-II (15Hours)**

Cryptographic Primitives and Overview of what is block chain: Cryptographic hash

functions – collision free, hiding, puzzle friendly (properties), Hash Chain, Hash tree- Merkle Tree, Public Key cryptography, Digital signatures. Use of hash functions and digital signatures in blockchain, recording transaction, confirmation and verification of transaction, consensus building: distributed consensus, Consensus mechanism: PoW, PoS, PoB, PoA, blockchain architecture, Merkle root tree.

**UNIT-III** **(15 Hours)**

Bitcoin and Etherum: History of bitcoin, Double Spending, Script (FORTH), Mining Process, History, Architecture, ACO23ount Types , Gas, Transactions, Introduction to etherum, Ethereum Virtual Machine, Ethereum Mining process, Solidity. Hyperledger Fabric: Features of hyperledger, Architecture, ordering service, Transaction Flow, Membership and IdentityManagement

**UNIT-IV** **(15 Hours)**

Case Study: Block chain in Government Digital Identity, Healthcare, Land registration,Supply Chain Management

**References:**


1.Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder,Bitcoin and Cryptocurrency Technologies, Princeton University Press

2.Don Tapscott,AlexTapscott, Blockchain Revolution, ISBN No. 9781101980132

3.Mark Gates, Blockchain ultimate Guide to understanding Blockchain, Bitcoin, Cryptocurrencies, Smart Contracts and Future of money, Wise Fox Publishing

4.Vikram Dhillon, David Metcalf, Max Hooper, Blockchain Enabled Applications, Apress,ISBN No.13:978-1-4842-3081-7

5.Melanie Swan, Blockchain Blueprint for a new economy, O'Reilly, First Edition, ISBNNo.978-1-491-92049-7


**M.Sc. (Computer Science) Part I Semester II(NEP-2020)**

**To be implemented from the academic year 2023-2024**

**Program Code: OJT/FP -206 Title of Program: On Job Training**

**Internal Marks: 00** **External Marks: 100** **Theory: not applicable**

The student is required to engage in on job training during their semester break