G. VENKATASWAMY NAIDU COLLEGE, KOVILPATTI-628502

(AUTONOMOUS)

(Re-Accredited with "A" Grade by NAAC)

Department of Information Technology

(For those admitted from the academic year 2023-2024 and onwards

VISION

To become a front-runner in preparing graduates to be efficient problem solvers, researchers, innovators and entrepreneurs, and making them competent professionals by enabling them to take up any kind of challenges in Information Technology industry or any organizations they serve.

MISSION

- To uplift rural students of our region through advanced quality education in Information Technology.
- Offer high-quality Postgraduate programs in order to prepare our graduates to become leaders in their profession.
- To provide technical solutions in the field of Information Technology to the local society.
- To provide need-based quality training in the field of Information Technology.
- To maintain state-of-the-art facilities and laboratories where students and faculty can enhance their understanding of technology.
- To provide students with the tools to become productive, participating global citizens and life-long learners.
- To provide an atmosphere for students and faculty for continuous learning to investigate, apply and transfer knowledge.

Programme Outcomes - (PO) (Aligned with Graduate Attributes)

At the completion of the Undergraduate Programme, the student will be able to accomplish the following outcomes:

Programme Outcomes

PO1 : Understand the fundamental concepts of Information Technology.

PO2 : Gain knowledge on programming language to construct applications and packages to solve real-world problems using Information Technology concepts

PO3 : Develop necessary skills to design digital system and acquire knowledge on computer hardware concepts and its functionality.

PO4 : Enhance problem solving techniques, analytical and communication skills, team work and potential to develop software and network management.

PO5 : Recognize the social and ethical responsibilities of a professional working in the discipline

PO6 : Create, select, and apply appropriate techniques, resources, and modern computing and IT tools including prediction and modelling to complex scientific activities with an understanding of the limitations.

PO7 : Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The objectives of this Programme is to equip/prepare the students

Programme Educational Objective

PEOs 1 : Effectively communicating computing concepts and solutions to bridge the gap between computing industry experts and business leaders to create and initiate innovation

PEOs 2 : Effectively utilizing their knowledge of computing principles and mathematical theory to develop sustainable solutions to current and future computing problems.

PEOs 3 : Exhibiting their computing expertise within the computing community through corporate leadership, entrepreneurship, and/or advanced graduate study

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSOs 1 : Professionally skilled in the areas of programming, multimedia, web designing, and networking and to obtain knowledge in various domain-based electives.

PSOs 2 : Accomplish the skill to design and develop computer programs, evaluate and recognize potential risks and provide innovative solutions.

PSOs 3 : Explore technical knowledge in diverse areas of applications and experience an environment conducive in cultivating skills for successful career, entrepreneurship and higher studies. Effectively integrate IT-based solution into the user environment

GRADUATE ATTRIBUTES (GAs)

GA1 : **Knowledge of the discipline**: Attribute describes the capability of demonstrating comprehensive and considered knowledge of a discipline

GA 2 : **Creativity:** Creativity is a skill that underpins most activities, although this may be less obvious in some Disciplines. Students are required to apply imaginative and reflective thinking to their studies.

GA 3 : **Intellectual Rigour:** Intellectual Rigour is the commitment to excellence in all scholarly a intellectual activities, including critical judgement. The students are expected in having clarity in thinking.

GA 4 : **Problem Solving Skills:** Problem solving skills empower students not only within the context of their programme but also, in their personal and professional lives.

GA 5 : **Lifelong Learning:** The skill of being a lifelong learner means a graduate is open, curious, willing to investigate, and consider new knowledge and ways of thinking.

GA 6 : **Communication and Social Skill:** The ability to communicate clearly and to work well in team setting is critical to sustained and successful employment.

GA 7 : **Self-Management:** Graduates must have capabilities for self-organisation, self-review, personal development and life-long learning.

DEPARTMENT OF INFORMATION TECHNOLOGY
Programme Structure for M.Sc(IT)
(For those admitted from the academic year 2023-24 and onwards)

Course Type	Course code	Course Title	Contact Hrs.	Exam Hrs.	Marks			Credit
					CIA	ESE	Total	
Semester- I								
Core :1	P23IT101	Python Programming	7	3	25	75	100	5
Core Lab – I	P23IT1P1	Python Programming - Practical	7	3	40	60	100	5
Core Lab – II	P23IT1P2	Web Development using Word Press– Practical	6	3	40	60	100	4
Core Elective – I	P23IT1E1A	Data Structures	5	3	25	75	100	3
	P23IT1E1B	Compiler Design						
	P23IT1E1C	Natural Language Processing						
Core Elective – II	P23IT1E2A	Operating Systems	5	3	25	75	100	3
	P23IT1E2B	Digital Computer Architecture						
	P23IT1E2C	Human Computer Interaction						
Comprehension – I (Online Exam)	P23IT1C1	Comprehension in Information Technology - I	-	1	-	50	50	1
Ability Enhancement	P23AE101	Cyber Security	-	2	-	50	50	2
NPTEL (Self Study Course – online – To be completed within 4 semester)								**1**
			30				**600**	**24**
Semester-II								
Core-2	P23IT202	Database Systems	6	3	25	75	100	5
Core Lab – III	P23IT2P3	RDBMS Lab	6	3	40	60	100	5
Core Lab – IV	P23IT2P4	Open Source Technologies -Practical	6	3	40	60	100	4
Core Elective- III	P23IT2E3A	Biometric Techniques	4	3	25	75	100	3
	P23IT2E3B	Distributed and Cloud Computing						
	P23IT2E3C	Advanced Digital Image Processing						

Core Elective- IV	P23IT2E4A	Machine Learning	4	3	25	75	100	3
	P23IT2E4B	Software Project Management						
	P23IT2E4C	Big data Analytics						
Skill enhancement (SE1)	P23IT2SE1	Data Science & Data Mining using R LAB	4	3	40	60	100	2
Comprehension-1 (Self Study Course-Online Exam)	P23IT2C2	Comprehension in Information Technology - II	-	1	-	50	50	1
Ability Enhancement	P232AE202	Teaching Skill	-	-	50		50	1
			30				**700**	**24**

SEMESTER I

M.Sc, Information Technology / Semester – I/
CORE-1: PYTHON PROGRAMMING
(P23IT101)

Lecture Hours	**: 100**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 05**
Contact Hours per Semester	**: 105**		
Contact hours per Week	**: 07**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To acquire programming skills in core Python and to develop database applications in Python

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POs AND PSOs)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Remember the basic concepts in python language.
CO2	Apply the various data types and identify the usage of control statements, loops, functions and modules in python for processing the data
CO3	Analyze and solve problems using basic constructs and techniques of python.
CO4	Understand the approaches used in the development of interactive application.
CO5	Evaluate build real time programs using python

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**3**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**3**
CO3	**3**	**2**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**2**
CO4	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**
CO5	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**
Total Contribution of COs to POs	**13**	**13**	**13**	**14**	**12**	**13**	**11**	**13**	**13**	**12**

Weighted Percentage of Cos contribution to POs contribute to each PSO	**86.6**	**86.6**	**86.6**	**93.3**	**80**	**86.6**	**73.3**	**86.6**	**86.6**	**80**

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

COURSE CONTENT

UNIT I: (L-20+T1 Hours)

Introduction - Python Basics: Comments - Statements and syntax - variable Assignment - Identifiers - Python objects : Built-in-types - Internal types - Standard Type operators - Standard type Built-in-functions. Numbers : Introduction to Numbers - Integers - Floating point numbers - Complex numbers - Operators - Built-in and factory functions –Conditionals and Loops -Sequences : Strings, Lists and Tuples

UNIT II: (L-20+T1 Hours)

Mapping and set types.- **Functions and functional programming**: Introduction - Calling functions - Creating functions - passing functions - Formal arguments - Variable - Length Arguments - Functional Programming - Variable Scope – Recursion.

UNIT III: (L-20+T1 Hours)

Modules: Modules and Files – namespaces - Importing Modules - Features - Built-in functions. **Object Oriented Programming**: Introduction - Object Oriented Programming – Encapsulation Inheritance – Polymorphism - **Errors and Exceptions**: Introduction – Exceptions in Python.

UNIT IV: (L-20+T1 Hours)

GUI Programming: Introduction – **Using Widgets**: Core widgets- Generic widget properties – Labels – Buttons – Radio Buttons – Check Buttons – Text – Entry – List Boxes – Menus –Frame – Scroll Bars – Scale

UNIT V: (L-20+T1 Hours)

Database Programming: Connecting to a database using MongoDB - Creating Tables - INSERT-UPDATE - DELETE - READ operations .

TEXT BOOKS:

1. Wesley J. Chun, (2007), "Core Python Programming", Pearson Education, Second Edition – (Unit I,II,III).
2. Charles Dierbach, (2015), "Introduction to Computer Science Using Python A Computational Problem-Solving Focus", Wiley India Edition- (Unit III- Object Oriented Programming)
3. Martin C Brown, (2018), "The Complete Reference Python", McGraw Hill Education (India) Private Limited – (Unit IV)

REFERENCE BOOKS:

1. Mark Lutz, (2013), "Learning Python Powerful Object Oriented Programming", O"reilly Media, 5 th Edition.
2. Timothy A. Budd, (2011), "Exploring Python", Tata MCGraw Hill Education PrivateLimited, First Edition.

3. Allen Downey, Jeffrey Elkner, Chris Meyers, (2012), "How to think like a computerscientist: learning with Python"
4. John V Guttag, ―Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press,2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in python: An Inter-disciplinary Approach, Pearson India Education Services Pvt.Ltd., 2016.

WEBSITE REFERENCES:

1. http://interactivepython.org/courselib/static/pythonds
2. http://www.ibiblio.org/g2swap/byteofpython/read/
3. http://www.diveintopython3.net/
4. http://docs.python.org/3/tutorial/index.html

M.Sc, Information Technology / Semester – I/
CORE LAB 1: PYTHON PROGRAMMING LAB
(P23IT1P1)

Lecture Hours	**: -**	**Tutorial Hours**	**:**
Practical Hours	**: 105**	**No. of Credit**	**: 05**
Contact Hours per Semester	**: 105**		
Contact hours per Week	**: 07**		
Internal Marks	**: 40**		
External Marks	**: 60**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To gives practical experience in Python basics, Object Oriented programming like Classes, Inheritance, and Polymorphism, GUI Applications and Database connection.

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POS AND PSOS)

On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Understand the significance of control statements, loops and functions in creating simple programs.
CO2	Apply the core data structures available in python to store, process and sort the data
CO3	Analyze the real time problem using suitable python concepts
CO4	Evaluate the complex problems using appropriate concepts in python
CO5	Create the real time applications using python programming language.

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	2	2	2	3	2
CO2	3	3	2	3	3	2	3	2	3	3
CO3	3	2	2	3	3	3	3	2	3	3
CO4	3	3	3	2	3	3	2	3	2	3
CO5	2	3	3	3	3	3	2	3	3	3
Total Contribution of COs to POs	14	13	12	14	13	13	12	12	14	13
Weighted Percentage of Cos contribution to POs contribute to eachPSO	93.3	86.6	80	93.3	86.6	86.6	80	80	93.3	86.6

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

LIST OF PRACTICALS

1. Python Basic programs
2. Control Structures
3. Lists
4. Functions and Recursions
5. Modules
6. String Processing
7. Dictionaries and Sets
8. Classes and Objects
9. Polymorphism
10. Inheritance
11. GUI Application
12. Working with Database

TEXT BOOKS:

1. Wesley J. Chun, (2007), "Core Python Programming", Pearson Education, Second Edition –

REFERENCE BOOKS:

1. Mark Lutz, (2013), "Learning Python Powerful Object Oriented Programming", O"reilly Media, 5 th Edition.
2. Timothy A. Budd, (2011), "Exploring Python", Tata MCGraw Hill Education PrivateLimited, First Edition.
3. Allen Downey, Jeffrey Elkner, Chris Meyers, (2012), "How to think like a computerscientist: learning with Python"
4. John V Guttag, ―Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press,2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in python: An Inter-disciplinary Approach, Pearson India Education Services Pvt.Ltd., 2016.

WEBSITE REFERENCES:

1. http://interactivepython.org/courselib/static/pythonds
2. http://www.ibiblio.org/g2swap/byteofpython/read/
3. http://www.diveintopython3.net/
4. http://docs.python.org/3/tutorial/index.html

M.Sc, Information Technology / Semester – I/

CORE LAB II: WEB DEVELOPMENT USING WORD PRESS LAB (P23IT1P2)

Lecture Hours	**: -**	**Tutorial Hours**	**:**
Practical Hours	**: 90**	**No. of Credit**	**: 04**
Contact Hours per Semester	**: 90**		
Contact hours per Week	**: 06**		
Internal Marks	**: 40**		
External Marks	**: 60**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To learn the fundamentals ofbasic web concepts, HTML, DHTML, JavaScript and Word Press.

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POS AND PSOS)

On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Remember the tools which will be suitable for the requirement of the webpage.
CO2	Understand Java script and Style Sheets effectively in the Web Pages
CO3	Analyze the different tools and built-in functions available to be applied in the webpage
CO4	Evaluate the design and effectiveness of the Web Pages created.
CO5	Create and publish a website using Word press

CO-PO Mapping (Course Articulation Matrix)

CO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	3	2	2	3	3	3	3	2
CO2	3	3	3	2	2	2	2	3	3	2
CO3	3	2	2	2	2	3	3	2	2	2
CO4	3	2	3	2	2	3	2	2	3	2
CO5	3	3	3	3	3	3	3	3	3	3
Total Contribution of COs to POs	14	13	14	11	11	14	13	13	14	11
Weighted Percentage of Cos contribution to POs contribute to each PSO	93.3	86.6	93.3	73.3	73.3	93.3	86.6	86.6	93.3	73.3

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

LIST OF PRACTICALS

1. Creating ordered and unordered Lists using simple tags
2. Creating Tables
3. Creating Hyperlinks
4. Creating Frames
5. Creating Embedded style sheet
6. Use of External style sheet
7. Creating Inline style sheet
8. Using Conditional checking
9. Using Looping constructs
10. Using Arrays and Functions
11. Creating Dialog Box
12. Handling Events
13. Creating Forms
14. Form Validation for Name, E-Mail Id and Password
15. Form Validation for Date, Month and Year
16. Using Built-in Objects

TEXT BOOKS:

1. Ivan N. Bayross, (2005), Web Enabled Commercial Applications Development UsingHTML, DHTML, JavaScript, perlCGI, 3rd Edition, BPB Publications. (Unit I, II, III and IV)
2. Jesse Friedman,(2012), Web Designer's Guide to WordPress: Plan, Theme, Build, Launch (Voices That Matter), 1st Edition , New Riders. (Unit V)

REFERENCE BOOKS:

1. N.P. Gopalan, J. Akilandeswari, (2009), Web Technology: A Developer‟s Perspective,Eastern Economy Edition, PHI Learning Private Limited.
2. Deitel&Deitel, (2000), Internet and World Wide Web How to program, Prentice Hall.
3. Jon Duckett, (2004), Beginning Web Programming with HTML, XHTML, and CSS, Wiley Publishing, Inc.
4. Brad Williams, Professional WordPress: Design and Development by David Damstra (Author), Hal Stern (Author) Publisher : John Wiley & Sons; 2nd edition (18 January 2013)
5. Dr. Andy Williams, WordPress for Beginners 2023: A Visual Step-by-Step Guide to Mastering WordPress.

WEBSITE REFERENCES:

1. http://www.sergey.com/web_course/content.html
2. http://www.pageresource.com/jscript/index.html
3. http://www.peachpit.com/guides/content.aspx
4. https://www.tutorialspoint.com/wordpress/index.htm

M.Sc, Information Technology / Semester – I/
Core Elective-I: DATA STRUCTURES
(P23IT1E1A)

Lecture Hours	**: 70**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 03**
Contact Hours per Semester	**: 75**		
Contact hours per Week	**: 05**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To increase the understanding of basic concepts of the design and use of algorithms

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POS AND PSOS)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Remember the basic data structures
CO2	Understand the different operations and memory representations
CO3	Analyze different techniques with their complexities
CO4	Apply the applications of various data structures
CO5	Evaluate the algorithm to solve simple problems suited for appropriate situations

CO-PO Mapping (Course Articulation Matrix)

CO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3
CO1	2	1	2	2	1	2	2	2	1	2
CO2	3	2	2	2	2	3	3	2	2	3
CO3	3	2	3	3	3	2	2	3	3	2
CO4	3	3	2	3	3	3	2	3	3	3
CO5	2	3	3	3	3	2	2	3	3	2
Total Contribution of COs to POs	13	11	12	13	12	14	11	13	12	14
Weighted Percentage of Cos contribution to POs contribute to each PSO	86.6	73.3	80	86.6	80	93.3	73.3	86.6	80	93.3

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

COURSE CONTENT

UNIT-1 : (L-14+T-1 Hours)

Introduction and Overview: Definitions – Concept of Data Structures – Overview of Data Structures – Implementation of Data Structures – Arrays: Definition – One Dimensional Array – Multidimensional Arrays: Two Dimensional Array – Sparse Matrices – Three dimensional and n-dimensional Arrays – Stacks : Introduction – Definition – Representation of Stack – Operations on Stack – Applications of Stacks: Evaluation of Arithmetic Expressions – Implementation of Recursion - Tower of Hanoi Problem

UNIT II: (L-14+T-1 Hours)

Queues: Introduction – Definition – Representation of Queues – **Various Queue Structures :** Circular Queue – Deque – Priority Queue – **Applications of Queues :** Simulation – CPU Scheduling in a Multiprogramming Environment – Round Robin Algorithm – **Linked Lists:** Single Linked List – Circular Linked List – Double Linked List – Circular Double Linked List – **Applications of Linked List:** Polynomial Representation

UNIT III: (L-14+T-1 Hours)

Trees: Basic Terminologies – Representation of Binary Tree: Linear Representation – Linked Representation – **Operations:** Traversals – **Types of Binary Trees:** Expression Tree – Binary Search Tree – Splay tree

UNIT IV: (L-14+T-1 Hours)

Sorting: Bubble Sort, Insertion Sort, Selection Sort, Shell Sort – Quick Sort - Merge Sort - Radix Sort - Heap Sort – **Searching:** Linear Search - Binary Search

UNIT V: (L-14+T-1 Hours)

Graphs: Introduction – Graph representation and its operations – Path Matrix – Graph Traversal - Application of DFS – Shortest Path Algorithm - **Minimum Spanning Tree :** Prim‟s Algorithm – Kruskal‟s Algorthim - Greedy – Knapsack – Back Tracking – 8 Queens.

TEXT BOOKS:

1. Debasis Samantha (2013), Classic Data Structures, Second Edition, PHI Learning Private Ltd.
2. P. Sudharsan, J. John Manoj Kumar, C & Data Structures, Third Edition, RBA Publications. Unit 4: Chapter 14, Unit 5: Chapter 13
3. Ellis Horowitz, SartajSahni, Sanguthevar Rajeshakaran, (2007), Fundamentals of Computer Algorithms, Second Edition, Universities Press (P) Limited

REFERENCE BOOKS:

1. Sara Baase, (1991), Computer Algorithms – Introduction to Design and Analysis, Addison-Wesley Publishing Company
2. Robert Kruse, C.L.Tondo, Bruce Leung, Data Structures and Program Design in C, 2nd Edition, PHI Publications.
3. ReemaThareja, “Data Structures Using C” , Second Edition, 2014, Oxford University Press.
4. M.A.Weiss, ”Data structures and Algorithm Analysis in C” , 2nd edition, 2002, Pearson
5. Ellis Horowitz, SartajSahni, Susan AndersonFreed,“Fundamentals of Data Structures in C”, Second Edition, 1993, Universities Press (India) Private Limited.

WEBSITE REFERENCES:

1. http://www.cs.sunysb.edu/~skiena/214/lectures/
2. http://datastructures.itgo.com/graphs/dfsbfs.htm
3. http://oopweb.com/Algorithms/Documents/PLDS210/VolumeFrames.html
4. http://discuss.codechef.com/questions/48877/data-structures-and-algorithms
5. http://code.tutsplus.com/tutorials/algorithms-and-data-structures--cms-20437

M.Sc, Information Technology / Semester – I/
Core Elective-I: COMPILER DESIGN
(P23IT1E1B)

Lecture Hours	**: 70**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 03**
Contact Hours per Semester	**: 75**		
Contact hours per Week	**: 05**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

PREAMBLE

- To acquire the knowledge about the compiler design and to understand the different phases of Compiler.

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POS AND PSOS)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Remember the major phases of compilation and the functionality of LEX and YACC
CO2	Understand the functionality of compilation process and symbol table management
CO3	Apply the various parsing, optimization techniques and error recovery routines to have a better code for code generation
CO4	Analyze the techniques and tools needed to design and implement compilers.
CO5	Create a compiler and experiment the knowledge of different phases in compilation

CO-PO Mapping (Course Articulation Matrix)

CO/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	3	2	2	2	2	3
CO2	3	2	2	2	3	3	2	2	2	3
CO3	3	2	3	3	2	3	3	2	3	3
CO4	2	3	3	3	2	3	2	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3
Total Contribution of COs to POs	14	12	13	13	13	14	12	12	13	14
Weighted Percentage of Cos contribution to POs contribute to each PSO	93.3	80	86.6	86.6	86.6	93.3	80	80	86.6	93.3

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

COURSE CONTENT

UNIT-1: (L-14+T-1 Hours)

Compilers & Translators, Need of Translators, Structure of a Compiler, Phases, Lexical Analysis, Syntax Analysis, Intermediate Code Generation, Code Optimization, Code Generation, Book Keeping, A Symbol Table in brief, Semantic Analysis, L-value, r-values, Error Handling

UNIT II : (L-14+T-1 Hours)

Rules of Lexical Analyser, Need for Lexical Analysis, Input Buffering, Preliminary Scanning, A simple Approach to the Design of Lexical Analysers, Transition Diagrams, Regular Expression, String & Languages, Finite Automata, Non-deterministic Automata, Deterministic Automata, From regular Expression to Finite Automata, Context free Grammars, Derivations & Parse Trees, Parsers, Shift Reduce Parsing, Operator-Precedence Parsing

UNIT III : (L-14+T-1 Hours)

Symbol Table Management, Contents of a Symbol Table, Names & Symbol table records, reusing of symbol table spaces, array names, Indirection in Symbol Table entries, Data Structures for Symbol Tables, List, Self Organizing Lists, Search Trees, Hash Tables, Errors, Reporting Errors, Sources of Errors Syntactic Errors, Semantic Errors, Dynamic Errors, Lexical Phase Errors, Minimum Distance Matching, Syntactic Phase Error, Time of Detection, Ponic mode, Case study on Lex and Yacc

UNIT IV : (L-14+T-1 Hours)

Principal Sources of Optimization, Inner Loops, Language Implementation Details Inaccessible to the User. Further Optimization, Algorithm Optimization, Loop Optimization , Code Motion, Induction Variables, Reduction in Strength, Basic Blocks, Flow Graphs, DAG Representation of Basic Blocks, Value Numbers & Algebraic Laws, Global Data Flow Analysis, Memory Management Strategies , Fetch Strategy, Placement Strategies, Replacement Strategies, Address Binding, Compile Time, Load Time, Execution Time, Static Loading, Dynamic Loading, Dynamic Linking

UNIT V: (L-14+T-1 Hours)

Problems in Code Generation, a Simple Code Generator, Next-Use Information, Register Descriptors, Address Descriptors, Code Generation Algorithm, Register Allocation & Assignment, Global Register Allocation, Usage Counts, Register Assignment for Outer Loops, Register Allocation by Graph Coloring, Code Generation from DAG's, Peep-Hole Optimization, Redundant Loads & Stores, Un-Reachable Code, Multiple Jumps, Algebraic Simplifications, Use of Machine Idioms.

TEXT BOOKS:

1. Compilers: Principles, Techniques & Tools, Second Edition by A. V. Aho, Monicas. Lam, Ravi Sethi, J. D. Ullman

REFERENCE BOOKS:

1. Dhamdhere D.M., “Compiler Construction: Theory and Practice”, McMillan India Ltd., 1983
2. Holub Allen, “Compiler Design in C”, Prentice Hall of India, 1990
3. Winster ,S. Aruna Devi ,R.Sujatha ,Compiler Design: First Revised Edition , January 2017, Dee Publishing.

4. Reinhard Wilhelm ,Helmut Seidl ,Sebastian Hack, 24 June 2015, Compiler Design: Syntactic and Semantic Analysis, Springer publishing
5. santanu Chattopadhyay , 1 January 2005 Compiler Design, Prentice Hall India Learning Private Limited

WEBSITE REFERENCES:

1. https://www.geeksforgeeks.org/compiler-design-tutorials/
2. https://www.tutorialspoint.com/compiler_design/
3. https://www.javatpoint.com/compiler-tutorial
4. https://onlinecourses.nptel.ac.in/noc19_cs01/preview
5. http://ecomputernotes.com/compiler-design

M.Sc, Information Technology / Semester – I/
Core Elective-I: NATURAL LANGUAGE PROCESSING
(P23IT1E1C)

Lecture Hours	**: 70**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 03**
Contact Hours per Semester	**: 75**		
Contact hours per Week	**: 05**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To learn the fundamentals of natural language processing and to understand the role of CFG, semantics of sentences and pragmatics

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POS AND PSOS)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Remember the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language
CO2	Understand various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parsing and semantic analysis
CO3	Create the text into an organized group using a set of handicraft linguistic rules with appropriate NLP processes and algorithms
CO4	Analyze the system with various language analysis methods and interpret the results
CO5	Evaluate NLP systems, identify and suggest solutions for the shortcomings

CO-PO Mapping (Course Articulation Matrix)

CO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3
CLO1	2	2	2	2	2	2	2	3	2	3
CLO2	2	2	2	2	2	2	3	2	2	4
CLO3	3	2	3	3	2	3	3	3	3	2
CLO4	3	2	2	3	2	3	3	2	3	2
CLO5	3	2	2	3	3	3	3	2	3	3
Total Contribution of COs to POs	13	10	11	13	11	13	14	12	13	14
Weighted Percentage of Cos contribution to POs contribute to each PSO	86.6	66.6	73.3	86.6	73.3	86.6	93.3	80	86.6	93.3

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

COURSE CONTENT

UNIT-1 : (L-14 + T-1 Hours)

Introduction: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT II : (L-14+T-1 Hours)

Word Level Analysis: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rulebased, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models

UNIT III : (L-14+T-1 Hours)

Syntactic Analysis: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures

UNIT IV : (L-14+T-1 Hours)

Semantics and Pragmatics: Requirements for representation, FirstOrder Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selection restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods

UNIT V : (L-14+T-1 Hours)

Discourse Analysis and Lexical Resources: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC)

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin;Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech; Pearson Publication; 2014.
2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python , First Edition, OReilly Media, 2009.

REFERENCE BOOKS:

1. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, ―Natural Language Processing with Java , O_Reilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval, Oxford University Press, 2008.
5. Steven Bird (Author), Ewan Klein (Author), Edward Loper (Author), August 4, 2009, Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit 1st Edition, O'Reilly Media

WEBSITE REFERENCES:

1. http://www.cse.iitb.ac.in/~pb/papers/nlp-iitb.pdf
2. https://www.nitk.ac.in/faculty/dr-sarika-jain
3. https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/what-is-natural-language-processing-nlp
4. https://www.sas.com/en_us/insights/analytics/what-is-natural-language-processing-nlp.html
5. https://towardsdatascience.com/your-guide-to-natural-language-processing-nlp-48ea2511f6e1

M.Sc, Information Technology / Semester – I/
Core Elective-II: OPERATING SYSTEMS
(P23IT1E2A)

Lecture Hours	**: 70**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 03**
Contact Hours per Semester	**: 75**		
Contact hours per Week	**: 05**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To develop fundamental knowledge of Operating systems, to become familiar with CPU Scheduling, memory and file management concepts, to learn concepts and programming techniques of Linux

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POS AND PSOS)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Remember the fundamental concepts of an OS and their respective functionality
CO2	Understand the importance of open-source operating system commands
CO3	Apply and stimulate management activities of operating system
CO4	Analyze the various services provided by the operating system
CO5	Evaluate different problems related to process, scheduling, deadlock, memory and files

CO-PO Mapping (Course Articulation Matrix)

CO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3
CO1	3	1	1	2	2	2	3	2	2	3
CO2	3	2	2	3	3	2	3	3	3	3
CO3	2	3	2	2	2	2	2	2	2	2
CO4	3	3	3	3	2	3	3	3	2	3
CO5	3	3	3	3	3	3	2	3	3	3
Total Contribution of COs to POs	14	12	11	13	12	12	13	13	12	14
Weighted Percentage of Cos contribution to POs contribute to each PSO	93.3	80	73.3	86.6	80	80	86.6	86.6	80	93.3

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

COURSE CONTENT

UNIT-1 (L-14+T-1 Hours)

Introduction : Evolution of Operating System - Structure - Processes - The Process Concepts - Inter Process Communication - IPC Problems - Scheduling Levels - Preemptive Vs Non- Preemptive Scheduling - **Scheduling Algorithms:** First Come First Served - Shortest Job First - Shortest Remaining Time Next - Three Level Scheduling - Round Robin Scheduling - Priority Scheduling -Multiple Queues - Shortest Process Next - Guaranteed Scheduling - Lottery Scheduling - Fair-Share Scheduling - Thread Scheduling.

UNIT II (L-14+T-1 Hours)

Swapping - Virtual Memory - Page Replacement Algorithm – Segmentation

UNIT III (L-14+T-1 Hours)

Deadlock - Examples of Deadlock - Detection - Recovery - Avoidance - Prevention – Semaphore -Shared Memory

UNIT IV (L-14+T-1 Hours)

File System - Files - Directories - I/O Management - Disks - Disk Arm Scheduling Algorithm.

UNIT V (L-14+T-1 Hours)

Introduction to Linux: Introducing Shell Programming - Linux File Systems - Linux File system calls - Implementation of Linux File systems - Linux Commands - Directory Oriented Commands - File Oriented Commands - Communication Oriented Commands- General Purpose Commands.

TEXT BOOKS:

1. Andrew S. Tanenbaum, (2001), Modern Operating Systems, 2nd Edition, Prentice Hall of India.
2. B.Mohamed Ibrahim, (2005) Linux Practical Approach, Firewall Media.

REFERENCE BOOKS:

1. Silberchatz, Galvin, Gagne, (2003), Operating Systems Concepts, 6th Edition Wiley India Edition.
2. JhonGoerzen, (2002), Linux Programming Bible, 4th Edition, Wiley- dreamtech India (P) Ltd.
3. Operating Systems, Internals and Design Principles, William Stallings, PHI, 2008.
4. Operating System Concepts – Silverschatz and Galvin, 6th Edition, John Wiley & Sons, Inc., 2004.
5. An Introduction to Operating Systems – Concepts and Practice, Pramod Chandra P. Bhatt, Prentice Hall of India, 2007.

WEBSITE REFERENCES:

1. https://www.webopedia.com/TERM/O/operating_system.html
2. https://www.tutorialspoint.com/operating_system/operating_system_tutorial.pdf
3. http://iips.icci.edu.iq/images/exam/Abraham-Silberschatz-Operating-System-Concepts- 9th2012.12.pdf
4. https://www.informatics.indiana.edu/rocha/academics/i101/pdfs/os_intro.pdf
5. https://www.youtube.com/watch?v=oJMYYMIGVMU

M.Sc, Information Technology / Semester – I/
Core Elective-II: DIGITAL COMPUTER ARCHITECTURE
(P23IT1E2B)

Lecture Hours	**: 70**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 03**
Contact Hours per Semester	**: 75**		
Contact hours per Week	**: 05**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To provide a comprehensive introduction of the basic design of a computer and the interdependence and interoperation between the various components inside a computer

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POS AND PSOS)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Remember the fundamental concept of binary representation and codes, combinational circuits, Instruction formats, register operations and memory organization
CO2	Understand the various types of flip flops, different types of micro operations, as well as the addressing modes in the instruction set
CO3	Apply the various number conversion systems and simplification of equations using K-map
CO4	Analyze the various design of combinational circuits and flip flops to design a computer
CO5	Evaluate the major components of a computer including CPU, memory, I/O and storage

CO-PO Mapping (Course Articulation Matrix)

CO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3
CO1	3	2	1	2	2	2	3	2	2	3
CO2	3	2	2	2	2	2	3	2	2	3
CO3	2	2	2	2	2	2	2	2	2	3
CO4	3	2	2	2	3	2	2	3	3	2
CO5	3	2	3	2	3	3	3	3	3	3
Total Contribution of COs to POs	14	10	11	10	12	11	13	12	12	14
Weighted Percentage of Cos contribution to POs contribute to each PSO	93.3	66.6	73.3	66.6	80	73.3	86.6	80	80	93.3

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

COURSE CONTENT

UNIT-1: (L-14+T-1 Hours)

Data Representation - Data Types - Number Systems - Decimal and Alphanumeric Representation - Complements - (r-1)"s complement - (r"s) complement - Fixed- point Representation - Floating-point Representation - Binary Codes - Gray Codes - Decimal Codes - Alphanumeric Codes – Error Detection Codes.

UNIT II : (L-14+T-1 Hours)

Digital Computers - Logic Gates - Boolean Algebra - K-Map Simplification - Combinational Circuits - Half Adder - Full Adder - SR, D, JK and T Flip Flops - Sequential Circuits - State Table - State Diagram - Digital Components: Integrated Circuits - Decoders - NAND Gate Decoder - Encoders - Multiplexers - Registers - Shift Registers - Binary Counters - Memory Unit

UNIT III : (L-14+T1 Hours)

Register Transfer and Micro-operations: Register Transfer Language - Register Transfer - Bus and Memory Transfers - Arithmetic Micro-operations - Logic Micro-operations - Shift Micro- operations - Arithmetic Logic Shift Unit. Computer Organization and Programming: Instruction Codes - Computer Registers - Computer Instructions - Timing and Control - Instruction Cycle - Memory Reference Instructions - Input-Output and Interrupt.

UNIT IV: (L-14+T-1 Hours)

Central Processing Unit: General Register Organization - Instruction Formats - Addressing Modes - Data Transfer and Manipulation - Program Control. I/O Organization: Peripheral Devices - I/O Interface - Asynchronous Data Transfer - Modes of Transfer - Priority Interrupt - DMA.

UNIT V : (L-14+T-1 Hours)

Memory Organization and CPU: Memory Hierarchy - Main Memory - Auxiliary Memory - Associative Memory - Cache Memory - Virtual Memory - Memory Management Hardware

TEXT BOOKS:

1. Andrew S. Tanenbaum, (2001), Modern Operating Systems, 2nd Edition, Prentice Hall of India.
2. B.Mohamed Ibrahim, (2005) Linux Practical Approach, Firewall Media.

REFERENCE BOOKS:

1. Silberchatz, Galvin, Gagne, (2003), Operating Systems Concepts, 6th Edition Wiley India Edition.
2. JhonGoerzen, (2002), Linux Programming Bible, 4th Edition, Wiley- dreamtech India (P) Ltd.
3. P.V.S. Rao "Computer System Architecture", 2008, PHILearning.
4. Nirmala Sharma,"Computer Architecture", First Edition,2009,University Science Press
5. NicholosCarter,"Computer Architecture" ,2006, Tata MCgraw Hill Publication.

WEBSITE REFERENCES:

1. https://www.webopedia.com/TERM/O/operating_system.html
2. https://www.tutorialspoint.com/operating_system/operating_system_tutorial.pdf
3. http://iips.icci.edu.iq/images/exam/Abraham-Silberschatz-Operating-System-Concepts-9th2012.12.pdf
4. https://www.informatics.indiana.edu/rocha/academics/i101/pdfs/os_intro.pdf
5. https://www.youtube.com/watch?v=oJMYYMIGVMU

M.Sc, Information Technology / Semester – I/
Core Elective-II: HUMAN COMPUTER INTERACTION
(P23IT1E2C)

Lecture Hours	**: 70**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 03**
Contact Hours per Semester	**: 75**		
Contact hours per Week	**: 05**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To think constructively and analytically in designing and evaluating interactive technologies

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POS AND PSOS)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Remember typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms
CO2	Understand the usability and the beneficiary factors of User support systems
CO3	Analyze the core theories, models and methodologies in the field of HCI
CO4	Evaluate interactive systems based on the human factor theories
CO5	Create an interactive system based on the design principles, standards and guidelines

CO-PO Mapping (Course Articulation Matrix)

CO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CO1	3	2	2	3	2	2	2	3	2	2
CO2	3	2	2	3	2	2	3	3	2	2
CO3	2	2	3	2	2	2	2	3	2	3
CO4	3	2	2	2	3	2	2	3	2	2
CO5	3	3	3	2	3	3	3	3	3	3
Total Contribution of COs to POs	14	11	12	12	12	11	12	13	11	12
Weighted Percentage of Cos contribution to POs contribute to each PSO	93.3	73.3	80	80	80	73.3	80	86.6	73.3	80

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

COURSE CONTENT

UNIT-1 **(L-14+T-1 Hours)**

Foundations: The Human: Introduction-Input-Output Channels- Memory. The Computer: Introduction- Text Entry Devices- Display Devices- Memory. The Interaction: Introduction – Models of Interaction-Frameworks and HCI Ergonomics-Interaction Styles-Elements of the WIMP Interface-Interactivity - The Context of the Interactions

UNIT II **(L-14+T-1 Hours)**

Design Process: Design Basics- Introduction - Process- User Focus-Scenarios- Navigation Design- Screen Design and Layout-Interaction and Prototyping. Design Rules-Introduction- Principles to Support Usability-Guidelines-Golden Rules and Heuristics-HCI Patterns

UNIT III **(L-14+T-1 Hours)**

Implementation Support: Introduction - Elements of Windowing Systems - Programming the Application-Using Toolkits-User Interface Management Systems. Evaluation Techniques: What is an Evaluation- Goal of Evaluation-Evaluation Through Expert Analysis-Choosing an Evaluation Method

UNIT IV **(L-14+T-1 Hours)**

Universal Design: Introduction - Universal Design Principles-Designing for Diversity. User Support: Introduction-Requirements of User Support-Approaches to User Support-Adaptive Help Systems-Designing User Support Systems

UNIT V **(L-14+T-1 Hours)**

Models: Cognitive Models: Introduction-Goals and Task-Linguistic Models- Challenge of Display Based System-Physical and Device Models - Cognitive Architectures

TEXT BOOK:

1. Alan dix, Janet finlay, Gregory D. Abowd and Russell Beale,(2004), Human Computer Interaction, 3rd edition, Pearson Education

REFERENCE BOOKS:

1. John C. Caroll, (2002), Human Computer Interaction in the new millennium, Pearson Education
2. Jenny Preece, Yvonne Rogers, Helen Sharp (2019), Interaction Design: Beyond Human–Computer Interaction,fifth edition, John Wiley & Sons Inc.
3. Andrew Sears, Julie A. Jacko, 2009 Human-Computer Interaction Development Process, Taylor & Francis
4. Alan Dix (Author), Janet E. Finlay (Author), Gregory D. Abowd (Author), Russell Beale (Author), 7 October 2003, Human-Computer Interaction Hardcover 3 edition, Pearson publishing
5. Dix , 1 January 2004, Human-Computer Interaction, 3e, Pearson Education India

WEBSITE REFERENCES:

1. http://courses.iicm.tugraz.at/hci/
2. http://www.hcibook.com/hcibook/downloads/pdf/exercises.pdf
3. http://www.idemployee.id.tue.nl/g.w.m.rauterberg/lectures.html
4. http://user.medunigraz.at/andreas.holzinger/holzinger/papersen/HCI/Workshop/forISSEP%2 02005.pdf
5. http://universaldesign.ie/What-is-Universal-Design/The-7-Principles/(UnitIV**:** Universal Design Principles)

SEMESTER II
M.Sc, Information Technology / Semester – II/
CORE-2: DATABASE SYSTEMS
(P23IT202)

Lecture Hours	**: 85**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 05**
Contact Hours per Semester	**: 90**		
Contact hours per Week	**: 06**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To cover Fundamental computer knowledge that includes the hardware and memory storage.

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POs AND PSOs)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Understand the relational databases and uses of PL/SQL
CO2	Apply Schema, ER- Model, normalization, transaction, concurrency, and recovery on tables using SQL and PL/SQL.
CO3	Analyze and manage relational & distributed, database, transaction, concurrency control and query languages
CO4	Evaluate the databases based on models and Normal Forms.
CO5	Create and construct tables and manipulate it effectively using PL/SQLdatabase objects

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	3	2	2	3	3	2
CO3	3	2	2	3	3	2	2	3	3	2
CO4	3	3	3	3	2	3	3	3	2	3
CO5	3	3	3	2	2	3	3	2	2	3
Total Contribution of COs to POs	14	13	13	14	13	13	13	14	13	13
Weighted Percentage of Cos contribution to POs contribute to each PSO	93.3	86.6	86.6	93.3	86.6	86.6	86.6	93.3	86.6	86.6

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

COURSE CONTENT

UNIT I: (L-17+T-1 Hours)

Introduction: Database System Applications-Purpose of Database Systems-View of Data- Database Users and Administrators. Relational Database: Structure of Relational Databases- Databases Schema- Keys-Schema Diagrams-Formal Relational Query Languages: Relational Algebra-Tuple Relational Calculus.

UNIT II: (L-17+T-1 Hours)

Database Design: Overview of Design Process-The Entity Relationship Model-Constraints- Removing Redundant Attributes in Entity Sets-Entity-Relationship Diagrams-Reduction to Relational Schemas-Extended E-R features -Alternative Notations for Modeling Data**. Relational Database Design:** Features of Good Relational Design-Functional Dependency- **Normalization**: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF-Functional Dependency Theory.

UNIT III: (L-17+T-1 Hours)

Transaction Management: Transaction Concept-Simple Transaction Model-Storage Structure- Transaction Atomicity and Durability-Transaction Isolation-Serializability. **Concurrency Control:** Lock Based Protocols-Locks-Granting of Locks-Two Phase Locking Protocol-Time Stamp Based Protocol - **Recovery System:** Failure Classification-**Recovery and Atomicity**: Log Records-Database Modification-Concurrency Control and Recovery-Recovery Algorithm

UNIT IV: (L-17+T-1 Hours)

Distributed Database: Homogeneous and Heterogeneous Databases-Distributed Data storage- Distributed Transactions-Commit Protocols-Concurrency Control in Distributed Databases- Distributed Query Processing. Case study: MongoDB

UNIT V: (L-17+T-1 Hours)

SQL - Table Fundamentals - Viewing Data - Inserting - Deleting - Updating - Modifying - Constraints - Functions - Grouping - Subqueries - Joins - Views.**PL/SQL:** Introduction - PL/SQL Block - Data Types And Variables - Control Structure - Cursors - PL/SQL Security - Locks. PL/SQL Database Objects: Exception Handling- Packages - Procedures and Functions - Database Triggers

TEXT BOOKS:

1. Abraham Silberchatz, Henry F.Korth, S.Sudarshan, Database Systems Concepts, SixthEdition, Tata Mcgraw Hill.
2. Ivan Bayross, SQL, PL/SQL The Programming Language of ORACLE, Fourth edition, BPB Publications. Unit IV & V

REFERENCE BOOKS:

1. AtulKahate, Introduction to Database Management systems, Pearson education.
2. Carlo Zaniolo, Stefano Ceri, Christos Faloustsos, R.T.Snodgrass, V.S.Subrahmanian, (1997), Advanced Database Systems, Morgan Kaufman.
3. George Koch, Kelvin Loney, (2002), Oracle 9i : The Complete Reference, Oracle Press, Tata McGrawHill Publication.
4. RamezElmasri, Shamkant B. Navathe (2014), “Database Systems”, Sixth edition, Pearson Education, New Delhi.
5. Abraham Silberschatz, Henry F.Korth, S.Sudarshan “Database System Concepts” McGraw –Hill Education, 2010.

WEBSITE REFERENCES:

1. http://awtrey.com/tutorials/dbeweb/database.php
2. http://www.slideshare.net/SalamaAlbusaidi/emerging-database-technology-multimedia- database.
3. http://www.tutorialspoint.com/dbms/index.htm
4. http://www.tutorialspoint.com/plsql/index.htm
5. https://opentextbc.ca/dbdesign/chapter/chapter-11-functional-dependencies/(FunctionalDependencies)

M.Sc, Information Technology / Semester – II/
CORE LAB III: RDBMS LAB
(P23IT2P3)

Lecture Hours	**: -**	**Tutorial Hours :**	
Practical Hours	**: 90**	**No. of Credit**	**: 05**
Contact Hours per Semester	**: 90**		
Contact hours per Week	**: 06**		
Internal Marks	**: 40**		
External Marks	**: 60**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To learn and implement SQL& PL/SQL.

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POS AND PSOS)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Remember appropriate SQL queries and PL/SQL blocks for the database.
CO2	Understand SQL and PL/SQL blocks for the given problem effectively.
CO3	Analyse the problem and Exceptions using queries and PL/SQL blocks.
CO4	Evalaute the database for normalization using SQL and PL/SQL blocks.
CO5	Create the Design Database tables, create Procedures, user-defined functions and Triggers.

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	3	2	2	2	3
CO2	3	3	3	3	3	3	3	3	2	3
CO3	3	3	2	3	2	3	2	3	2	3
CO4	2	3	2	3	2	2	2	3	3	2
CO5	2	2	3	3	3	3	3	3	3	2
Total Contribution of COs to POs	13	14	12	14	13	14	12	14	12	13
Weighted Percentage of Cos contribution to POs contribute to eachPSO	86.6	93.3	80	93.3	86.6	93.3	80	93.3	80	86.6

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

LIST OF PRACTICALS

1. DDL Commands
2. DML Commands
3. DCL Commands
4. Usage of Sub Queries in DML and Create-SQL
5. Solving queries using built-in functions
6. Simple programs in PL/SQL block
7. Exception Handling in PL/SQL
8. Programs using Implicit Cursors
9. Programs using Explicit Cursors
10. Procedures & User-defined functions
11. Creation of Triggers

TEXT BOOKS:

1. Ivan Bayross, SQL, PL/SQL The Programming Language of ORACLE, Fourth edition, BPBPublications

REFERENCE BOOKS:

1. RamezElmasri, Shamkant B. Navathe (2014), "Database Systems", Sixth edition, PearsonEducation, New Delhi
2. Rajesh Narang – "Database Management Systems", PHI Learning Pvt. Ltd., 2006.
3. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw – Hill Education, 2002.
4. Michael Abbay, Mike Corey, Ian Abramson, "ORACLE 9i A Beginner's Guide", Tata McGraw – Hill Publishing Company Ltd., New Delhi, 2002.
5. The Database Application Book using the MYSQL Database Gehani – Universities Press.

WEBSITE REFERENCES:

1. http://awtrey.com/tutorials/dbeweb/database.php
2. http://www.slideshare.net/SalamaAlbusaidi/emerging-database-technology-multimedia-database.
3. http://www.tutorialspoint.com/dbms/index.htm
4. http://www.tutorialspoint.com/plsql/index.htm

M.Sc, Information Technology / Semester – II/
CORE LAB IV: OPEN SOURCE TECHNOLOGIES LAB
(P23IT2P4)

Lecture Hours	**: -**	**Tutorial Hours :**	
Practical Hours	**: 90**	**No. of Credit**	**: 04**
Contact Hours per Semester	**: 90**		
Contact hours per Week	**: 06**		
Internal Marks	**: 40**		
External Marks	**: 60**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To learn the efficiency of Open Source Technology and to train to have a good practical knowledge of how to write successful PHP and Ruby code and utilizing adatabase using PHP.

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POs AND PSOs)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Remember the setup and configuration of development environment to write PHP and Ruby Scripts
CO2	Understand the appropriate language fundamentals and techniques to write and compile PHP and Ruby programs
CO3	Evaluate the bugs and analyze how to prevent and remove the bugs
CO4	Analayze the test and debug the application with sample inputs to check the correctness andconsistency of the scripts
CO5	Create simple programs that make use of various PHP and Ruby features and functions and solve web application and database tasks using PHP

CO-PO Mapping (Course Articulation Matrix)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	1	2	3	3	2	3	3
CO2	3	3	3	2	2	2	2	2	3	2
CO3	3	2	3	3	2	2	2	2	2	3
CO4	3	2	2	2	3	3	3	3	3	3
CO5	2	3	3	3	2	3	3	3	3	3
Total Contribution of COs to POs	14	13	14	11	11	13	13	12	14	14
Weighted Percentage of Cos contribution to POs contribute to each PSO	93.3	86.6	93.3	73.3	73.3	86.6	86.6	80	93.3	93.3

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

LIST OF PRACTICALS

1. Creating, running and displaying a PHP page
2. Working with Control Structures
3. String Functions
4. Number Functions
5. Date Functions
6. Time Functions
7. Working with Arrays
8. Associative Array
9. Working with Functions
10. Working with Form Data
11. Data Validation
12. Working with Files
13. Working with MySql
14. Working with Cookies
15. Working with Sessions
16. Working with Numbers
17. Working with Strings
18. Working with Control statements
19. Working with Arrays
20. Working with Hashes
21. Working with Methods
22. Creating Classes and Objects
23. Exception Handling
24. Working with Files

TEXT BOOKS:

1. Steven Holzner, (2016), "PHP: The Complete Reference", McGraw Hill Education Private Limited, Indian Edition. (Unit I, II)
2. RachnaKapur, Mario Briggs, Tapas Saha, Ulisses Costa, Pedro Carvalho, Raul F. Chong, Peter Kohlmann (2010), "Getting Started with Open Source Development", DB2 on Campus Book Series. (Unit III)

REFERENCE BOOKS:

1. W. Jason Gilmore (2010), "Beginning PHP &MySql", Apress.
2. Joel Murach, Ray Harris (2010), "PHP and MySQL",Shroff Publishers & Distributors
3. Larry Ullman (2008), "PHP 6 and MySQL 5", Pearson Education.
4. John Coggeshall (2006), "PHP 5", Pearson Education.
5. Michale C. Glass (2004), "Beginning PHP, Apache, MySQL Web Development", Wiley DreamTech Press.

WEBSITE REFERENCES:

1. http://www.w3schools.com/php/
2. http://howtostartprogramming.com/PHP/
3. http://www.massey.ac.nz/~nhreyes/MASSEY/159339/Lectures/Lecture%2011%20-%20PHP%20-%20Part%205%20-%20CookiesSessions.pdf
4. http://www.tutorialspoint.com/mysql/
5. http://ruby.bastardsbook.com/chapters/exception-handling/

M.Sc, Information Technology / Semester – II/
Core Elective-III: BIOMETRIC TECHNIQUES
(P23IT2E3A)

Lecture Hours	**: 55**	**Tutorial Hours**	**:05**
Practical Hours	**: -**	**No. of Credit**	**: 03**
Contact Hours per Semester	**: 60**		
Contact hours per Week	**: 04**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To understand various physiological and behavioural biometrics and its applications

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POS AND PSOS)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Understand the existing theories, methods and interpretations in the field of biometrics
CO2	Apply the deployment areas, competing technologies, strength and weakness of various Physiological and Behavioral Biometrics
CO3	Analyze various Application areas, Biometric security issues and Biometric standards
CO4	Evaluate the methods relevant for design, development and operation of biometric access control systems
CO5	Create identification /verification systems to validate the user identity and technological uplifts in biometrics compared to traditional securing mechanisms

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	1	2	2	2	1	2	2	2	2
CO2	2	2	2	2	2	2	2	3	2	2
CO3	3	2	2	2	3	3	3	3	3	3
CO4	3	2	2	3	3	2	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
Total Contribution of COs to POs	13	10	11	12	12	11	13	14	13	13
Weighted Percentage of Cos contribution to POs contribute to each PSO	86.6	66.6	73.3	80	80	73.3	86.6	93.3	86.6	86.6

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

COURSE CONTENT

UNIT-1: (L-11+T-1 Hours)

Introduction: Biometric Fundamentals - Biometrics Vs Traditional Techniques - Benefits of Biometrics in Identification Systems - Key Biometric Terms and Processes: Verification, Identification and Biometric Matching - Accuracy in Biometric Systems: False Match Rate, False Non-Match Rate, Failure to Enroll Rate, Derived Metrics

UNIT II : (L-11+T-1 Hours)

Physiological Biometrics: Finger Scan: Components-How it works-Competing Technologies- Deployments-Strengths and Weaknesses. Facial Scan: Components- How it Works-Competing Technologies-Deployments-Strengths and Weaknesses

UNIT III : (L-11+T-1 Hours)

Other Physiological Biometrics: Iris Scan: Components- How it Works-Competing Technologies-Deployments-Strengths and Weaknesses. Voice Scan: How it Works-Competing Technologies-Deployments-Strengths and Weaknesses. Other Physiological Biometrics: Hand Scan and Retina Scan

UNIT IV : (L-11+T-1 Hours)

Behavioural Biometrics: Signature Scan and Keystroke Scan: How it Works-Competing Technologies-Deployments-Strengths and Weaknesses. Esoteric Biometrics: Vein Pattern- Facial Thermography-DNA-Sweat Pores- Hand Grip- Finger Nail Bed- Body Odor- Ear-Gait- Skin Luminescence- Brain Wave Pattern-Foot Print and Foot Dynamics

UNIT V: (L-11+T-1 Hours)

Biometric Applications: Categorizing Biometric Applications - Application Areas: Criminal and Citizen Identification, Surveillance, PC/Network Access, E-Commerce/Telephony and Retail/ATM - Costs to Deploy -Issues in Deployment- Biometric Standards

TEXT BOOKS:

1. Samir Nanavati, Michael Thieme, Raj Nanavati,(2003),Biometrics - Identity Verification in a Networked World, Wiley-dreamtech India Pvt Ltd, New Delhi
2. John D. Woodward, Nicholas M. Orlans, Peter T. Higgins, Biometrics: the ultimate reference, Dreamtech Press

REFERENCE BOOKS:

1. Anil K Jain, Patrick Flynn, Arun A Ross, (2008), Handbook of Biometrics, Springer
2. Ravi Das, "Biometric Technology Authentication, Biocryptography, and Cloud-Based Architecture", September 30, 2020 by Routledge
3. Arun A. Ross Anil Jain, Patrick Flynn, Handbook of Biometrics Hardcover – 1 January 2018 Springer; First Edition.
4. "Biometrics, Computer Security Systems and Artificial Intelligence Applications" by Khalid Saeed and Jerzy Pejas
5. John Chirillo and Scott Blaul, Implementing Biometric Security" by 2018 First Edition.

WEB REFERENCES:

1. http://www.sans.org/reading-room/whitepapers/authentication/biometric-scanning/
2. http://www.biometrics.gov/documents/biointro.pdf
3. http://www.cse.unr.edu/~bebis/CS790Q/Lect/IntroBiometrics.pdf
4. http://www.planetbiometrics.com/creo_files/upload/article-files/btamvol1 update.pdf
5. http://www.biometrics.gov/documents/biointro.pdf (Unit V: Biometric Applications)

M.Sc, Information Technology / Semester – II/
Core Elective-III: DISTRIBUTED AND CLOUD COMPUTING (P23IT2E3B)

Lecture Hours	**: 55**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 03**
Contact Hours per Semester	**: 60**		
Contact hours per Week	**: 04**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To learn rerequisites of Cloud computing is it builds upon prior knowledge that students have on computing and software systems and programming knowledge

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POs AND PSOs)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Remember to distributed systems and cloud computing.
CO2	Understand Design, architectures and technology. Cloud applications, service quality and security
CO3	Analyze Algorithms for synchronization, coordination, data sharing, resource allocation, consistency, fault tolerance.
CO4	Apply the Replication, consistency and concurrency control in transactional systems.
CO5	Evaluate the use of load balancing techniques for stateful and stateless applications.

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	1	3	1	1	2	2	2	2	2
CO2	2	2	2	1	2	2	3	2	2	2
CO3	3	2	2	2	2	3	3	2	3	3
CO4	3	2	2	3	3	2	3	3	3	3
CO5	3	3	2	3	3	3	3	3	3	3
Total Contribution of COs to POs	13	10	11	10	11	12	14	12	13	13
Weighted Percentage of Cos contribution to POs contribute to each PSO	86.6	66.6	73.3	66.6	73.3	80	93.3	80	86.6	86.6

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

COURSE CONTENT

UNIT-1: (L-11+T-1 Hours)

Distributed Communication Introduction to Distributed Systems – Characterization of Distributed Systems – Distributed Architectural Models –Remote Invocation – RequestReply Protocols – Remote Procedure Call – Remote Method Invocation – Group Communication – Coordination in Group Communication– Ordered Multicast – Time Ordering – Physical Clock Synchronization – Logical Time and Logical Clocks.

UNIT II : (L-11+T-1 Hours)

Distributed Resource Management Global States– Distributed Mutual Exclusion – Election Algorithms – Distributed Deadlock – Distributed File System Architecture – HDFS – Map Reduce.

UNIT III : (L-11+T-1 Hours)

Introduction to Cloud Cloud Computing Overview – Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self-service , Broad network access , Location independent resource pooling , Rapid elasticity , Measured service. Architectural influences – High- performance Computing, Utility and Enterprise Grid Computing, Autonomic Computing, Service Consolidation, Horizontal scaling, Web services, High scalability Architecture. Cloud Benefits – Cloud Deployment Model: Public Clouds – Private Clouds – Community Clouds - Hybrid Clouds - Advantages of Cloud Computing.

UNIT IV : (L-11+T-1 Hours)

Virtualization Techniques Introduction to Virtual Machines, Emulation :Interpretation and Binary Translation, Process Virtual machines and System Virtual machines Virtualization : Virtualization and cloud computing - Need of virtualization – limitations – Types of Hardware Virtualization: Full Virtualization – Para Virtualization – Case Studies : Xen,VMware – Desktop Virtualization – Network Virtualization.

UNIT V : (L-11+T-1 Hours)

Cloud Resources Management And Issues Cloud architecture: Cloud delivery model, Cloud Storage Architectures, Software as a Service (SaaS): SaaS service providers – Google App Engine, Salesforce.com and googleplatfrom – Benefits – Operational benefits - Economic benefits – Evaluating SaaS – Platform as a Service (PaaS): PaaS service providers – Right Scale – Salesforce.com – Rackspace – Force.com – Services and Benefits – Infrastructure-as-a -Service (IaaS): IaaS Service Providers – Amazon EC2 – GoGrid

TEXT BOOKS:

1. George Coulouris, Jean Dollimore, Tim Kindberg, Distributed Systems Concepts and Design, Fifth Edition, Pearson Education Asia, 2012.

REFERENCE BOOKS:

1. Distributed Systems - Principles and Paradigms, Andrew S. Tanenbaum,Maarten Van Steen, Second Edition, Pearson Prentice Hall, 2006.
2. MukeshSinghal, Advanced Concepts In Operating Systems, McGraw Hill Series in Computer Science, 1994. 3. Cloud Computing A Practical Approach - Anthony T.Velte, Toby J. Velte, Robert Elsenpeter Tata-McGraw- Hill , New Delhi – 2010.
3. Anthony T Velte, Toby J Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 1st Edition, 2010, Tata McGraw-Hill.
4. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate ", 1st edition, 2008, Que Publishing.
5. James E Smith, Ravi Nair, "Virtual Machines", 1st Edition, 2005, Morgan Kaufmann Publishers.

WEBSITE REFERENCES:

1. https://nptel.ac.in/courses/106/104/106104182/
2. https://onlinecourses.nptel.ac.in/noc21_cs15/preview

M.Sc, Information Technology / Semester – II/
Core Elective-III: ADVANCED DIGITAL IMAGE PROCESSING (P23IT2E3C)

Lecture Hours	**: 55**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 03**
Contact Hours per Semester	**: 60**		
Contact hours per Week	**: 04**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To know extract from Differential Equations and the understanding of Linear Algebra.

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POS AND PSOS)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Understand the knowledge of principles of digital image processing
CO2	Apply the problems pertaining to the field of image acquisition, preprocessing, Fourier domain processing.
CO3	Analyze the basic image restoration, image segmentation and image compression
CO4	Evaluate the foundations for life-long learning and continual professional development in the areas of image applications.
CO5	Create the various image compression standards

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	3	2	2	2	2
CO2	3	2	3	2	3	3	2	2	2	2
CO3	3	2	3	2	2	1	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	2	2	3	3	3	3	3	3	3	2
Total Contribution of COs to POs	14	12	14	12	14	13	13	11	13	12
Weighted Percentage of Cos contribution to POs contribute to each PSO	93.3	80	93.3	80	93.3	86.6	86.6	73.3	86.6	80

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

COURSE CONTENT

UNIT-1: (L-11+T-1 Hours)

DIGITAL IMAGE FUNDAMENTALS – Introduction -Resolution and Quantization- Image format-The Origins of digital image processing – fundamental steps in Digital Image Processing -elements of visual perception systems-Light and the electromagnetic Spectrum-Image Sensing and Acquisition- Image sampling and Quantization- Some basic Relationship between Pixels- Introduction to the Basic Mathematical Tools Used in Digital Image Processing.

UNIT II : (L-11+T-1 Hours)

INTENSITY TRANSFORMATION AND SPATIAL FILTERING: Mathematics of Image formation- The Basic of Intensity Transformations and Spatial Filtering- Background-Some basic Intensity Transformation Function – Histogram Processing-Histogram Equations –Histogram Matching-Local Histogram Processing-Smoothing(Low Pass) Spatial Filter – Sharpening (High Pass) Spatial Filter – Highpass, Bandreject, and Bandpass Filters from Low pass Filters – Combining Spatial Enhancement Methods

UNIT III : (L-11+T-1 Hours)

IMAGE RESTORATIONAND RECONTRUCTION: Image Modeling- Spatial and Frequency Properties of Noise – Periodic Noise-A Model of the Image Degradation/Restoration Process. Noise Models. Restoration in the Presence of Noise Only-Spatial Filtering- The WeinerHistogram filter-.Matrix formulation of image restoration- Constrained Least Squares Filtering- Geometric Mean Filter.

UNIT IV : (L-11+T-1 Hours)

COLOR IMAGE PROCESSING: Color Fundamentals – Color Models - Pseudo color Image Processing - Basics of Full –Color Image Processing-Color Transformations –Color Image Smoothing and Sharpening – Image Segmentation based on color - Using Color in Image Segmentation-Noise in Color Images - Color Image Compression

UNIT V : (L-11+T-1 Hours)

COLOR IMAGE COMPRESSION & WATER MARKING: Fundamentals-Huffman Coding – Golomb Coding – Arithmetic Coding – LZW Coding – Run length Coding – Symbol Based CodingBit Plane Coding – Black Transform Coding- Predictive CodingWavelet Coding – Digital Image Water marking.

TEXT BOOKS:

1. R.C. Gonzalez and R. E. Woods, Digital image processing, AddisonWesley Publishing House, 4th edition, 2018.

REFERENCE BOOKS:

1. Chris Solomon and Toby Breckon, Fundamentals of Digital image processing, A Practical Approach with Examples in MATLAB, First edition, 2011 John wiley& Sons
2. Anil.K. Jain, "Fundamentals of Digital Image Processing",2rd Edition ,1989,Prentice-Hall.
3. Chanda & Majumdar, "Digital Image Processing and Analysis",3rd Edition, 2011,Prentice Hall.
4. Dr. SanjaySharma,"Fundamentals of Digital Image Processing",Fourth Edition, 2013, S.K. Kataria& Sons.
5. S.Sridhar, "Digital Image Processing", Second Edition, 2011,Oxford University Press.

WEBSITE REFERENCES:

1. www.imageprocessingplace.com/
2. https://www.fundipbook.com/

M.Sc, Information Technology / Semester – II/
Core Elective-IV: MACHINE LEARNING
(P23IT2E4A)

Lecture Hours	**: 55**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 03**
Contact Hours per Semester	**: 60**		
Contact hours per Week	**: 04**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To understand, and practice machine learning approaches and familiarity with data handling techniques.

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POS AND PSOS)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Remember the basic concepts and techniques of Machine Learning.
CO2	Understand the regression methods, classification methods, clustering methods.
CO3	Apply Dimensionality reduction Techniques
CO4	Analyze machine learning techniques suitable for a given problem
CO5	Create application using machine learning techniques

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	3	2	2	2	2
CO2	3	2	3	2	3	3	2	2	2	2
CO3	3	2	3	2	2	1	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	2	2	3	3	3	3	3	3	3	2
Total Contribution of COs to POs	14	12	14	12	14	13	13	11	13	12
Weighted Percentage of Cos contribution to POs contribute to each PSO	93.3	80	93.3	80	93.3	86.6	86.6	73.3	86.6	80

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

COURSE CONTENT

UNIT-1: (L-11+T-1 Hours)

Introduction: Machine Learning - Machine Learning Foundations –Overview – Applications - Types of Machine Learning - Basic Concepts in Machine Learning - Examples– Applications. Linear Models for Regression-Linear Basis Function Models-The Bias-Variance Decomposition- Bayesian Linear Regression-Bayesian Model Comparison.

UNIT-II : (L-11+T-1 Hours)

Supervised Learning Linear Models for Classification - Discriminant Functions - Probabilistic Generative Models - Probabilistic Discriminative Models - Bayesian Logistic Regression - Decision Trees - Classification Trees - Regression Trees – Pruning - Neural Networks - Feed-Forward Network Functions - Error Back-Propagation - Regularization - Mixture Density and Bayesian Neural Networks - Kernel Methods - Dual Representations - Radial Basis Function Networks - Ensemble methods - Bagging - Boosting.

UNIT III : (L-11+T-1 Hours)

Unsupervised Learning Clustering- K-means - EM - Mixtures of Gaussians - The EM Algorithm in General - Model Selection for Latent Variable Models - High-Dimensional Spaces - The Curse of Dimensionality - Dimensionality Reduction - Factor Analysis - Principal Component Analysis - Probabilistic PCAIndependent Components Analysis.

UNIT IV : (L-11+T-1 Hours)

Probabilistic Graphical Models Directed Graphical Models - Bayesian Networks - Exploiting Independence Properties - From Distributions to Graphs - Examples - Markov Random Fields - Inference in Graphical Models - Learning – Naive Bayes Classifiers - Markov Models – Hidden Markov Models – Inference – Learning- Generalization – Undirected graphical models - Markov Random Fields- Conditional Independence Properties - Parameterization of MRFs - Examples - Learning - Conditional Random Fields (CRFs) - Structural SVMs

UNIT V : (L-11+t-1 Hours)

Advanced Learning Sampling – Basic sampling methods – Monte Carlo - Reinforcement Learning - K-Armed Bandit Elements - Model-Based Learning - Value Iteration- Policy Iteration - Temporal Difference Learning- Exploration StrategiesDeterministic and Non- deterministic Rewards and Actions Eligibility Traces- Generalization- Partially Observable States- The Setting- Example - Semisupervised Learning - Computational Learning Theory - Mistake Bound Analysis - Sample Complexity Analysis - VC Dimension - Occam Learning - Accuracy and Confidence Boosting.

TEXT BOOK:

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2006

REFERENCE BOOKS:

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012
2. EthemAlpaydin, “Introduction to Machine Learning”, Prentice Hall of India, 2005
3. Tom M. Mitchell, Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
4. Hastie,Tibshirani, Friedman, “The Elements of Statistical Learning” (2nd ed).,Springer, 2008
5. Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, CRC Press, 2009

WEBSITE REFERENCES:

1. https://nptel.ac.in/courses/106/106/106106139/
2. https://www.coursera.org/learn/machine-learning
3. https://onlinecourses.nptel.ac.in/noc21_cs24/preview

M.Sc, Information Technology / Semester – II/
Core Elective-IV: SOFTWARE PROJECT MANAGEMENT
(P23IT2E4B)

Lecture Hours	**: 55**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 03**
Contact Hours per Semester	**: 60**		
Contact hours per Week	**: 04**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

- To learn basic knowledge about the fundamentals of software project development

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POS AND PSOS)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Understanding the project management fundamentals such as project planning, risk management and quality assurance
CO2	Analyze the appropriate scheduling and testing techniques to build a quality product
CO3	Apply different cost estimation techniques and quality measures for software development
CO4	Evaluate various software development models and methodologies, planning activities and scheduling methods
CO5	Create the importance of software project documentation and identify the methods to create project documentation, including requirements documents, design documents, and project plans

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO 2	PO 3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	3	2	2	2	2
CO2	3	2	2	2	3	3	2	2	2	2
CO3	3	2	3	2	2	1	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3
CO5	2	2	3	3	3	3	3	3	3	2
Total Contribution of COs to POs	14	12	13	12	14	13	13	12	13	12
Weighted Percentage of Cos contribution to POs contribute to each PSO	93.3	80	86.6	80	93.3	86.6	86.6	80	86.6	80

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

COURSE CONTENT

UNIT-1: (L-11+T-1 Hours)

Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organization for Standardization.

UNIT-II : (L-11+T-1 Hours)

Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones - Work Packages - Building a WBS for Software.

UNIT III : (L-11+T-1 Hours)

Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning - Project Roles and Skills Needed.

UNIT IV : (L-11+T-1 Hours)

Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling

UNIT V : (L-11+T-1 Hours)

Quality: Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organizing - Tools - Benefits - Legal Issues in Software

TEXT BOOK:

1. Robert T. Futrell, Donald F. Shafer, Linda I. Safer, “Quality Software Project Management”, Pearson Education Asia 2002.

REFERENCE BOOKS:

1. Pankaj Jalote, “Software Project Management in Practice”, Addison Wesley 2002.
2. Hughes, “Software Project Management”, Tata McGraw Hill 2004, 3rd Edition
3. Timothy C. Lethbridge and Robert Laganiere, “Object – Oriented Software Engineering: Practical software Development using UML and Java”, 2005, 2nd Edition, Tata McGraw – Hill Publishing Company Limited, New Delhi.
4. Ian Sommerville, “Software Engineering”, 9th Edition 2011, Pearson Education Pvt, .Ltd.Delhi
5. Roger S. Pressman, “Software Engineering A Practitioner Approach”,2001 5th Edition, Tata McGraw Hill Education Private Limited, New Delhi.

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1. https://highered.mheducation.com/sites/0077109899/informa tion-center-view/
2. https://www.tutorialspoint.com/software_engineering/software_project_management.html
3. https://www.smartsheet.com/content/software-projectmanagement
4. https://www.philadelphia.edu.jo/academics/lalqoran/uploads/SPM_Chapter_1-%202016%204.ppt
5. https://cs.gmu.edu/~kdobolyi/cs421/projectmanagement.ppt

M.Sc, Information Technology / Semester – II/
Core Elective-IV: BIG DATA ANALYTICS
(P23IT2E4C)

Lecture Hours	**: 55**	**Tutorial Hours**	**: 05**
Practical Hours	**: -**	**No. of Credit**	**: 03**
Contact Hours per Semester	**: 60**		
Contact hours per Week	**: 04**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE :

To provide grounding in basic and advanced methods to big data technology and tools, including Map Reduce and Hadoop and its ecosystem.

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POS AND PSOS)
On successful completion of the course the students should be able to

COs	Course Outcome
CO1	Understand the concepts of Big data, R-Programming and clustering
CO2	Apply various classification algorithms
CO3	Analyze the classification methods and decision trees
CO4	Evaluate various analytics technology and tools
CO5	Create ARMA and ARIMA models

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	3	2	2	2	2
CO2	3	2	2	2	3	3	2	2	2	2
CO3	3	2	3	2	2	1	3	2	3	3
CO4	2	3	3	3	3	3	3	3	3	3
CO5	2	2	3	3	3	3	3	3	3	2
Total Contribution of COs to POs	13	12	13	12	14	13	13	12	13	12
Weighted Percentage of Cos contribution to POs contribute to each PSO	86.6	80	86.6	80	93.3	86.6	86.6	80	86.6	80

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

COURSE CONTENT

UNIT I: (L-11+T-1 Hours)

Big Data Overview – Data Structures – Analyst Perspective on Data Repositories - State of the Practice in Analytics – BI Versus Data Science - Current Analytical Architecture – Drivers of Big Data – Big Data Ecosystem - Data Analytics Lifecycle – Data Discovery – Data Preparation – Model Planning – Model Building.

UNIT II: (L-11+T-1 Hours)

Introduction to R programming – R Graphical User Interfaces – Data Import and Export – Attribute and Data Types – Descriptive Statistics Exploratory Data Analysis: Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables Data Exploration Versus Presentation

UNIT III: (L-11+T-1 Hours)

Clustering – K Means – Use Cases – Overview – Determining number of clusters – Diagnostics – Reasons to choose and cautions – Additional Algorithms - Regression: Linear Regression and Logistic Regression: – Use cases – Model Description – Diagnostics - Additional Regression Models.

UNIT IV: (L-11+T-1 Hours)

Decision Trees – Overview – Genetic Algorithm – Decision Tree Algorithms – Evaluating Decision Tree – Decision Trees in R - Naive Bayes – Bayes Theorem – ARIMA Model – Autocorrelation Function – Autoregressive Models – Moving Average Models – ARMA and ARIMA Models – Building and Evaluating and ARIMA Model

UNIT V : (L-11+T-1 Hours)

Map Reduce and Hadoop : Analytics for Unstructured Data .- Use Cases - Map Reduce - Apache Hadoop – The Hadoop Ecosystem –Tools in Database Analytics : SQL Essentials – Joins – Set operations – Grouping Extensions – In Database Text Analysis - Advanced SQL.

TEXT BOOK:

1. Data Science & Big Data Analytics: Discovering, Analysing, Visualizing and Presenting Data", EMC Education Services Published by John Wiley & Sons, Inc. 2015

REFERENCE BOOKS:

1. Noreen Burlingame, "The little book on Big Data", New Street publishers, 2012.
2. Anil MaheshWari, "Data Analytics", McGraw Hill Education, 2017.
3. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", StarchPress; 1 edition, 2011.
4. Sandip Rakshit, "R for Beginners", McGraw Hill Education, 2017
5. Michael Minelli · Michele Chambers · Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Oct 2018 · Gildan Media · Narrated by Ryan Burke

WEBSITE REFERENCES:

1. http://www.johndcook.com/R_language_for_programmers.html.
2. http://bigdatauniversity.com/
3. http://home.ubalt.edu/ntsbarsh/stat-data/topics.htm#rintroduction.

M.Sc, Information Technology / Semester – I/
Skill Enhancement: DATA SCIENCE & DATA MINING USING R LAB (P23IT2SE1)

Lecture Hours	**:**	**Tutorial Hours**	**:**
Practical Hours	**: 60**	**No. of Credit**	**: 02**
Contact Hours per Semester	**: 60**		
Contact hours per Week	**: 04**		
Internal Marks	**: 40**		
External Marks	**: 60**		
Total Marks	**: 100**		

OBJECTIVES OF THE COURSE

- To enable the students to learn the concepts of Data Mining algorithms namely classification, clustering, regression….
- To understand & write programs using the DM algorithms
- To apply statistical interpretations for the solutions
- Able to use visualizations techniques for interpretations.

COURSE LEARNING OUTCOMES (FOR MAPPING WITH POS AND PSOS)
On successful completion of the course the students should be able to

CO's	Course Outcomes
CO1	Understand to write programs using R for Association rules , Clustering techniques
CO2	Remember To implement data mining techniques like classification, prediction
CO3	Analyze to use different visualization techniques using R
CO4	Apply different data mining algorithm s to solve real world applications
CO5	Create simple and linear regression

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

COs/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	2	2	3	3	2
CO2	2	3	3	3	2	3	2	3	2	3
CO3	2	2	2	2	3	3	2	2	3	3
CO4	2	2	3	2	2	1	2	3	3	1
CO5	3	2	3	2	3	2	2	2	3	2
Total Contribution of COs to POs	10	12	13	12	13	11	10	13	14	11
Weighted Percentage of Cos contribution to POs contribute to each PSO	66.6	80	86.6	80	86.6	73.3	66.6	86.6	93.3	73.3

(0-No Correlation; 1-Weak; 2-Moderate; 3-Strong)

LIST OF PRACTICALS

1. Creating and displaying Data.
2. Matrix manipulations
3. Creating and manipulating a List and an Array
4. Creating a Data Frame and Matrix-like Operations on a Data Frame
5. Merging two Data Frames
6. Applying functions to Data Frames
7. Using Functions with Factors
8. Accessing the Internet
9. String Manipulations
10. Visualization Effects
11. Implement Apriori algorithm to extract association rule of data mining.
12. Implement k-means clustering technique.
13. Implement anyone Hierarchal Clustering.
14. Implement Classification algorithm.
15. Implement Decision Tree.
16. Linear Regression.

TEXT BOOKS :

1. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson education,2003.
2. C.S.R. Prabhu, "Data Warehousing Concepts, Techniques, Products and Applications", PHI, Second Edition

REFERENCE BOOKS :

1. Arun K. Pujari, "Data Mining Techniques", Universities Press (India) Pvt. Ltd.,2003.
2. Alex Berson ,Stephen J. Smith, "Data Warehousing, Data Mining and OLAP", TMCH, 2001.
3. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", Starch Press; 1 edition, 2011.
4. Sandip Rakshit, "R for Beginners", McGraw Hill Education, 2017
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3. http://home.ubalt.edu/ntsbarsh/stat-data/topics.htm#rintroduction.