

Rayat Shikshan Sanstha's

**Yashavantrao Chavan Institute of Science, Satara
(Autonomous)**

M.Sc. I

Syllabus 2021-22

Rayat Shikshan Sanstha's
Yashavantrao Chavan Institute of Science, Satara
(Autonomous Institute)

Department of Computer Science

**Scheme of Credit for
M.Sc. Computer Science**

Under Choice Based Credit System (CBCS)

Wef (June2021-22)

• **OBJECTIVES:**

1. To create post-graduates with sound knowledge of Computer Science , who can contribute towards recent advances in technology
2. To provide advanced and in-depth knowledge of computer science and specialization in one or two subjects of new era of technology.
3. To prepare Post Graduates who will achieve peer-recognition, as an individual or in a team, through demonstration of good analytical, design, programming and implementation skills.
4. To enable students, pursue a professional career in Artificial Intelligence and IOT in related industry, business and research.
5. To impart industry knowledge and practical skills of current trends in IT field to the students.
6. To develop ability among students to formulate, analyze and solve real life problems faced in Computer Science industry.
7. To produce computer science professionals who can be directly employed or start his/her own work as Freelance Software Developer, IT consultant, Software Tester, Service engineer, Project Manager and even an entrepreneur in Computer Science industry.
8. To Develop designing, analyzing and critical thinking skill among students.

• **OUTCOMES:**

After completing this courses students shall be expert in following things:

1. Avail the skills of Current trends in IT Industries and new Technologies.
2. Apply knowledge of programming platforms in IOT and AI in real life.
3. Student should avail detail knowledge of Artificial Intelligence, IOT, and Networking etc.
4. Students will demonstrate their ability of advanced programming to design and develop innovative applications.
5. Student will be able to Access, evaluate, understand, and compare digital information from various sources and apply it for scientific knowledge acquisition as well as scientific data analysis and presentation
6. Students will critically evaluate, analyze, and comprehend a scientific problem. Think creatively, experiment and generate a solution independently, check and validate it and modify if necessary.
7. Translate academic research into innovation and creatively design scientific solutions to problems. Exemplify project plans, use management skills, and lead a team for planning and execution of a task.
8. Student can start his own business or start up.

- **SCOPE:**

After Successful completion of two years Master's Degree in Computer Science, we observed that the students have the ample opportunities in diversified areas such as:

1. Software Industry.
2. Communication Industry
3. Digital Media
4. Agriculture Industry
5. Health and Care.
6. Research Field.
7. IoT Architects

Courses Structure for Postgraduate Programme to be implemented from Academic year 2020-21 for Computer Science

Course Structure

Course Code	Title of the Course	Credits	Teaching Scheme (h/w)		Evaluation Scheme (marks)		Total
			L	P	ESE	ISE	
M.Sc. Part I - Semester I							
MCST 101	Design and Analysis of Algorithms	4	4	-	60	40	100
MCST 102	Principles of Programming languages	4	4	-	60	40	100
MCST 103	Advanced Database Management Systems	4	4	-	60	40	100
MCST 104	Advanced Networking	4	4	-	60	40	100
MCSP 105	Lab I: Design and Analysis of Algorithms and Principles of Programming languages	4	-	12	60	40	100
MCSP 106	Lab II: Advanced Database Management Systems and Advanced Networking	4	-	12	60	40	100
	Total	24	16	24	360	240	600
M.Sc. Part I - Semester II							
MCST 201	Python Programming	4	4	-	60	40	100
MCST 202	Cloud Computing	4	4	-	60	40	100
MCST 203	Cyber Security and Laws	4	4	-	60	40	100
MCST 204	Digital Image Processing	4	4	-	60	40	100
MCST 205	Mathematical and Statistical Foundations	4	4	-	60	40	100
MCSP 206	Lab III: Python Programming and Cloud Computing	4	-	12	60	40	100
MCSP 207	Lab IV: Cyber Security and Laws, Mathematical and Statistical Foundations and Digital Image Processing	4	-	12	60	40	100
	Total	28	20	24	420	280	700
M.Sc. Part II - Semester III							
MCST 301	Emerging Technologies	4	4	-	60	40	100
MCST 302	Data Mining	4	4	-	60	40	100
MCST 303	Business Analytics	4	4	-	60	40	100
MCST 304	Elective I	4	4	-	60	40	100
MCST305	Elective I	4	4	-	60	40	100
MCSP 306	Lab V: Emerging Technologies, Data Mining and Business Analytics	4	-	12	60	40	100
MCSP 307	Lab VI: Elective I	4	-	12	60	40	100
	Total	28	20	24	420	280	700
M.Sc. Part II - Semester IV							
MCST 401	Elective II	4	4	-	60	40	100
MCST 402	Elective II	4	4	-	60	40	100

MCSP 403	LAB VII: Elective II	4	-	12	60	40	100
MCSP 404	LAB VIII: Internship Program (Industrial Training)	4	-	12	60	40	100
	Total	16	8	24	240	160	400
	Grand Total	96	64	96	1440	960	2400

Course Code	Elective-I	Course Code	Elective-II
MCST 30x	Machine Learning	MCST 40x	Deep Learning
MCST 30x	Artificial Intelligence	MCST 40x	Big-data Analytics
MCST 30x	Fundamentals of IOT	MCST 40x	Control Systems
MCST 30x	Microcontrollers for IoT	MCST 40x	Wireless Sensor Networks

Project Academic Project is divided into 4 phases.

- Phase I : Literature Survey
- Phase II : Data Collection & Design
- Phase III : Implementation
- Phase IV : Publication

Evaluation Pattern PG: M.Sc. I Semester-I
Theory: Practical (60: 40)
ESE: ISE (60: 40)

Class	Semester	Course Name	Theory			Practical			Total	
			ESE	ISE	Total	ESE	ISE	Total		
M.Sc. I	I	Course I: MET101	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Book Review)	100	-	-	-	100	
		Course II: MET102	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Home Assignments)	100	-	-	-	100	
		Course III: MET103	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Survey/Seminar)	100	-	-	-	100	
		Course IV: MET104	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Group Discussion/Innovative Idea Presentation)	100	-	-	-	100	
		Practical P-I: MEP105	-	-	-	60	40 Journal: 10 Day to Day Performance: 10 Activity: 20 (Case Study/Survey Report)	100	-	100
		Practical P-II: MEP106	-	-	-	60	40 Journal: 10 Day to Day Performance: 10 Activity: 20 (Model Presentation/ Project Part I)	100	-	100
		Total		240	160	400	120	80	200	600

Class	Semester	Course Name	Theory			Practical			Total
			ESE	ISE	Total	ESE	ISE	Total	
M.Sc. I	II	Course V: MXT201	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Book Review)	100	-	-	-	100
		Course VI: MXT202	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Home Assignments)	100	-	-	-	100
		Course VII: MXT203	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Survey/Seminar)	100	-	-	-	100
		Course VIII: MXT204	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Group Discussion/ Innovative Idea Presentation)	100	-	-	-	100
		Course IX: MXT205	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (MOOC/Open Book Test)	100	-	-	-	100
		Practical P-III: MXP206	-	-	-	60	40 Journal: 10 Day to Day Performance: 10 Activity: 20 (Case Study/Survey Report)	100	100
		Practical P-IV: MXP207	-	-	-	60	40 Journal: 10 Day to Day Performance: 10 Activity: 20 (Model Presentation/ Project Part II)	100	100
		Total		300	200	500	120	80	200

Class	Semester	Course Name	Theory			Practical			Total	
			ESE	ISE	Total	ESE	ISE	Total		
M.Sc. II III		Course X: MXT301	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Book Review/ Innovative Idea Presentation)	100	-	-	-	100	
		Course XI: MXT302	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Home Assignments)	100	-	-	-	100	
		Course XII: MXT303	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Seminar)	100	-	-	-	100	
		Course XIII: MXT304	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Open Book Test)	100	-	-	-	100	
		Course XIV: MXT305	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (MOOC/Group Discussion)	100	-	-	-	100	
		Practical P-V: MXP306	-	-	-	-	60	40 Journal: 10 Day to Day Performance: 10 Activity: 20 (Case Study/Survey Report)	100	100
		Practical P-VI: MXP307	-	-	-	-	60	40 Journal: 10 Day to Day Performance: 10 Activity: 20 (Model Presentation/ Project Part III)	100	100
		Total		300	200	500	120	80	200	700

Class	Semester	Course Name	Theory			Practical			Total
			ESE	ISE	Total	ESE	ISE	Total	
M.Sc. II	IV	Course XV: MXT401	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Paper Presentation/ Webinar Participation)	100	-	-	-	100
		Course XVI: MXT402	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (MOOC/Open Book Test)	100	-	-	-	100
		Practical P-VII: MXP403	-	-	-	60	40 Journal: 10 Day to Day Performance: 10 Activity: 20 (Case Study/Survey Report)	100	100
		Internship	-	-	-	60 Internship: (Report Submission: 30 Presentation and Viva: 30)	40 Internship certificate: 10 Day to Day Performance: 10 Activity: 20 (Model Presentation/ Project Part IV)	100	100
		Total	120	80	200	120	80	200	400

Note:
The strength of the student per batch is as per university norms.
The duration of practical examination for M.Sc. Semester I, II, III and IV should be 2 days of 12 hours excluding inspection day.

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Department of Computer Science

Scheme of Credit for

M.Sc. Computer Science

Under Choice Based Credit System (CBCS)

W e f (June 2021-22)

1. SUBJECT: Computer Science

2. YEAR OF IMPLEMENTATION: New Syllabi for the M.Sc. I Computer Science will be implemented from June 2021 onwards.

3. PREAMBLE:

Master of Science is an integrated academic degree in faculty of Science. The faculty is not ignoring the developments in the field of Computer Science. The revision of existing syllabus of 6 Computer Science subject in science faculty is essential. This is a humble endeavor to initiate the process towards an era of knowledge. The students from science faculty should also be competent for this change in the technology. In this year, a student will be able to understand Computer languages and technologies to build software with confidence. In the subject, the student will also get a basic and proper knowledge in the field of Artificial Intelligence and IOT.

4. GENERAL OBJECTIVES OF THE COURSE:

1. To create post-graduates with sound knowledge of fundamentals of Computer Science, who can contribute towards advancing science and technology.
2. To create post-graduates with sufficient capabilities in Computer Science who can become researchers and developers to satisfy the needs of the core Computer Science Industry.
3. To develop ability among students to formulate, analyze and solve real life problems.
4. To provide opportunity to students to learn the latest trends in Computer Science and make them ready for life-long learning process.
5. To make the students aware of professional ethics of the industry, and prepare them with basic soft skills essential for working in community and professional teams.
6. To prepare the students for postgraduate studies through competitive examinations, enabling them to reach higher echelons of excellence.
7. To produce Computer Science professionals who can be directly employed or start his/her own work as Software Developer, Data Scientist, testing professional, Network engineer and even an entrepreneur in IT industry.

5. DURATION: 02 Years (Full Time)

6. PATTERN: SEMESTER EXAM (CBCS)

7. MEDIUM OF INSTRUCTIONS : ENGLISH

8. STRUCTURE OF COURSE:

1. FIRST SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		COURSE NO & Course Code	No. of lectures per week	Credits		No. of lectures Per week	Credits
1	Computer Science	Course I: MCST101	16	16	Practical Course– I : MCSP105	12	4
		Course II: MCST102					
		Course III: MCST103			Practical Course– I : MCSP106	12	4
		Course IV: MCST104					

2. SECOND SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		COURSE NO & Course Code	No. of lectures per week	Credits		No. of lectures Per week	Credits
1	Computer Science	Course I: MCST201	20	20	Practical Course– I : MCSP206	12	4
		Course II: MCST202					
		Course III: MCST203			Practical Course– I : MCSP207	12	4
		Course IV: MCST204					
		Course V: MCST205					

3. Structure and Title of Papers of M. Sc. Course:

- **M. Sc. I Semester I**

Course I: Design and Analysis of Algorithms

Course II: Principles of Programming languages

Course III: Advanced Database Management Systems

Course IV: Advanced Networking

- **M. Sc. I Semester II**

Course V : Python Programming

Course VI: Cloud Computing

Course VII: Cyber Security and Laws

Course VIII: Digital Image Processing

Course IX: Mathematical and Statistical Foundations

MCST/Pxyz–

M	M.Sc.
CS	Computer Science
T	Theory
P	Practical
x	1 to 4 :Semester number
yz	1 to 7 :course number

Rules and Regulations:

1. Core courses will be offered only to the students of M.Sc. Computer Science.
2. The pre-requisites for electives courses will be decided by the departmental committee and Certificate and diploma program will be mandatory for all students.
3. Electives will be offered for minimum 08 and maximum 12 students in view of the infrastructure of the department. Electives to be offered or otherwise will be at the sole discretion of the departmental committee.
4. Minimum attendance required to appear for semester-end examination will be 75 % for each credit course.

4. OTHER FEATURES:

A. LIBRARY:

• REFERENCE BOOKS

1. Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran, "Computer algorithms", SiliconPr Publication, 2007.
2. T. Cormen, C. Leiserson, & R. Rivest, "Introduction to Algorithms", MIT Press, 2009.
3. Steven Skiena, "The Algorithm Manual", Springer, 2010.
4. Jungnickel, "Graphs, Networks and Algorithms", Springer, 2012.
5. Rajesh K. Shukla, "Analysis and Design of Algorithms: A Beginner's Approach", Wiley, 2015.
6. Sandeep Sen, "Design and Analysis of Algorithms: A Contemporary Perspective", Cambridge University Press, 2019.
7. Michel L. Scott, "Programming Language Pragmatics", Kaufmann Publishers, An Imprint of Elsevier, USA, 2015.
8. Robert W. Sebesta, "Concepts of Programming Languages", Eighth Edition, Pearson Education, 2016.
9. Alvin Alexander, "Scala Cookbook", O'REILLY publication, 2013
10. Rajiv Chopra, "Principles of Programming Languages", I K International Publishing House, 2014.
11. Doweck, "Principles of Programming Languages", Springer, 2009
12. A. Silberschatz, H. F. Korth S. Sudershan, "Database System Concepts", McGraw Hill, 6th Edition 2010.
13. Thomas Connolly, Carolyn Begg, "Database Systems: A Practical Approach to Design, Implementation and Management", 6th Edition, 2012.
14. Pramod J. Sadalage and Marin Fowler, "NoSQL Distilled: A brief guide to merging world of Polyglot persistence", Addison Wesley, 2012.
15. Shashank Tiwari, "ProfessionalNoSql", Wiley, 2011.
16. Behrouz A. Forouzan, "TCP/IP Protocol Suite", McGraw Hill, 4th Ed., 2010.
17. Tanenbaum, A. S., "Computer Networks", Prentice Hall, Upper Saddle River, New Jersey, 5th Ed., 2013.
18. B.M. Harwani, "Advanced Computer Networks", DT Editorial Services, Dreamtech New Delhi- 2014.
19. Mark Stamp, "Information Security: Principles and Practice", John Wiley and Sons, 2011.
20. William Stallings, "Cryptography and Network Security: Principle and Practice", Pearson, 5th Edition, 2017.
21. Matt Bishop, Sathyanarayana, S. Venkatramanayya, "Introduction to Computer Security", Pearson Education, 2004.
22. Greg Michaelson, "An Introduction to Functional Programming Through Lambda Calculus", Dover Publications Inc., 2011.
23. Jan van Eijck, Christina Unger, "Computational Semantics with Functional Programming", Cambridge University Press, 2012.
24. Charles Dierbach, "Introduction to Computer Science Using Python: A Computational Problem-Solving Focus", John Wiley & Sons, 2013.
25. Kenneth C. Louden, "Programming Languages: Principles and Practice", Course Technology Inc., 2011.
26. Richard L. Halterman, "LEARNING TO PROGRAM WITH PYTHON", Southern Adventist University, 2011
27. Dusty Phillips, "Python 3 Object-oriented Programming Second Edition", Packt Publishing, 2015.
28. Adrian Holovaty and Jacob Kaplan-Moss, "The Definitive Guide to Web Development Done

Right”, Apress Publishing, 2009.

30. Khanna V. K. and Bhambri S. K., “A Course in Abstract Algebra”, Vikas Publishing House PVT Ltd., New Delhi , 5th Edition 2016.
31. H. Anton & C. Rorres, “Elementary Linear Algebra (with Supplemental Applications)”, Wiley India Pvt. Ltd (Wiley Student Edition), New Delhi, 11th Edition 2016.
32. S. Friedberg, A. Insel, L. Spence, “Linear Algebra”, Prentice Hall of India, 4th Edition, 2014.
33. David Lay, Steven Lay, Judi McDonald, “Linear Algebra and its Applications”, Pearson Education Asia, Indian Reprint, 5th Edition 2016 .
34. Thomas Haslwanter, "An Introduction to Statistics with Python with Applications in the Life Sciences", Springer International Publishing Switzerland 2016
35. Preston Gralla, “How Personal and Internet Security Work”, Que Publications, 2004.
36. Alfred Basta and Wolf Halton, Computer Security Concepts, Issues and Implementation, Cengage Learning, 2010.
37. Joseph Pelton , Indu B. Singh, “Digital Defense: A Cybersecurity Primer”, Copernicus, 2015.
38. John R. Vacca, “Computer and Information Security Handbook”, Morgan Kaufmann, 3rd Edition, 2017.
39. Brian Craig, “Cyberlaw: The Law of the Internet and Information Technology”, Lexis Nexis publishing, 2014.
40. Jason Andress, Steve Winterfeld, “Cyber Warfare: Techniques, Tactics and Tools for Security Practitioners 2nd Edition”, Syngress publishing, 2013.
41. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Third Edition, - Pearson Education, 2008.
42. S Sridhar, “Digital Image Processing”, Oxford University Press, 2016.
43. Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, “Digital Image Processing Using MATLAB”, Second Edition, - Tata McGraw Hill Publication, 2020.
44. S Jayaraman, S Esakkirajan, T Veerakumar, “Digital Image Processing”, Tata McGraw Hill Publication, 2017.

• JOURNALS AND PERIODICALS

1. Acta Informatica. 0.900 Impact Factors 2019.
2. AI and Ethics.
3. AI & SOCIETY.
4. Algorithmic. 0.650 Impact Factors 2019.
5. Annals of Mathematics and Artificial Intelligence. 0.778 Impact Factor 2019.
6. Applicable Algebra in Engineering, Communication and Computing.
7. Applied Intelligence. ...
8. International journal of computer vision
9. Expert Systems with applications
10. IEEE Transactions on Image Processing

B. SPECIFIC EQUIPMENTS:

Computers, Laptops, Printers, Scanners, LCD Projectors, E-Podium, Smart Board, Document Camera, Visualizer

C. LABORATORY EQUIPMENTS:

1. DigitalstorageOscilloscope:60MHz
2. Signal generator
3. Microwave Test bench(Gunn Source)
4. Antenna Trainer
5. Arduino Development Board
6. CPLD development boards
7. Microcontroller Boards – 8051, MSP430, PIC18F, AVR MEGA32, ARDUINONANO,UNO, MEGA
8. KEIL-IDE
9. Mikro C Compilersfor8051,PICandARM
10. Soft Computing Tools –SCILAB,MATLAB

Semester I
Course I
MCST101: Design & Analysis of Algorithms

Learning Objectives:

1. To learn the algorithms and to learn basic Algorithm Analysis techniques and understand the use of asymptotic notation.
2. To understand different design strategies and Greedy Method.
3. Understand classical problem and solutions and Learn a variety of useful algorithms
4. Understand classification of problems

Unit I: Basics of Algorithms

12L

Basics of Algorithms , Space complexity , Time complexity, worst case-best case-average case , complexity, asymptotic notation ,Recursive and non-recursive algorithms , Sorting algorithms (insertion sort, heap sort, bubble sort) ,Sorting in linear time: counting sort, concept of bucket and radix sort ,Searching algorithms: Linear, Binary, Divide and conquer strategy ,General method, control abstraction , Binary search, Merge sort, Quick sort , Comparison between Traditional Method of Matrix Multiplication vs. Strassen's Matrix Multiplication

Unit II: Greedy Method

12L

Knapsack problem ,Job sequencing with deadlines, , Minimum-cost spanning trees: Kruskal and Prim's algorithm , Optimal storage on tapes , Optimal merge patterns , Huffman coding , Shortest Path :Dijkstra's Algorithm Graphs : Traversals, Topological sort, Minimum spanning trees, single source shortest path, All pair shortest path, Maximum flow problems.

Unit III: Dynamic Programming 12L

Principle of optimality , Matrix chain multiplication , 0/1 Knapsack Problem i)Merge & Purge ii)Functional Method , Bellman Ford Algorithm ,All pairs Shortest Path Floyd- Warshall Algorithm ,Longest common subsequence, ,String editing, Travelling Salesperson problem

Unit IV: Backtracking and Problem Classification

12L

General method , Fixed Tuple vs. Variable Tuple Formulation , n- Queen's problem • Graph coloring problem , Hamiltonian cycle , Sum of subsets Problem Classification - Nondeterministic algorithm • The class of P, NP, NP-hard and NP -Complete problems • Cook's theorem

Learning Outcomes: Students are able to

1. Understanding Algorithmic complexity and analyzing the same
2. Developing an understanding of various techniques and methods to design algorithms
3. Skill to make the algorithm and solve real-world problems
4. Analysis of traditional algorithms and apply to various problems.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran, "Computer algorithms", Silicon Pr Publication, 2007 (Unit I (1-68 ,91-99) ,Unit II (127-179), Unit III (197-250),Unit IV(253-2998,339-368)).
2. T. Cormen, C. Leiserson, & R. Rivest, "Introduction to Algorithms", MIT Press, 2009. (Unit I (5-57 ,151-200) ,Unit II (359-397), Unit III (1048-1086),Unit IV(1111))
3. Steven Skiena,"The Algorithm Manual", Springer, 2010. Unit I (31-57) Unit II(103-139) Unit III(316-350)
4. Jungnickel, "Graphs, Networks and Algorithms", Springer, 2012.
5. Rajesh K. Shukla, "Analysis and Design of Algorithms: A Beginner's Approach", Wiley, 2015.
6. Sandeep Sen, "Design and Analysis of Algorithms: A Contemporary Perspective", Cambridge University Press, 2019 (Unit I (54-78) Unit II(92-103) Unit IV(230-254))

Semester I
Course II
MCST 102: Principles of Programming Language

Learning Objectives:

To prepare student to think about programming languages analytically:

1. Compare programming language designs
2. Learn new languages more quickly
3. Understand basic language implementation techniques
4. Learn small programs in different programming Languages

Unit I: Introduction, Names, Scopes, and Bindings

12L

The Art of Language Design, The Programming Language Spectrum, Why Study Programming Languages?, Compilation and Interpretation, Programming Environments, The Notion of Binding Time, Object Lifetime and Storage Management, Static Allocation- (Stack-Based Allocation, Heap-Based Allocation, Garbage Collection Scope Rules), Static Scoping, Nested Subroutines, Declaration Order, Dynamic Scoping The meaning of Names in a Scope, Aliases, Overloading, Polymorphism and Related Concepts, the Binding of Referencing Environments, Subroutine Closures, First-Class Values and Unlimited Extent, Object Closures Macro Expansion

Unit II: Control Flow

12L

Expression Evaluation, Precedence and Associativity, Assignments, Initialization, Ordering Within Expressions, Short-Circuit Evaluation, Structured and Unstructured Flow, Structured Alternatives to goto, Sequencing, Selection - Short-Circuited Conditions, Case/Switch Statements Iteration, Iteration - Enumeration-Controlled Loops, Combination Loops, Iterators, Logically Controlled Loops Recursion, Recursion - Iteration and Recursion, Applicative- and Normal-Order Evaluation

Unit III: Data Abstraction and Object Orientation

12L

Object-Oriented Programming, Encapsulation and Inheritance Modules, Classes, Nesting (Inner Classes), Type Extensions, Extending without Inheritance, Initialization and Finalization Choosing a Constructor, References and Values, Execution Order, Garbage Collection, Dynamic Method Binding, Virtual- and Non-Virtual Methods, Abstract Classes, Member Lookup, Polymorphism, Object Closures, Multiple Inheritance, Semantic Ambiguities, Replicated Inheritance

Unit IV: Functional Programming in Scala

12L

Strings, Numbers, Control Structures, Classes and Properties, Methods, Objects, Functional Programming, List, Array, Map, Set

Learning Outcomes:

After completion of this course student will be able to

1. Get knowledge of, and ability to use, language features used in current programming languages.
2. To program in different language paradigms and evaluate their relative benefits.
3. Understand key concepts in the implementation of common features of programming languages.
4. To implement object oriented Programming concepts.

References:

1. Michel L. Scott, "Programming Language Pragmatics", Kaufmann Publishers, An Imprint of Elsevier, USA, 2015(Unit 1,(Pg. 5 -26) Unit –II Pg(27 -144).
2. Robert W. Sebesta, "Concepts of Programming Languages", Eighth Edition, Pearson Education,2016.(Unit-II Pg. 57-124)
3. Alvin Alexander, "Scala Cookbook", O'REILLY publication, 2013(Unit-IV,Pg. 3-115).
4. Rajiv Chopra, "Principles of Programming Languages", I K International Publishing House, 2014(Unit III Pg. 224 -230).
5. Dowek, "Principles of Programming Languages", Springer, 2009(Unit III,Pg-56-80).

Semester I
Course III
MCST103: Advanced Database Management System

Learning Objectives:

1. Learn different types of databases.
2. Be exposed to query languages and active databases.
3. Be familiar with the indexing techniques.
4. Learn how to solve complex and recursive queries.

Unit I: Query Processing and Evaluation

12L

Measures of Query Cost, Selection Operation, Sort Join Operation, other Operations Evaluation of Expression, Transformation of Relational Expressions, Role of Relational Algebra and Relational Calculus in query optimization, Estimating Statistics of Expression, Choice of Evaluation Plans, Views and query processing, Storage and query optimization

Unit II: Transaction Management and Recovery

12L

Advanced feature of Transactions, Enhanced Lock Based and timestamp-based Protocols, Multiple Granularity, Multi-version Schemes, Deadlock Handling, Weak Levels of Consistency, Concurrency in Index Structures, Recovery and Atomicity, Recovery with Concurrent Transaction, Buffer Management, Advanced Recovery Techniques, Remote Backup Systems, Use of SQL in recovery, Examples of e-transactions.

Unit III: Database Security and Authorization

10L

Levels of database security, Access control, Multilevel security, Statistical database security, Audit trails in the databases, Examples of e security

Unit IV: Distributed Databases

14L

Centralized versus non centralized Databases, Homogeneous and Heterogeneous DDBMS and their comparison, Functions and Architecture ,Distributed database design, query processing in DDBMS, Distributed concurrency management, deadlock management, Distributed Commit Protocols: 2 PC and 3 PC, Concepts of replication servers

Learning Outcomes:

1. Demonstrate the basics of query evaluation and heuristic query optimization techniques.
2. Apply Concurrency control and recovery mechanisms for the desirable database problem.
3. Apply security to database.
4. Design and implement the database system with the fundamental concepts of DBMS.

TEXT BOOK:

1. R. Elmasri S. B. Navathe, Fundamentals of Database Systems, Addison Wesley, 2015 (Unit I – (Pg. 207-249), Unit II – (Pg. 551-576), (Unit III –(Pg.731-750)
2. Raghu Ramakrishnan, Database Management Systems,Mcgraw-Hill,4th edition,2015.(Unit I – (Pg. 177-189), (Unit I – (Pg. 521-564), (Unit III –(Pg.597-632)

REFERENCES:

1. A. Silberschatz, H. F. Korth S. Sudershan, Database System Concepts, McGraw Hill, 6th Edition 2010. (Unit I – (Pg. 679-733), Unit II – (Pg. 737-780), Unit III –(Pg.559-590), Unit IV – (Pg. 783-792))
2. Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation and Management,6th Edition,2012 (Unit I – (Pg. 679-733),

- Unit II – (Pg. 737-780), Unit III –(Pg.559-590),Unit IV – (Pg. 783-792))
3. Pramod J. Sadalage and Marin Fowler, NoSQL Distilled: A brief guide to merging world of Polyglot persistence, Addison Wesley, 2012. (Unit I – (Pg. 3-12), Unit II – (Pg. 47-59), Unit IV – (Pg. 81-84))
 4. Shashank Tiwari ,ProfessionalNoSql,Wiley ,2011 (Unit I – (Pg. 73-169))

**Semester I
Course IV
MCST104: Advanced Computer Networks**

Learning Objectives:

1. To understand the concept of security and its applications
2. To know various detection and prevention techniques in diversified environments
3. To learn various vulnerabilities, threats and attacks
4. To prepare globally competent post graduates with enhanced domain knowledge and skills attaining professional excellence

Unit I: Introduction to Network layers and Protocols

12L

Introduction to networking, TCP/IP Protocol Model, IP Addressing- Address Space, Network Address Translation, Notations, Internet Protocol- Datagram format, fragmentation, IPV4, IPV6, Virtual Private network technology, Mobile IP – Addressing, Agents, Efficiency in Mobile IP.

Unit II: Transport Layer Protocols

12L

User Datagram Protocol-User datagram, UDP Services, UDP Applications, Transmission Control Protocol- TCP services, TCP Features, State Transition Diagram, Flow Control, Error Control, TCP congestion, SCTP- Services, features, flow control, error control.

Unit III: Classification of Network Attacks & Cryptographic Techniques

12L

Basic Security Concepts, History Of Network Security, Data Security Vs. Network Security, Computer And Network Attacks, Introduction To Vulnerabilities, Threats And Attacks, Layers Of Attacks, Spoofing, Sniffing, Malware: Viruses, Worms, Trojan horses ,Ciphers, Cryptography-Cryptographic systems, Types of Cryptography: Symmetric key and Asymmetric Key Cryptography, Encryption and Decryption Techniques.

Unit IV: Application Layer & Protocols

12L

WWW, HTTP, File Transfer- FTP, TFTP, Electronic mail – architecture, web based mails ,email security, SMTP,POP,IMAP, MIME ,SNMP, DNS – Concept of domain name space, DNS Operations ,DHCP- Static and Dynamic allocation, DHCP operations, Remote Login – TELNET and SSH.

Learning Outcomes:

1. Design and choose appropriate security model
2. Specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols.
3. Able to use specific frameworks as per applications need.
4. Have a working knowledge of datagram and internet.

References:

1. Behrouz A. Forouzan, “TCP/IP Protocol Suite”, McGraw Hill, 4th Ed., 2010.
(Unit 1 – Pg 93,Unit 2 – Pg 373,Unit 3 – Pg 873, Unit 4 – Pg 542)
2. Tanenbaum, A. S., “Computer Networks”, Prentice Hall, Upper Saddle River, New Jersey, 5 th Ed., 2013.(Unit 1 – Pg 355, Unit 2 – Pg 495, Unit 3 – Pg 763, Unit 4 – Pg 611)
3. B.M.Harwani , “Advanced Computer Networks”, DT Editorial Services, Dreamtech New Delhi- 2014. (Unit 1 – Pg 15)
4. Mark Stamp, “Information Security: Principles and Practice”, John Wiley and Sons, 2011.
(Unit 3 – Pg 17 , Unit 4 – Pg 311)
5. William Stallings, “Cryptography and Network Security: Principle and Practice”, Pearson, 5th Edition, 2017.(Unit 1 – Pg 19)

Semester I
LAB-I
MCSP105: Design& Analysis of Algorithms and Principles of Programming

• **Learning Objectives:**

1. To understand how to implement different algorithms.
2. To learn how to use different methods to solve real world Problems.
3. To learn how to program using scala language.
4. To understand implementation of Object Oriented concepts.

List of Experiments:

GROUP A :

1. Write a program to Sorting Algorithms
2. Write a program to Searching Algorithms
3. Write a program to Warshall's Algorithm
4. Write a program to Knapsack Problem
5. Write a program to Shortest Paths Algorithm
6. Write a program to Bellman Ford Algorithm
7. Write a program to Minimum Cost Spanning Tree
8. Write a program to All Pairs Shortest Paths

GROUP B :

1 .Programs based on Control Structures

1. Write a program to calculate average of all numbers between n1 and n2(eg.100 to 300 Read values of n1 and n2 from user)
2. Write a program to calculate factorial of a number.
3. Write a program to read five random numbers and check that random numbers are perfect number or not.
4. Write a program to find second maximum number of four given numbers.
5. Write a program to calculate sum of prime numbers between 1 to 100
6. Write a program to read an integer from user and convert it to binary and octal using user defined functions.

2.Classes and Objects

1. Define a class CurrentAccount (accNo, name, balance, minBalance). Define appropriate constructors and operations withdraw(), deposit(), viewBalance(). Create an object and perform operations.
2. Define a class Employee (id, name, salary). Define methods accept() and display().Display details of employee having maximum salary.
3. Create abstract class Order (id, description). Derive two classes PurchaseOrder&SalesOrder with members Vendor and Customer. Create object of each PurchaseOrder and SalesOrder. Display the details of each account.
4. Create abstract class Shape with abstract functions volume() and display(). Extend two classes Cube and Cylinder from it. Calculate volume of each and display it.

3.List

1. Create Lists using five different methods(Lisp style, Java style, fill, range and tabulate methods)
2. Create two Lists and Merge it and store the sorted in ascending order.
3. Create a list of integers divisible by 3 from List containing numbers from 1 to 50.
4. Create a list of even numbers up to 10 and calculate its product.

4.Set

1. Write a program to create two sets and find common elements between them.
2. Write a program to display largest and smallest element of the Set
3. Write a program to merge two sets and calculate product and average of all elements of the Set

Learning Outcomes: Students will be able to

1. To understand and implement different algorithms.
2. To learn and use different methods to solve real world Problems.
3. To program using scala language.
4. To implement Object Oriented concepts.

References:

1. Ellis Horowitz, Sartaj Sahni &Sanguthevar Rajasekaran, “Computer algorithms”,Silicon Pr Publication, a. 2007.
2. T. Cormen, C. Leiserson, & R. Rivest, “Introduction to Algorithms”, MIT Press, 2009.
3. Steven Skiena,“The Algorithm Manual”, Springer, 2010.
4. Jungnickel, “Graphs, Networks and Algorithms”, Springer, 2012.
5. Rajesh K. Shukla, “Analysis and Design of Algorithms: A Beginner's Approach”,Wiley, 2015.
6. Sandeep Sen, “Design and Analysis of Algorithms: A Contemporary Perspective”, Cambridge University Press, 2019.
7. Michel L. Scott, “Programming Language Pragmatics”, Kaufmann Publishers, An Imprint of Elsevier, USA, 2015.
8. Robert W. Sebesta, “Concepts of Programming Languages”, Eighth Edition,Pearson Education,2016.
9. Alvin Alexander, “Scala Cookbook”, O'REILLY publication, 2013.
10. Rajiv Chopra, “Principles of Programming Languages”, I K International Publishing House, 2014.
11. Dowek, “Principles of Programming Languages”, Springer, 2009.

Semester I
LAB-II
MCSP106: Advanced DBMS & Advanced Computer Networks

Learning Objectives:

1. Understand the basic concepts and the applications of database systems.
2. Master the basics of SQL and construct queries using SQL.
3. To study the basics of Computer Networks
4. To study TCP /IP Protocols and implement it.

List of Experiments:

Group A :

1. DDL and DML
2. Single row and aggregate functions
3. Joins and Sub queries
4. Anonymous blocks and control structures
5. Iterations 3 hours 6. Cursors
7. Functions and Procedures
8. Exception Handling and triggers
9. DBA Concepts
10. XML, DTD, XQuery Representations

Group B :

1. Exercise on Data Transfer.
2. Exercise on Advanced Data Transfer.
3. Exercise of Flow and Error Control.
4. Exercise on Data Encryption with algorithms.
5. Exercise on Data Decryption with algorithms.

Learning Outcomes:

1. Understand the basic concepts and the applications of database systems.
2. Master the basics of SQL and construct queries using SQL.
3. Apply cryptographic algorithms of encryption and description
4. Learn TCP /IP Protocol suite.

References:

1. Silberschatz, H. F. Korth S. Sudershan, "Database System Concepts", McGraw Hill, 6th Edition 2010.
2. Thomas Connolly, Carolyn Begg, "Database Systems: A Practical Approach to Design, Implementation and Management", 6th Edition, 2012.
3. Pramod J. Sadalage and Marin Fowler, "NoSQL Distilled: A brief guide to merging world of Polyglot persistence", Addison Wesley, 2012.
4. Shashank Tiwari, "Professional NoSql", Wiley, 2011.
5. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Edition, - Pearson Education, 2008.
6. S Sridhar, "Digital Image Processing", Oxford University Press, 2016.

7. Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, "Digital Image Processing Using MATLAB", Second Edition, - Tata McGraw Hill Publication, 2020.
8. S Jayaraman, S Esakkirajan, T Veerakumar, "Digital Image Processing", Tata McGraw Hill Publication, 2017.

SEMESTER II
Course V
MCST 201: Python Programming

Learning Objectives:

1. An understanding of programming language paradigm.
2. Understanding of Lambda Calculus.
3. Learning functional programming language Python.
4. To learn and implement Database concepts in python

Unit I : Introduction To Python

12L

Installation and , Working with Python ,Understanding Python variables , Python basic Operators ,Understanding python blocks, Declaring and using Numeric data types: int, float, complex , Using string data type and string operations , Defining list and list slicing , Use of Tuple data type.

Unit II: Python Program Flow Control

12L

Conditional blocks using if, else and elif , Simple for loops in python , For loop using ranges, string, list and dictionaries , Use of while loops in python Loop manipulation using pass, continue, break and else , Programming using Python conditional and loops block , Modules And Packages , Organizing python codes using functions ,Understanding Packages

Unit III: Python String, List And Dictionary Manipulations

12L

Building blocks of python programs , Understanding string in build methods , List manipulation using in build methods , Dictionary manipulation Programming using string, list and dictionary in build functions , Reading config files in python , Writing log files in python , Read functions, read(), readline() and readlines() , Write functions, write() and writelines() , Manipulating file pointer using seek Programming using file operations

Unit IV: Python Database Interaction and Libraries

12L

SQL Database connection using python , Creating and searching tables Reading and storing config information on database , Numpy , Pandas , Matplotlib , Scipy Only Introduction

Learning Outcomes:

On completion of the course, student will be able to–

1. To understand and use basics of Python
2. To Solve problems by using Python language.
3. To implement projects by using Python Framework.
4. To create application with help of python libraries.

References:

1. Greg Michaelson, “An Introduction to Functional Programming Through Lambda Calculus” ,Dover Publications Inc.,2011. (Unit 1 (6.1-6.14))
2. Jan van Eijck , Christina Unger, ”Computational Semantics with Functional Programming”, Cambridge University Press, 2012 . (Unit 3 (15-32))
3. Charles Dierbach ,”Introduction to Computer Science Using Python: A Computational Problem-Solving Focus”,John Wiley & Sons,2013. Unit 1- 3 (1-206) ,Unit 4 (289-460)
4. Kenneth C. Loudon, “Programming Languages: Principles and Practice”, Course Technology Inc., 2011. Unit 1(47-90))
5. Richard L. Halterman, “LEARNING TO PROGRAM WITH PYTHON”, Southern Adventist University, 2011 (Unit 1 (1-9,11-32m,35-53) Unit 2 (57-77)Unit 3(81-97),Unit 4 (115-231,267-272))
6. Dusty Phillips, “Python 3 Object-oriented Programming Second Edition”, Packt Publishing, 2015. (All related to object oriented Programming and Design patterns)
7. Adrian Holovaty and Jacob Kaplan-Moss, “The Definitive Guide to Web Development Done Right”, Apress Publishing, 200 (Unit 1 (3-16),Unit 2(17-30,59-64))

Semester II
Course VI
MCST 202: Cloud Computing

Learning Objectives:

1. To understand the principles and paradigm of Cloud Computing
2. To appreciate the role of Virtualization Technologies
3. Ability to design and deploy Cloud Infrastructure
4. Understand cloud security issues and solutions

Unit I: Introduction to Cloud Computing **12L**

Overview, Evolution of Cloud Computing, Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Multitenant Technology. Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology. Infrastructure as a Service, Platform as a Service, Software as a Service, Cloud Deployment Models

Unit II: Cloud Models & Services: **12L**

Cloud Models – Benefits of Cloud Models, Public, Private, Hybrid, and Community Clouds , Types of Clouds Services: SaaS, PaaS, IaaS, DaaS, MaaS, CaaS. Service Providers: Google App Engine, Microsoft Azure, Amazon EC2, IBM, Sales Force; Introduction to MapReduce, GFS, HDFS, Hadoop Framework.

Unit – III: Essentials & Collaborating with Cloud: **12L**

Hardware and Infrastructure – Clients, Security, Network, Services; Accessing Cloud – Platforms, Web Applications, Web APIs, Web Browsers; Cloud Storage – Overview, Cloud Storage Providers; Standards – Application, Client, Infrastructure, Service; Centralizing Email Communications, Collaborating on Calendars, Schedules & Task Management, Event Management, Project Management and Contact Management

Unit IV: Virtualization and Security for Cloud **12L**

Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Provisioning in the Cloud Context Virtualization of CPU, Memory , I/O Devices, Virtual Clusters and Resource management, Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security

Learning Outcomes:

1. Understand the fundamental principles of distributed computing.
2. Understand how the distributed computing environments known as Grids can be built from lower level services.
3. Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
4. Analyze the performance of Cloud Computing.

References:

1. Brian J.S. Chee and Curtis Franklin, “Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center”, CRC Press, 2019. (Unit I –(Pg.1-26), Unit II– (Pg. 27-71), Unit III – (Pg. 73-103), Unit IV – (Pg. 139-150))
2. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi , “Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, 2013. (Unit I –(Pg.3-27), Unit II– (Pg. 111-139),Unit IV – (Pg. 71-109))
3. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.(Unit I –(Pg.3-51), Unit II– (Pg. 189-203), Unit III – (Pg. 215-225),Unit IV – (Pg. 129-183))

**Semester II
Course VII**

MCST 203: Cyber Security and Law

Learning Objectives:

- 1) Study the concepts of Cyber Security
- 2) Protect and defend computer systems and networks from cyber security attacks
- 3) Understand the cyber law and Rights in Cyberspace
- 4) Understand Cyber Torts and Dispute Resolution in Cyberspace

Unit-I Introduction to Cyber Security

12L

Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace. Cyber Security Vulnerabilities and Cyber Security Safeguards :Cyber Security Vulnerabilities- Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, ThreatManagement.

Unit-II Securing Web Applications and Servers

12L

Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges. Intrusion Detection and Prevention: Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.

Unit-III Introduction to Cyber Law and Rights in Cyberspace

12L

Computer and its impact in society, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013, Need for Cyber Law, Cyber Jurisprudence at Indian Level, Freedom of speech and expression in cyberspace, Right to access cyberspace-access to internet, Right to privacy, Right to data protection

Unit –IV Cyber Torts and Dispute Resolution in Cyberspace

12L

Different offences under IT act,2000, Different types of civil wrongs under the IT act ,2000, Interface with copyright law, Interface with patent law, Concept of Jurisdiction, Indian context of Jurisdiction and IT Act,2000, Dispute resolutions, Impact of cyber warfare on privacy, identity theft, International law governing Censorship, online privacy, copyright regulations, Online Intermediaries in the governance of Internet, Social Networking Sites, Human Rights, Trademarks and Domain name related issue

Learning Outcomes:

After completion of this course student will be able to

- 1) Realize the need for Cyber Security
- 2) Understand the need for Security in day to day communications
- 3) Understand the cyber law and rights in cyberspace
- 4) Understand Cyber Torts and Dispute Resolution in Cyberspace

References:

1. Preston Gralla, "How Personal and Internet Security Work", QuePublications, 2004 (Unit I ,Pg. 15-199).
2. Alfred Basta and Wolf Halton, Computer Security Concepts, Issuesand Implementation,Cengage Learning, 2010(Unit I, Pg. 5-26)(Unit- II Pg. 40-80).
3. Joseph Pelton , Indu B.Singh, "Digital Defense: A Cybersecurity Primer", Copernicus, 2015(Unit III, Pg. 25-48), (Unit III, Pg. 83-101)..
4. John R. Vacca, "Computer and Information Security Handbook", Morgan Kaufmann, 3rd Edition, 2017(Unit I, Pg. 8-56), (Unit III, Pg. 80-112).
5. Brian Craig, "Cyberlaw: The Law of the Internet and Information Technology", Lexis Nexis publishing, 2014(Unit III, Pg. 1-66), (Unit IV, Pg. 70-201).
6. Jason Andress, Steve Winterfeld, "Cyber Warfare: Techniques, Tactics and Tools for Security Practitioners2nd Edition ", Syngress publishing, 2013 (Unit IV, Pg. 56-110).

Semester II
Course IX
MCST 204: Digital Image Processing

Learning Objectives:

1. To learn the fundamental concepts of Digital Image Processing.
2. To study basic image processing operations.
3. To understand image analysis algorithms.
4. To expose students to current applications in the field of digital image processing.

Unit I: Fundamentals of Image Processing **12L**

Steps in image processing, Human visual system, Sampling & quantization, Representing digital images, Spatial & gray-level resolution, Image file formats, Basic relationships between pixels, Distance Measures. Basic operations on images-image addition, subtraction, logical operations, scaling, translation, rotation. Image Histogram, Color fundamentals & models – RGB, HSI YIQ.

Unit II: Image Enhancement, Restoration and Compression **12L**

Spatial domain enhancement: Point operations-Log transformation, Power-law transformation, Piecewise linear transformations, Histogram equalization. Filtering operations- Image smoothing, Image sharpening. Frequency domain enhancement:2D DFT, Smoothing and Sharpening in frequency domain. Homomorphic filtering. Restoration: Noise models, Restoration using Inverse filtering and Wiener filtering. Types of redundancy, Fidelity criteria, Lossless compression – Run length coding, Huffman coding, Bit-plane coding, Arithmetic coding. Introduction to DCT, Wavelet transform. Lossy compression – DCT based compression, Wavelet based compression. Image and Video Compression Standards – JPEG, MPEG.

Unit III: Image Segmentation and Morphological Operations **12L**

Image Segmentation: Point Detections, Line detection, Edge Detection-First order derivative – Prewitt and Sobel. Second order derivative – LoG, DoG, Canny. Edge linking, Hough Transform, Thresholding – Global, Adaptive. Otsu's Method. Region Growing, Region Splitting and Merging. Morphological Operations: Dilation, Erosion, Opening, Closing, Hit-or-Miss transform, Boundary Detection, Thinning, Thickening, Skeleton.

Unit IV: Object Recognition and Applications **12L**

Feature extraction, Patterns and Pattern Classes, Representation of Pattern classes, Types of classification algorithms, Minimum distance classifier, Correlation based classifier, Bayes classifier. Applications: Biometric Authentication, Character Recognition, Content based Image Retrieval, Remote Sensing, Medical application of Image processing

Learning Outcomes: After successfully completing the course students will be able

1. To understand fundamentals of Image Processing
2. To understand image segmentation and morphological operations.
3. To Develop and implement algorithms for digital image processing.
4. To apply image processing algorithms for practical object recognition applications.

Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Edition, - Pearson Education, 2008. (Unit I, Pg. 58-118,Unit II, Pg. 334-403,Unit- III Pg. 649-698,Unit IV pg.883-926).
2. Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, "Digital Image Processing Using MATLAB", Second Edition, - Tata McGraw Hill Publication, 2020.
3. S Jayaraman, S Esakkirajan, T Veerakumar, "Digital Image Processing", Tata McGraw Hill Publication, 2017. (Unit I, Pg. 1-42,Unit II, Pg. 243-337,Unit- III Pg. 368-397,Unit IV pg.408-434).

Semester II
Course X
MECST205: Mathematical and Statistical Foundation

Learning Objectives:

1. To Understand the notion of vector space..
2. To Work out algebra of linear transformations.
3. Appreciate connection between linear transformation and matrices.
4. Work out Eigen values, Eigen vectors and its connection with real life situation.

UNIT – I: Vector Spaces

12L

Vector space, Subspace, Sum of subspaces, direct sum, Quotient space, Homomorphism or Linear transformation, Kernel and Range of homomorphism, Fundamental Theorem of homomorphism, Isomorphism theorems, Linear Span, Finite dimensional vector Space, Linear dependence and independence, basis, dimension of vector space and Subspaces.

UNIT – II: Linear Transformations

12L

Linear Transformation, Rank and nullity of a linear transformation, Sylvester's Law, Algebra of Linear Transformations, Sum and scalar multiple of Linear Transformations. The Vector space of homomorphism, Product (composition) of Linear Transformations, Linear Operator, Linear functional, Invertible and non-singular Linear Transformation, Eigen space, Characteristic Polynomial of a matrix and remarks on it, similar matrices, Characteristic Polynomial of a Linear operator, Examples on eigenvalues and eigenvectors.

UNIT III: Statistical Modeling and Distributions

12L

Overview of linear correlation and correlation, application and numerical examples on linear correlation and correlation. Introduction to Residual Error, Mean Square Error, RMSE, Multilinear correlation Regression, Logistic Regression, Simulation using Monte Carlo Method
Overview of Discrete and Continuous Probability Distributions, Binomial Distribution, Poisson Distribution, Geometric Distribution, Exponential Distribution, Normal Distributions, Numeric Examples and Random No. Generation Using Python

UNIT IV: Hypothesis Tests and Statistical Tests

12L

Typical Analysis procedures, Hypothesis Concept, Errors, p-Value, and Sample Size, Confusion Matrix, ANOVA, Test on Sample Mean, Comparison of Two Groups, Comparison of Multiple Groups, Categorical data analysis

Learning Outcomes:

1. Explain the concepts of basis and dimension of a vector space.
2. Understands Eigen values, Eigen functions, Characteristic Polynomial of a matrix.
3. Design and analyze real world engineering problems by applying various statistical modeling techniques.
4. Formulate suitable statistical method required as pre-processing technique for finding the Solution of machine learning algorithm.
5. Model and solve computing problem using correlation, and resampling using appropriate statistics algorithms.

References:

1. Khanna V. K. and Bhambri S. K., "A Course in Abstract Algebra", Vikas Publishing House PVT Ltd., New Delhi , 5thEdition 2016. (Unit I,(Pg. 275-328) Unit –II Pg(329-393))
2. H. Anton & C. Rorres, "Elementary Linear Algebra (with Supplemental Applications)", Wiley India Pvt.Ltd (Wiley Student Edition), New Delhi, 11thEdition 2016.
3. S. Friedberg, A. Insel, L. Spence, "Linear Algebra", Prentice Hall of India, 4th Edition, 2014. (Unit 1,(Pg. 6-24) Unit –II Pg(26-58))
4. David Lay, Steven Lay, Judi McDonald, "Linear Algebra and its Applications", Pearson Education Asia, Indian Reprint, 5th Edition 2016 . (Unit I,(Pg. 191-264))
5. Thomas Haslwanter, "An Introduction to Statistics with Python with Applications in the Life Sciences", Springer International Publishing Switzerland 2016.(Unit III(Pg. 39,51-71,76-78,89-118) Unit –IV Pg(121-156))

Semester II

LAB-III

MCSP : 206 Python Programming and Cloud Computing

- **Learning Objectives:**

1. To learn how to read and write files in Python and use libraries of Python.
2. To learn how to design object-oriented programs with Python classes.
3. Analyze the problems and solutions to cloud application problems.
4. Apply principles of best practice in cloud application design and management

Group A : Python Programming

1. Introduction To Python Installation of Python on different OS Working with Python as a calculator
2. Programs on Flow Control Basic programs for understanding of different control flow in Python
3. Functions Writing Programs using functions Use of Modules Use of packages
4. Python programs for String, List Building blocks of python programs Understanding string in build methods List manipulation using in build methods
5. Dictionary Manipulations Dictionary manipulation Programming using string, list and dictionary in build functions
6. Python File Operation Reading config files in python Writing log files in python read functions, read(), readline() and readlines() write functions, write() and writelines()
7. Python Database Interaction Demo for SQL/ SQLite connectivity
8. Python Libraries Numpy Pandas
9. Python Libraries Matplotlib Scipy
10. Python Framework Tutorial on Django

Group B : Cloud Computing

1. Working and Implementation of Infrastructure as a service.
2. Working and Implementation of Software as a service.
3. Working and Implementation of Platform as a services.
4. Practical Implementation of Storage as a Service.
5. Working of Google drive to make spreadsheet and notes.
6. Working and Implementation of identity management.
7. Write a program for web feed.
8. Execute the step to Demonstrate and implementation of cloud on single sign on.
9. Practical Implementation of cloud security.
10. Installing and Developing Application Using Google App Engine.

- **Learning Outcomes:**

1. Understand the fundamental principles of distributed computing.
2. Understand how the distributed computing environments known as Grids can be built from lower level services
3. Explain basic principles of Python programming language
4. Implement object oriented concepts, Implement database and GUI applications.

- **Reference Books:**

1. Greg Michaelson, "An Introduction to Functional Programming Through Lambda Calculus", Dover Publications Inc., 2011.
2. Jan van Eijck, Christina Unger, "Computational Semantics with Functional Programming", Cambridge University Press, 2012.
3. Charles Dierbach, "Introduction to Computer Science Using Python: A Computational Problem-Solving Focus", John Wiley & Sons, 2013.
4. Kenneth C. Loudon, "Programming Languages: Principles and Practice", Course Technology Inc., 2011.
5. Richard L. Halterman, "LEARNING TO PROGRAM WITH PYTHON", Southern Adventist University, 2011
6. Dusty Phillips, "Python 3 Object-oriented Programming Second Edition", Packt Publishing, 2015.
7. Adrian Holovaty and Jacob Kaplan-Moss, "The Definitive Guide to Web Development Done Right", Apress Publishing, 2009.
8. Brian J.S. Chee and Curtis Franklin, "Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center", CRC Press, 2019.
9. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing: Foundations and Applications Programming", McGraw Hill, 2013.
10. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012

Semester II
LAB-IV
MCSP 207: Cyber Security & Laws and Digital Image Processing

Learning Objective:

1. To study different types of Vulnerabilities of E-commerce services.
2. To learn encryption and decryption techniques.
3. Understand the basics of images, image transformations.
4. Understand Image Color Processing.

Group A :Cyber Security & Laws

5. Study of the features of firewall in providing network security and to set Firewall Security in windows.
6. Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome)
7. Study of different types of vulnerabilities for hacking a websites / Web Applications.
8. Analysis the Security Vulnerabilities of E-commerce services.
9. Analysis the security vulnerabilities of E-Mail Application
10. Perform encryption and decryption of Caesar cipher. Write a script for performing these operations.
11. Perform encryption and decryption of a Rail fence cipher. Write a script for performing these operations
12. Case Study on – Cyber Harassment.
13. Case Study on – Cyber Law
14. Case Study on – Patent Law

Group B : Digital Image Processing

1. Image Basics:
 - 1.1. W.A.P to read and Display an Image.
 - 1.2. W.A.P to read an image & Display its Matrix information.
2. Image Arithmetic:-
 - 2.1 W.A.P to perform image Addition.
 - 2.2 W.A.P to perform image Subtraction.
 - 2.3 W.A.P to perform image Multiplication.
 - 2.4 W.A.P to perform image Division.
3. Image Transforms using Properties of 2D-DFT. :-
 - 3.1 W.A.P to implement 2DFT Convolution Property.
 - 3.2 W.A.P to implement 2DFT Rotational Property.
4. Image Enhancement in Spatial Domain:-
 - 4.1. Enhancement Through Point Operation:-
 - 4.2. Linear Gray Level Transformations:-
5. Image Enhancement in Frequency Domain:-
 - 5.1 Low-Pass Filtering in Frequency Domain:-
 - 5.2. High-Pass Filtering In Frequency Domain:-
6. Color Image Processing:-
 - 6.1 W.A.P to Read an RGB Image and extract the three Colour Components Red, Green and Blue.
 - 6.2 W.A.P to Read a colour image and separate the colour image into Red, Green and Blue Planes.
 - 6.3 W.A.P to implement RGB to YCbCr Model Conversion.
 - 6.4 W.A.P to implement RGB to HSV Model Conversion

Learning Outcomes:

1. Student will be able to check security of Emails and E commerce Vulnerabilities.
2. Student will learn case studies of Cyber Security.
3. Student will be able to do image transformations.
4. Student will be able to do image Processing.

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