DEPARTMENT OF COMPUTER SCIENCE

VISION

- To become a centre of excellence in computer science with provision of quality education to mold innovative professionals for nation's welfare.

MISSION

- Providing learner-centric Teaching-Learning Process in Excellent infrastructure.
- Grooming the students with professional and social ethics.
- Provide latest tools and technology to the students as a part of learning structure.

PROGRAMME OUTCOMES - (PO)

PO1: Scientific knowledge: Apply the knowledge of mathematics, science, and computing to the solution of complex scientific problems.

PO2: Problem analysis: Identify, formulate, research literature, and analyze complex scientific problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and applied sciences.

PO3: Design/development of solutions: Design solutions for complex problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tools usage: Create, select, and apply appropriate techniques, resources, and modern computing and IT tools including prediction and modeling to complex scientific activities with an understanding of the limitations.

PO6: The software engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional practice.

PO7: Environment and sustainability: Understand the impact of the professional software engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Graduates of the Programme will be successful in their professional careers,including entrepreneurship using their knowledge in computer science (90%).

PEO2: Graduates of the Programme will continue to learn and adopt latest technologies tosolve real life problems. (60%)

PEO3: Graduates of the Programme will pursue research and higher education (40%)

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1. Demonstrate mastery of Computer Science in the following core knowledge areas

- Programming Languages and Data Structures
- Databases, Software Development and Maintenance
- Computer Hardware and Architecture

PSO2. Apply problem-solving skills and the knowledge of computer science to solve real world problems.

PSO3. Develop technical project reports and present them orally among the users.

Graduate Attributes (GAs)

GA1: Knowledge of the discipline: Knowledge of a discipline is defined as "command of a discipline to enable a smooth transition and contribution to professional and community settings. This Graduate Attribute describes the capability of demonstrating comprehensive and considered knowledge of a discipline. It enables students to evaluate and utilise information and apply their disciplinary knowledge and their professional skills in the workplace.

GA2: Creativity: Creativity is a skill that underpins most activities. Students are required to apply imaginative and reflective thinking to their studies. Students are encouraged to look at the design or issue through differing and novel perspectives. Creativity allows the possibility of a powerful shift in outlook and enables students to be open to thinking about different concepts and ideas.

GA3: Intellectual Rigour: Intellectual Rigour is the commitment to excellence in all cholarly and intellectual activities, including critical judgement. The students are expected in having clarity in thinking. This capability involves engaging constructively and methodically when exploring ideas, theories and philosophies. It also relates to the ability to analyse and construct knowledge with depth, insight and intellectual maturity.

GA4: Problem Solving and Design: Problem solving skills empower students within the context of their programmes, personal and professional lives.They can consolidate new and emergent knowledge and develop a deeper understanding of their subject discipline.With an ability to seek out and identify problems, effective problem solvers are able to actively engage with a situation, think creatively, to consider different perspectives to address identified challenge, to try out possible solutions and subsequently evaluate results as a way to make decisions.

GA5: Ethical Practices: Ethical practice is a key component of professionalism and needs to be instilled in curricula across courses. Ethical behavior involves tolerance and responsibility. It includes being open-minded about cultural diversity, linguistic difference, and the complex nature of our world. It also means behaving appropriately towards colleagues and the community and being sensitive to local and global social justice issues.

GA6:Life-Long 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. This flexibility of mind means they are always amenable to new ideas and actively seek out new ways of learning or understanding the world.

GA7: Communication and Social Skills: The ability to communicate clearly and to work well in a team setting is critical to sustained and successful employment. Good communication and social skills involve the ability to listen to, as well as clearly express, information back to others in a variety of ways - oral, written, and visual - using a range of technologies.

G. VENKATASWAMY NAIDU COLLEGE (AUTONOMOUS), KOVILPATTI
Programme Structure for M.sc Computer Science
(For those admitted from the academic year 2023-24 and onwards)

Category	Course Type	Course Code	Course Title	Contact Hours	Exam Hours	Marks			Credit
						CIA	ESE	Total Marks	
Semester-1									
Core	Core -1	P23CS101	Analysis and Design of Algorithm	6	3	25	75	100	5
	Core -2	P23CS102	Object Oriented Analysis and design & C++	6	3	25	75	100	5
	Core Lab 1	P23CS1P1	Algorithm and OOPs lab	5	3	40	60	100	3
	Core-3	P23CS103	Python Programming	5	3	25	75	100	4
	Core Lab 2	P23CS1P2	Python Programming Lab	4	3	40	60	100	3
Elective	Elective -I	P23CS1E1A	Advanced Software Engineering	4	3	25	75	100	3
		P23CS1E1B	Advanced Computer Networks						
Self Study	Ability Enhancement-I	P23CSAE101	Cyber Security	-	2	-	50	50	2
	Comprehension-I (Online Exam)	P23CS1C1	Comprehension in Computer Science-I	-	-	-	50	50	1
			NPTEL						1
TOTAL				**30**				**700**	**27**
Semester-II									
Core	Core-4	P23CS204	Data Mining and Data Warehousing	6	3	25	75	100	5
	CoreLab-3	P23CS2P3	Data Mining lab using R	4	3	40	60	100	2
	Core-5	P23CS205	Advanced Operating Systems	6	3	25	75	100	5
	Core -6	P23CS206	Advanced Java Programming	6	3	25	75	100	4

	Core Lab 4	P23CS2P4	Advanced Java Programming Lab	4	3	40	60	100	3
Elective	Elective – II	P23CS2E2A	Artificial Intelligence and Machine Learning	4	3	25	75	100	3
		P23CS2E2B	Internet of Things						
Self Study	Ability Enhancement-II	P23CSAE202	Teaching Skill	-	-	50	-	50	1
	Comprehension – II (Self Study Course-Online Exam)	P23CS2C2	Comprehension in Computer Science – II	-	1	-	50	50	1
TOTAL				**30**				**700**	**24**

Semester – I

M.Sc. Computer Science / Semester – I /

Core-1: Analysis and Design of Algorithm

(P23CS101)

Lecture Hours	**: 85**	**Tutorial Hours**	**: 5**
Lab Practice Hours	**: -**	**No. of Credit**	**: 5**
Contact Hours per Semester	**: 90**		
Contact hours per Week	**: 6**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

Pre-requisite: Basic Data Structures & Algorithms

Objectives of the Course:

The main objectives of this course are to:

- Enable the students to learn the Elementary Data Structures and algorithms.
- Presents an introduction to the algorithms, their analysis and design.
- Discuss various methods like Basic Traversal and Search Techniques, divide and conquer method, Dynamic programming, and backtracking.
- Understood the various design and analysis of the algorithms.

Course Learning Outcomes: (for mapping with PO's and PSO's)

On the successful completion of the course, student will be able to:

CO1: Get knowledge about algorithms and determines their time complexity. Demonstrate specific search and sort algorithms using divide and conquer technique.

CO2: Gain good understanding of Greedy method and its algorithm.

CO3: Able to describe about graphs using dynamic programming technique.

CO4: Demonstrate the concept of backtracking & branch and bound technique.

CO5: Explore the traversal and searching technique and apply it for trees and graphs.

Mapping with Programme Outcomes and Programme Specific Outcomes:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CO1	2	3	2	1	2	2	2	3	3	3
CO2	2	1	2	2	2	2	2	2	1	2
CO3	2	3	1	2	3	2	2	3	3	3
CO4	2	2	3	2	2	1	2	1	2	1
CO5	1	2	2	2	2	2	1	1	2	1
Total Contribution of COs to POs	**9**	**11**	**10**	**9**	**11**	**9**	**9**	**10**	**11**	**10**
Weighted Percentage of COs Contribution to POs	**60**	**73**	**66**	**60**	**73**	**60**	**60**	**66**	**73**	**66**

Strong-3; Medium-2; Low-1

Course Content

UNIT I **L-17 HOURS**

Introduction: - Algorithm Definition and Specification – Space complexity-Time Complexity Asymptotic Notations – Elementary. **Data Structure**: Stacks and Queues – Binary Tree - Binary Search Tree - Heap – Heap sort- Graph.

UNIT II **L-17 HOURS**

Basic Traversal And Search Techniques: Techniques for Binary Trees-Techniques for Graphs - **Divide and Conquer:** General Method – Binary Search – Merge Sort – Quick Sort.

UNIT III **L-17 HOURS**

The Greedy Method: General Method–Knapsack Problem–Minimum COst Spanning Tree–Single Source Shortest Path.

UNIT IV **L-17 HOURS+T-2 HOURS**

Dynamic Programming: General Method–Multistage Graphs–All Pair Shortest Path–Optimal Binary Search Trees – 0/1 Knapsacks – Traveling Salesman Problem – Flow Shop Scheduling.

UNIT V **L-17 HOURS+T-3 HOURS**

Backtracking: GeneralMethod–8-QueensProblem–SumOfSubsets–GraphColoring– Hamiltonian Cycles – Branch And Bound: - The Method – Traveling Salesperson. Contemporary Issues: Expert lectures, on line seminars– webinars.

Text Books

1. Ellis Horowitz, “Computer Algorithms”, Galgotia Publications.
2. Alfred V. Aho, John E . Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms".

Reference Books

1. Goodrich, “Data Structures& Algorithms in Java”,Wiley3rd edition
2. Skiena,”The Algorithm Design Manual”,SecondEdition,Springer,2008
3. Anany Levith,”Introduction to the Design and Analysis of algorithm”, Pearson Education Asia, 2003
4. Robert Sedgewick, Phillipe Flajolet,”An Introduction to the Analysis of Algorithms”, Addison-Wesley Publishing Company,1996.

Website Resources:

1. https://nptel.ac.in/courses/106/106/106106131/
2. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
3. https://www.javatpoint.com/daa-tutorial

M.Sc. Computer Science / Semester – I /

Core-2: Object Oriented Analysis and design & C++ (P23CS102)

Lecture Hours	**: 80**	**Tutorial Hours**	**: 10**
Lab Practice Hours	**: -**	**No. of Credit**	**: 5**
Contact Hours per Semester	**: 90**		
Contact hours per Week	**: 6**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

Pre-requisite: Basics of C++ and Object Oriented Concepts

Objectives of the Course:

The main objectives of this course are to:

- Present the object model, classes and objects, object orientation, machine view and model management view.
- Enables the students to learn the basic functions, principles and concepts of object oriented analysis and design.
- Enable the students to understand C++ language with respect to OOAD

Course Learning Outcomes: (for mapping with PO's and PSO's)

On the successful completion of the course, student will be able to:

CO1: Understand the concept of Object-Oriented development and modeling techniques

CO2: Gain knowledge about the various steps performed during object design

CO3: Abstract object -based views for generic software systems

CO4: Link OOAD with C++ language

CO5: Apply the basic concept of OOPs and familiarize to write C++ program

Mapping with Programme Outcomes and Programme Specific Outcomes:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	3	1	2	2	3	2	3
CO2	2	2	2	1	2	2	2	1	2	2
CO3	3	2	2	3	2	3	1	3	2	3
CO4	1	2	1	2	2	2	3	2	2	1
CO5	1	1	2	2	2	2	2	2	1	1
Total Contribution of COs to POs	**10**	**9**	**9**	**11**	**9**	**11**	**10**	**11**	**9**	**10**
Weighted Percentage of COs Contribution to POs	**66**	**60**	**60**	**73**	**60**	**73**	**66**	**73**	**60**	**66**

Strong-3; Medium-2; Low-1

Course Content

UNIT I **L-18 HOURS**

The Object Model: The Evolution of the Object Model – Elements of the Object Model – Applying the Object Model. Classes and Objects: The Nature of an Object – Relationship among Objects.

UNIT II **L-15 HOURS+T-3 HOURS**

Classes and Object: Nature of Class – Relationship Among classes – The Interplay of classes and Objects. Classification: The importance of Proper Classification –identifying classes and objects – Key Abstractions and Mechanism.

UNIT III **L-15 HOURS+T-3 HOURS**

Introduction to C++: Input and output statements in C++-Declarations-control structures–Functions in C++.

UNIT IV **L-17 HOURS+T-1 HOURS**

Inheritance and Overloading: Classes and Objects–Constructors and Destructors–operators over loading–Type ConversionInheritance – Pointers and Arrays.

UNIT V **L-15 HOURS+ T-3 HOURS**

Memory Management: Operators-Polymorphism–Virtual functions–Files–Exception Handling – String Handling -Templates. **Contemporary Issues:** Expert lectures, online seminars – webinars

Text Books

1. "Object Oriented Analysis and Design with Applications", Grady Booch, Second Edition, Pearson Education.
2. "Object-Oriented Programming with ANSI & Turbo C++", Ashok N.Kamthane, First Indian Print -2003, Pearson Education.

Reference Book

1. Balagurusamy "Object Oriented Programming with C++",TMH, SecondEdition,2003.

Website Resources:

1. https://onlinecourses.nptel.ac.in/noc19_cs48/preview
2. https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/
3. https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.h

M.Sc. Computer Science / Semester – I /

Core Lab-1: Algorithm and OOPs lab (P23CS1P1)

Lecture Hours	**: -**	**Tutorial Hours**	**: -**
Lab Practice Hours	**: 75**	**No. of Credit**	**: 3**
Contact Hours per Semester	**: 75**		
Contact hours per Week	**: 5**		
Internal Marks	**: 40**		
External Marks	**: 60**		
Total Marks	**: 100**		

Pre-requisite: Basic Programming of C++ language

Objectives of the Course:

The main objectives of this course are to:

- This course covers the basic data structures like Stack, Queue, Tree, and List.
- This course enables the students to learn the applications of the data structures using various techniques
- It also enables the students to understand C ++ language with respect to OOAD concepts
- Application of OOPS concepts.

Course Learning Outcomes: (for mapping with PO's and PSO's)

On the successful completion of the course, student will be able to:

CO1: Understand the concepts of object oriented with respect to C++

CO2: Able to understand and implement OOPS concepts

CO3: Implementation of data structures like Stack, Queue, Tree, and List using C++

CO4: Application of the data structures for Sorting, searching usingdifferent techniques.

CO5: Gain knowledge about the various steps performed during object design

Mapping with Programme Outcomes and Programme Specific Outcomes:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2	2	3	3	2
CO2	2	1	2	2	2	2	2	1	2	2
CO3	3	3	2	1	2	3	2	3	3	2
CO4	1	2	2	3	2	2	2	2	1	1
CO5	1	2	1	2	2	2	1	2	1	2
Total Contribution of COs to POs	**10**	**11**	**9**	**10**	**9**	**11**	**9**	**11**	**10**	**9**
Weighted Percentage of COs Contribution to POs	66	73	60	66	60	73	60	73	66	60

Strong-3; Medium-2; Low-1

Course Content

List of Exercises:

1) Write a program to solve the tower of Hanoi using recursion.
2) Write a program to traverse through binary search tree using traversals.
3) Write a program to perform various operations on stack using linked list.
4) Write a program to perform various operation in circular queue.
5) Write a program to sort an array of an elements using quick sort.
6) Write a program to solve number of elements in ascending order using heap sort.
7) Write a program to solve the knap sack problem using greedy method
8) Write a program to search for an element in a tree using divide& conquer strategy.
9) Write a program to place the 8 queens on an 8X8 matrix so that no two queens Attack.
10) Write a C++ program to perform Virtual Function
11) Write a C++ program to perform Parameterized constructor
12) Write a C++ program to perform Friend Function
13) Write a C++ program to perform Function Overloading
14) Write a C++ program to perform Single Inheritance
15) Write a C++ program to perform Employee Details using files.

Text Books

1. Goodrich, “Data Structures& Algorithms in Java”, Wiley 3rd edition.
2. Skiena,”The Algorithm Design Manual”, Second Edition,Springer,2008.

Reference Books

1. Anany Levith, ”Introduction to the Design and Analysis of algorithm”, Pearson Education Asia, 2003.
2. Robert Sedgewick, Phillipe Flajolet, ”An Introduction to the Analysis of Algorithms”, Addison-Wesley Publishing Company,1996.

Website Resources:

1. https://onlinecourses.nptel.ac.in/noc19_cs48/preview
2. https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/
3. https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.html

M.Sc. Computer Science / Semester – I /

Core-3: Python Programming (P23CS103)

Lecture Hours	**: 65**	**Tutorial Hours**	**: 10**
Lab Practice Hours	**: -**	**No. of Credit**	**: 4**
Contact Hours per Semester	**: 75**		
Contact hours per Week	**: 5**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

Pre-requisite: Basics of any OO Programming Language

Objectives of the Course:

The main objectives of this course are to:

- Presents an introduction to Python, creation of web applications, network applications andworking in the clouds
- Use functions for structuring Python programs
- Understand different Data Structures of Python
- Represent compound data using Python lists, tuples and dictionaries.

Course Learning Outcomes: (for mapping with PO's and PSO's)

On the successful completion of the course, student will be able to:

CO1: Understand the basic concepts of Python Programming

CO2: Understand File operations, Classes and Objects

CO3: Acquire Object Oriented Skills in Python

CO4: Develop web applications using Python

CO5: Develop Client Server Networking applications

Mapping with Programme Outcomes and Programme Specific Outcomes:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	1	3	2	2	3
CO2	1	2	2	2	2	2	2	2	2	1
CO3	3	2	3	1	3	2	3	2	2	3
CO4	2	1	1	3	2	2	1	2	2	2
CO5	2	2	1	2	2	2	1	1	1	2
Total Contribution of COs to POs	**11**	**9**	**10**	**10**	**11**	**9**	**10**	**9**	**9**	**11**
Weighted Percentage of COs Contribution to POs	**73**	**60**	**66**	**66**	**73**	**60**	**66**	**60**	**60**	**73**

Strong-3; Medium-2; Low-1

Course Content

UNIT I **L-13 HOURS+T-2 HOURS**

Python: Introduction–Numbers–Strings–Variables–Lists–Tuples–Dictionaries–Sets–Comparison.

UNIT II **L-13 HOURS+T-2 HOURS**

Code Structures: if, else if, and else – Repeat with while – Iterate with for – Comprehensions– Functions – Generators – Decorators – Namespaces and Scope – Handle Errors with try andexcept – User Exceptions.

UNIT III **L-13 HOURS+T-2 HOURS**

Modules, Packages, and Programs: Standalone Programs – Command-Line Arguments – Modules and the import Statement – The Python Standard Library. **Objects and Classes:** Define a Class with class – Inheritance – Override a Method – Add a Method – Get Help from Parent with super–Inself Defense –Get and Set Attribute Values with Properties –Name Mangling for Privacy – Method Types – Duck Typing – Special Methods –Composition.

UNIT IV **L-13 HOURS+T-3 HOURS**

DataTypes: TextStrings–BinaryData.**StoringandRetrievingData:**FileInput/Output–StructuredText Files – Structured Binary Files - Relational Databases – NoSQL Data Stores.

Web: Web Clients –Web Servers–Web Services and Automation

UNIT V **L-13 HOURS+T-1 HOURS**

Systems: Files–Directories–Programs and Processes–Calendars and Clocks.

Concurrency: Queues– Processes–Threads–Green Threads and event–twisted–Redis.

Networks: Patterns – The Publish-Subscribe Model – TCP/IP – Sockets – ZeroMQ –Internet Services – Web Services and APIs – Remote Processing – Big Fat Data and MapReduce – Working in the Clouds. **Contemporary Issues:** Expert lectures, online seminars –webinars.

Text Books

1. BillLubanovic,"IntroducingPython",O'Reilly,FirstEdition-SecondRelease,2014.
2. Mark Lutz,"Learning Python", O'Reilly, Fifth Edition, 2013.

Reference Books

1. David M.Beazley, "Python Essential Reference",Developer's Library,FourthEdition,2009.
2. Sheetal Taneja, Naveen Kumar,"Python Programming-A Modular Approach", Pearson Publications.

Website Resources:

1. https://www.programiz.com/python-programming/
2. https://www.tutorialspoint.com/python/index.htm
3. https://onlinecourses.swayam2.ac.in/aic20_sp33/preview

M.Sc. Computer Science / Semester – I /

Core Lab 2-: Python Programming Lab (P23CS1P2)

Lecture Hours	**: -**	**Tutorial Hours**	**: -**
Lab Practice Hours	**: 60**	**No. of Credit**	**: 3**
Contact Hours per Semester	**: 60**		
Contact hours per Week	**: 4**		
Internal Marks	**: 40**		
External Marks	**: 60**		
Total Marks	**: 100**		

Pre-requisite: Basics of any OO Programming Language

Objectives of the Course:

The main objectives of this course are to:

- This course presents an overview of elementary data items, lists, dictionaries, sets and tuples
- To understand and write simple Python programs
- To Understand the OOPS concepts of Python
- To develop web applications using Python

Course Learning Outcomes: (for mapping with PO's and PSO's)

On the successful completion of the course, student will be able to:

CO1: Able to write programs in Python using OOPS concepts

CO2: To understand the concepts of File operations and Modules in Python

CO3: Implementation of lists, dictionaries, sets and tuples as programs

CO4: To develop web applications using Python

CO5: To define the structure and components of a Python program.

Mapping with Programme Outcomes and Programme Specific Outcomes:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	2	3	2	1	2	2	3	3
CO2	2	2	2	1	2	2	2	2	2	1
CO3	2	3	2	3	1	2	3	2	3	3
CO4	1	1	2	2	3	2	2	2	1	2
CO5	2	1	1	2	2	2	2	1	1	2
Total Contribution of COs to POs	**9**	**10**	**9**	**11**	**10**	**9**	**11**	**9**	**10**	**11**
Weighted Percentage of COs Contribution to POs	**60**	**66**	**60**	**73**	**66**	**60**	**73**	**60**	**66**	**73**

Strong-3; Medium-2; Low-1

Course Content

List of Exercises:

Implement the following in Python:

1. Programs using elementary data items, lists, dictionaries and tuples
2. Programs using conditional branches,
3. Programs using loops.
4. Programs using functions
5. Programs using exception handling
6. Programs using inheritance
7. Programs using polymorphism
8. Programs to implement file operations.
9. Programs using modules.
10. Programs for creating dynamic and interactive Web Pages using forms.

Text Books

1. BillLubanovic,“IntroducingPython”,O’Reilly,FirstEdition-SecondRelease,2014.
2. Mark Lutz,“Learning Python”, O’Reilly, Fifth Edition, 2013.

Reference Books

1. David M.Beazley, “PythonEssential Reference”, Developer’s Library,FourthEdition,2009.
2. Sheetal Taneja, Naveen Kumar,“Python Programming-A Modular Approach”, Pearson Publications.

Website Resources:

1. https://www.programiz.com/python-programming/
2. https://www.tutorialspoint.com/python/index.htm
3. https://onlinecourses.swayam2.ac.in/aic20_sp33/preview

M.Sc. Computer Science / Semester – I /

Elective Course -I: Advanced Software Engineering

(Elective - P23CS1E1A)

Lecture Hours	**: 55**	**Tutorial Hours**	**: 5**
Contact Hours per Semester	**: 60**	**No. of Credit**	**: 3**
Contact hours per Week	**: 4**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

Pre-requisite: Basics of Software Engineering & SPM

Objectives of the Course:

The main objectives of this course are to:

- Introduce to Software Engineering, Design, Testing and Maintenance.
- Enable the students to learn the concepts of Software Engineering.
- Learn about Software Project Management, Software Design & Testing.

Course Learning Outcomes: (for mapping with PO's and PSO's)

On the successful completion of the course, student will be able to:

CO1: Understand about Software Engineering process

CO2: Understand about Software project management skills, design and qualitymanagement

CO3: Analyze on Software Requirements and Specification

CO4: Analyze on Software Testing, Maintenance and Software Re-Engineering

CO5: Design and conduct various types and levels of software quality for a software project

Mapping with Programme Outcomes and Programme Specific Outcomes:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	2	2	3	1
CO2	1	2	2	2	2	2	2	2	1	2
CO3	3	3	3	2	2	3	1	2	3	2
CO4	2	1	1	2	1	2	3	2	2	2
CO5	2	1	1	1	2	2	2	1	2	2
Total Contribution of COs to POs	**11**	**10**	**10**	**9**	**9**	**11**	**10**	**9**	**11**	**9**
Weighted Percentage of COs Contribution to POs	**73**	**66**	**66**	**60**	**60**	**73**	**66**	**60**	**73**	**60**

Strong-3; Medium-2; Low-1

Course Content

UNIT I **L-11 HOURS**

Introduction: The Problem Domain – Software Engineering Challenges - Software Engineering Approach – Software Processes: Software Process – Characteristics of a Software Process – Software Development Process Models – Other software processes.

UNIT II **L-11 HOURS**

Software Requirements Analysis and Specification : Requirement engineering – Type of Requirements – Feasibility Studies – Requirements Elicitation – Requirement Analysis – Requirement Documentation – Requirement Validation – Requirement Management – SRS - Formal System Specification – Axiomatic Specification – Algebraic Specification - Case study: Student Result management system. Software Quality Management –Software Quality, Software Quality Management System, ISO 9000, SEI CMM.

UNIT III **L-11 HOURS**

Software Project Management: Responsibilities of a software project manager – Project planning– Metrics for Project size estimation – Project Estimation Techniques – Empirical Estimation Techniques – COCOMO – Halstead's software science – Staffing level estimation – Scheduling– Organization and Team Structures – Staffing – Risk management – Software Configuration Management – Miscellaneous Plan.

UNIT IV **L-11 HOURS+T-3 HOURS**

Software Design: Outcome of a Design process – Characteristics of a good software design – Cohesion and coupling - Strategy of Design – Function Oriented Design – Object Oriented Design - Detailed Design - IEEE Recommended Practice for Software Design Descriptions.

UNIT V **L-11 HOURS+T-2 HOURS**

Software Testing: A Strategic approach to software testing – Terminologies – Functional testing– Structural testing – Levels of testing – Validation testing - Regression testing – Art of Debugging–Testingtools-Metrics-ReliabilityEstimation.SoftwareMaintenance -Maintenance Process - Reverse Engineering – Software Re-engineering - Configuration Management Activities.

Text Books

1. An Integrated Approach to Software Engineering – Pankaj Jalote, Narosa Publishing House,Delhi, 3rd Edition.
2. Fundamentals of Software Engineering –Rajib Mall, PHI Publication,3rdEdition.

Reference Books

1. Software Engineering– K.K. Aggarwal and Yogesh Singh, New Age International Publishers,3 rd edition.
2. A Practitioners Approach-Software Engineering,- R.S. Pressman, McGraw Hill.
3. Fundamentals of SoftwareManodrioli, PHI Publication.

Website Resources:

1. https://www.javatpoint.com/software-engineering-tutorial
2. https://onlinecourses.swayam2.ac.in/cec20_cs07/preview
3. https://onlinecourses.nptel.ac.in/noc19_cs69/preview

M.Sc. Computer Science / Semester – I /

Elective Course I: Advanced Computer Networks

(Elective - P23CS1E1B)

Lecture Hours	**: 55**	**Tutorial Hours**	**: 5**
Contact Hours per Semester	**: 60**	**No. of Credit**	**: 3**
Contact hours per Week	**: 4**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

Pre-requisite: Basic Knowledge on mathematics and networking.

Objectives of the Course:

The main objectives of this course are to:

- Have a detailed knowledge on the concept of networks
- Know the idea on protocols, OSI layers and its functions.
- Get knowledge on protocols used in different layers.
- Know about the function of Internet

Course Learning Outcomes: (for mapping with PO's and PSO's)

On the successful completion of the course, student will be able to:

CO1: Understand fundamental underlying principles of computer networking

CO2: Understand details and functionality of layered network architecture.

CO3: Apply mathematical foundations to solve computational problems in computer networking

CO4: Analyze and evaluate performance of various communication protocols.

CO5: Compare and create new routing algorithms.

Mapping with Programme Outcomes and Programme Specific Outcomes:

POs / COs	PO 1	PO2	PO3	PO4	PO5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CO1	1	3	2	3	3	2	2	2	2	3
CO2	2	1	2	2	2	2	2	2	2	1
CO3	2	3	2	3	3	2	3	1	2	3
CO4	2	2	2	1	1	1	2	3	2	2
CO5	2	2	1	1	1	2	2	2	1	2
Total Contribution of COs to POs	**9**	**11**	**9**	**10**	**10**	**9**	**11**	**10**	**9**	**11**
Weighted Percentage of COs Contribution to POs	**60**	**73**	**60**	**66**	**66**	**60**	**73**	**66**	**60**	**73**

Strong-3; Medium-2; Low-1

Course Content

UNIT I **L-11 HOURS**

Introduction- data communications – networks – The internet – Protocols and standards – OSI model– layers in OSI model – TCP/IP protocol suite – addressing – guided media – Unguided media.

UNIT II **L-11 HOURS**

Switching – Circuit switched networks – datagram networks – virtual circuit networks – Framing –Flow and error control multiple access – random access – wired Lan – wireless Lan – Cellular telephony – satellite networks.

UNIT III **L-11 HOURS**

Network layer – IP V4 addressing – IPV6 addressing – ICMP – IGMP –Network layer delivery –forwarding – unicast and multicast routing protocols.

UNIT IV **L-11 HOURS+T-3 HOURS**

Transport layer – Process to process delivery – UDP -TCP -Congestion – congestion control – QOS– Techniques to improve QOS.

UNIT V **L-11 HOURS+T-2 HOURS**

Domain name system – name space – domain name space – distribution of name space – DNS in theinternet – remote logging - email – file transfer -Network management system – SNMP Protocol **Contemporary Issues:** Expert lectures ,online seminars– webinars.

Text Book

1. Data communications and networking – Behrouz A Forouzan McGraw Hill 4th Edition 2015 Reprint.

Reference Books

1. Computer Networks – Tenenbaum -Pearson -2022
2. Computer networking –Kurose James F, Ross Keith W -Pearson – 2017
3. Data and computer communications – William Stallings – Pearson 2017
4. Computer networks and Internet – Douglas E Comer – Pearson – 2018.

Website Resources:

1. https://nptel.ac.in/courses/106105080
2. https://www.tutorialspoint.com/computer-networks/index.asp
3. https://www.javatpoint.com/computer-network-tutorial

Semester – II

M.Sc. Computer Science / Semester – II /

Core-4: DATA MINING AND WAREHOUSING

(P23CS204)

Lecture Hours	**: 85**	**Tutorial Hours**	**: 5**
Lab Practice Hours	**: -**	**No. of Credit**	**: 5**
Contact Hours per Semester	**: 90**		
Contact hours per Week	**: 6**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

Pre-requisite: Basics of RDBMS & Algorithms

Objectives of the Course:

The main objectives of this course are to:

- Enable the students to learn the concepts of Mining tasks, classification, clustering and DataWarehousing.
- Develop skills of using recent data mining software for solving practical problems.
- Develop and apply critical thinking, problem-solving, and decision-making skills.

Course Learning Outcomes: (for mapping with PO's and PSO's)

On the successful completion of the course, student will be able to:

CO1: Understand the basic data mining techniques and algorithms

CO2: Understand the Association rules, Clustering techniques and Data warehousing Contents.

CO3: Compare and evaluate different data mining techniques like classification, Prediction, Clustering and association rule mining

CO4: Design data warehouse with dimensional modeling and apply OLAP operations

CO5: Identify appropriate data mining algorithms to solve real world problems

Mapping with Programme Outcomes and Programme Specific Outcomes:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CO1	3	2	3	3	2	2	3	1	2	2
CO2	1	2	2	2	2	2	1	2	2	2
CO3	3	2	3	3	2	2	3	2	3	1
CO4	2	2	1	1	2	1	2	2	2	3
CO5	2	1	1	1	1	2	2	2	2	2
Total Contribution of COs to POs	**11**	**9**	**10**	**10**	**9**	**9**	**11**	**9**	**11**	**10**
Weighted Percentage of COs Contribution to POs	**73**	**60**	**66**	**66**	**60**	**60**	**73**	**60**	**73**	**66**

Strong-3; Medium-2; Low-1

Course Content

UNIT I **L-18 HOURS**

Basics: Basic data mining tasks – data mining versus knowledge discovery in databases – data mining issues – data mining metrics – social implications of data mining – data mining from a database perspective. **Data mining techniques**: Introduction – a statistical perspective on data mining – similarity measures – decision trees – neural networks – genetic algorithms.

UNIT II **L-18 HOURS**

ALGORITHMS: Classification: Introduction –Statistical –based algorithms -distance–based algorithms-decision tree-based algorithms-neural network–based algorithms–rule-based algorithms–combiningtechniques.

UNIT III **L-18 HOURS**

Clustering: Introduction–SimilarityandDistanceMeasures–Outliers–HierarchicalAlgorithms -Partitional Algorithms. **Association rules:** Introduction - large item sets - basic algorithms – parallel &distributed algorithms – comparing approaches- incremental rules – advanced association rules techniques – measuring the quality of rules.

UNIT IV **L-13 HOURS+T-5 HOURS**

Data warehousing: introduction-characteristics of a data warehouse–data marts–other aspects Of data mart. Online analytical processing: introduction -OLTP & OLAP systems. **Data modeling**: star schema for multidimensional view –data modeling – multi fact star schema or snow flake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet.

UNIT V **L-18 HOURS**

Developing a data Warehouse: why and how to build a data warehouse –data warehouse architectural strategies and organization issues - design consideration – data content – metadata distribution of data – tools for data warehousing – performance considerations – crucial decisions in designing a data warehouse. Applications of data warehousing and data mining in government: Introduction - national data warehouses – other areas for data warehousing and data mining. **Contemporary Issues:** Expert lectures, online seminars –webinars

Text Books

1. MargaretH.Dunham,"DataMining:IntroductoryandAdvancedTopics",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. Jiawei Han & Micheline Kamber,"Data Mining Concepts&Techniques", 2001, Academicpress.

Website Resources:

1. https://www.javatpoint.com/data-warehouse
2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/
3. https://www.btechguru.com/training--it--database-management-systems--file-structures-- introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html

M.Sc. Computer Science / Semester – II /

Core Lab 3-: Data Mining lab using R (P23CS2P3)

Lecture Hours	**: -**	**Tutorial Hours**	**: -**
Lab Practice Hours	**: 5**	**No. of Credit**	**: 2**
Contact Hours per Semester	**: 60**		
Contact hours per Week	**: 4**		
Internal Marks	**: 40**		
External Marks	**: 60**		
Total Marks	**: 100**		

Pre-requisite: Basics of DM Algorithms & R Programming

Objectives of the Course:

The main objectives of this course are to:

- To enable the students to learn the concepts of Data Mining algorithms namelyclassification, 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 PO's and PSO's)

On the successful completion of the course, student will be able to:

CO1: Able to write programs using R for Association rules, Clustering techniques.

CO2: To implement data mining techniques like classification, prediction.

CO3: Able to use different visualization techniques using R.

CO4: To apply different data mining algorithm s to solve real world applications.

CO5: To describe and conduct appropriate statistical modeling techniques.

Mapping with Programme Outcomes and Programme Specific Outcomes:

POs / COs	PO 1	PO 2	PO3	PO4	PO5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	3	1	2	3	2	2
CO2	1	2	1	2	2	2	2	2	2	2
CO3	3	1	3	2	3	2	3	3	2	2
CO4	2	3	2	2	1	2	2	1	2	1
CO5	2	2	2	1	1	2	2	1	1	2
Total Contribution of COs to POs	**11**	**10**	**11**	**9**	**10**	**9**	**11**	**10**	**9**	**9**
Weighted Percentage of COs Contribution to POs	**73**	**66**	**73**	**60**	**66**	**60**	**73**	**66**	**60**	**60**

Strong-3; Medium-2; Low-1

Course Content

List of Exercises:

1. Implement Apriori algorithm to extract association rule of data mining.
2. Implement k-means clustering technique.
3. Implement anyone Hierarchal Clustering.
4. Implement Classification algorithm.
5. Implement Decision Tree.
6. Linear Regression.
7. Data Visualization.

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.

Website Resources:

1. https://www.javatpoint.com/data-warehouse
2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/

M.Sc. Computer Science / Semester – II /

Core-5: Advanced Operating Systems (P23CS205)

Lecture Hours	**: 85**	**Tutorial Hours**	**: 5**
Lab Practice Hours	**: -**	**No. of Credit**	**: 5**
Contact Hours per Semester	**: 90**		
Contact hours per Week	**: 6**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

Pre-requisite: Basics of OS& its functioning

Objectives of the Course:

The main objectives of this course are to:

- Enable the students to learn the different types of operating systems and their functioning.
- Gain knowledge on Distributed Operating Systems
- Gain insight into the components and management aspects of real time and mobile operatingsystems.
- Learn case studies in Linux Operating Systems

Course Learning Outcomes: (for mapping with PO's and PSO's)

On the successful completion of the course, student will be able to:

CO1: Understand the design issues associated with operating systems

CO2: Master various process management concepts including scheduling, deadlocks and distributed file systems

CO3: Prepare Real Time Task Scheduling

CO4: Analyze Operating Systems for Handheld Systems

CO5: Analyze Operating Systems like LINUX and IOS

Mapping with Programme Outcomes and Programme Specific Outcomes:

POs / COs	PO 1	PO2	PO3	PO4	PO5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CO1	2	3	2	3	3	1	2	3	2	2
CO2	2	1	2	2	1	2	2	2	2	2
CO3	1	3	2	3	3	2	3	3	2	2
CO4	3	2	2	1	2	2	2	1	2	1
CO5	2	2	1	1	2	2	2	1	1	2
Total Contribution of COs to POs	**10**	**11**	**9**	**10**	**11**	**9**	**11**	**10**	**9**	**9**
Weighted Percentage of COs Contribution to POs	**66**	**73**	**60**	**66**	**73**	**60**	**73**	**66**	**60**	**60**

Strong-3; Medium-2; Low-1

Course Content

UNIT I **L-18 HOURS**

Basics of Operating Systems: What is an Operating System? – Main frame Systems –Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems –Real-Time Systems – Handheld Systems – Feature Migration – Computing Environments -Process Scheduling – Cooperating Processes – Inter Process Communication- Deadlocks –Prevention – Avoidance – Detection – Recovery.

UNIT II **L-18 HOURS**

Distributed Operating Systems: Issues – Communication Primitives – Lamports Logical Clocks –Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems –design issues – Case studies – The Sun Network File System-Coda.

UNIT III **L-18 HOURS**

Real-time Operating Systems : Introduction – Applications of Real Time Systems – Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling.

UNIT IV **L-13 HOURS+T-5 HOURS**

Operating Systems for Handheld Systems: Requirements–Technology Overview–Handheld Operating Systems–Palm OS-Symbian Operating System-Android–Architecture of android–Securing handheld systems.

UNIT V **L-18 HOURS**

Case Studies : Linux System: Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS : Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System. **Contemporary Issues:** Expert lectures, online seminars–webinars.

Text Books

1. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts",Seventh Edition, John Wiley & Sons, 2004.
2. Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems –Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.

Reference Books

1. Rajib Mall, "Real-Time Systems: Theory and Practice ",Pearson Education India,2006.
2. Pramod Chandra P. Bhatt, An introduction to operating systems, concept and practice, PHI,Third edition, 2010.
3. Daniel.P.Bovet&MarcoCesati,"UnderstandingtheLinuxkernel",3rd ed,O"Reilly,2005.
4. Neil Smyth, "iPhone iOS 4Development Essentials–Xcode", Fourth Edition, Payload media,2011.

Website Resources:

1. https://onlinecourses.nptel.ac.in/noc20_cs04/preview
2. https://www.udacity.com/course/advanced-operating-systems--ud189
3. https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf

M.Sc. Computer Science / Semester – II /

Core-6: Advanced Java Programming (P23CS206)

Lecture Hours	**: 80**	**Tutorial Hours**	**: 10**
Lab Practice Hours	**: -**	**No. of Credit**	**: 4**
Contact Hours per Semester	**: 90**		
Contact hours per Week	**: 6**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

Pre-requisite: Basics of Java & its Usage

Objectives of the Course:

The main objectives of this course are to:

- Enable the students to learn the basic functions, principles and concepts of advanced javaprogramming.
- Provide knowledge on concepts needed for distributed Application Architecture.
- Learn JDBC, Servlet packages, JQuery, Java Server Pages and JAR file format

Course Learning Outcomes: (for mapping with PO's and PSO's)

On the successful completion of the course, student will be able to:

CO1: Understand the advanced concepts of Java Programming

CO2: Understand JDBC and RMI concepts

CO3: Apply and analyze Java in Database

CO4: Handle different event in java using the delegation event model, event listener and class

CO5: Design interactive applications using Java Servlet, JSP and JDBC

Mapping with Programme Outcomes and Programme Specific Outcomes:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CO1	1	2	2	3	2	3	3	2	2	3
CO2	2	2	2	1	2	2	2	2	2	1
CO3	2	3	1	3	2	3	3	2	2	3
CO4	2	2	3	2	2	1	1	2	1	2
CO5	2	2	2	2	1	1	1	1	2	2
Total Contribution of COs to POs	**9**	**11**	**10**	**11**	**9**	**10**	**10**	**9**	**9**	**11**
Weighted Percentage of COs Contribution to POs	**60**	**73**	**66**	**73**	**60**	**66**	**66**	**60**	**60**	**73**

Strong-3; Medium-2; Low-1

Course Content

UNIT I **L-16 HOURS**

Java Basics Review: Components and event handling–Threading concepts–Networking features –Media techniques.

UNIT II **L-16 HOURS**

Remote Method Invocation-Distributed Application Architecture- Creating stubs and skeletons-Defining Remote objects- Remote Object Activation-Object Serialization-Java Spaces.

UNIT III **L-16 HOURS**

Java in Databases-JDBC principles–database access-Interacting-database search–Creating multimedia databases – Database support in web applications.

UNIT IV **L-16 HOURS+T- 5 HOURS**

Java Servlets: Java Servlet and CGI programming- A simple java Servlet-Anatomy of a java Servlet-Reading data from a client-Reading http request header-sending data to a client and writing the http response header-working with cookies

Java Server Pages: JSP Overview-Installation-JSP tags-Components of a JSP page-Expressions- Scriptlets-Directives-Declarations-A complete example.

UNIT V **L-16 HOURS+T- 5 HOURS**

JAR file format creation–Internationalization–Swing Programming–Advanced java Techniques

Contemporary Issues: Expert lectures ,online seminars –webinars.

Text Books

1. Jamie Jaworski, "Java Unleashed", SAMS Tech media Publications,1999.
2. Campione, Walrath and Huml, "The Java Tutorial", Addison Wesley,1999.

Reference Books

1. JimKeogh,"TheCompleteReferenceJ2EE",TataMcGrawHillPublishing CompanyLtd,2010.
2. DavidSawyerMcFarland,"JavaScriptAndJQuery-TheMissingManual",Oreilly Publications,3rd Edition,2011.
3. Deitel and Deitel, "Java How to Program", Third Edition, PHI/Pearson Education Asia.

Website Resources:

1. https://www.javatpoint.com/servlet-tutorial
2. https://www.tutorialspoint.com/java/index.htm
3. https://onlinecourses.nptel.ac.in/noc19_cs84/preview

M.Sc. Computer Science / Semester – II /

Core Lab 4-: Advanced Java Programming Lab (P23CS2P4)

Lecture Hours	**: -**	**Tutorial Hours**	**: -**
Lab Practice Hours	**: 60**	**No. of Credit**	**: 3**
Contact Hours per Semester	**: 60**		
Contact hours per Week	**: 4**		
Internal Marks	**: 40**		
External Marks	**: 60**		
Total Marks	**: 100**		

Pre-requisite: Basics in Java Programming

Objectives of the Course:

The main objectives of this course are to:

- To enable the students to implement the simple programs using JSP, JAR
- To provide knowledge on using Servlets, Applets
- To introduce JDBC and navigation of records
- To understand RMI & its implementation
- To introduce to Socket programming

Course Learning Outcomes: (for mapping with PO's and PSO's)

On the successful completion of the course, student will be able to:

CO1: Understand to the implement concepts of Java using HTML forms, JSP & JAR.

CO2: Must be capable of implementing JDBC and RMI concepts.

CO3: Able to write Applets with Event handling mechanism.

CO4: To create interactive web based applications using servlets and jsp.

CO5: To learn the Internet Programming, using Java Applets.

Mapping with Programme Outcomes and Programme Specific Outcomes:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	3	1	3	2	3	3	2	2
CO2	2	2	2	2	1	2	1	2	2	2
CO3	2	3	3	2	3	1	3	3	2	2
CO4	2	2	1	2	2	3	2	1	2	1
CO5	1	2	1	2	2	2	2	1	1	2
Total Contribution of COs to POs	**9**	**11**	**10**	**9**	**11**	**10**	**11**	**10**	**9**	**9**
Weighted Percentage of COs Contribution to POs	**60**	**73**	**66**	**60**	**73**	**66**	**73**	**66**	**60**	**60**

Strong-3; Medium-2; Low-1

Course Content

List of Exercises:

1. Display a welcome message using Servlet.
2. Design a Purchase Order form using Html form and Servlet.
3. Develop a program for calculating the percentage of marks of a student using JSP.
4. Design a Purchase Order form using Html form and JSP.
5. Prepare a Employee pay slip using JSP.
6. Write a program using JDBC for creating a table, Inserting, Deleting records and list out the records.
7. Write a program using Java servlet to handle form data.
8. Write a simple Servlet program to create a table of all the headers it receives along with their associated values.
9. Write a program in JSP by using session object.
10. Write a program to build a simple Client Server application using RMI.

11. Create an apple for a calculator application.
12. Program to send a text message to another system and receive the text message from the system (use socket programming).

Text Books

1. JamieJaworski,"JavaUnleashed",SAMSTechmediaPublications,1999.
2. Campione, Walrath and Huml,"TheJavaTutorial",AddisonWesley,1999.

Reference Books

1. JimKeogh,"TheCompleteReferenceJ2EE",Tata Mc Graw Hill Publishing Company Ltd,2010.
2. DavidSawyerMcFarland,"JavaScriptAndJQuery-TheMissingManual",Oreilly Publications,3rd Edition,2011.

Website Resources:

1. https://www.javatpoint.com/servlet-tutorial
2. https://www.tutorialspoint.com/java/index.htm
3. https://onlinecourses.nptel.ac.in/noc19_cs84/preview

M.Sc. Computer Science / Semester – II /

Elective Course II: Artificial Intelligence and Machine Learning

(Elective - P23CS2E2A)

Lecture Hours	**: 55**	**Tutorial Hours**	**: 5**
Contact Hours per Semester	**: 60**	**No. of Credit**	**: 3**
Contact hours per Week	**: 4**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

Pre-requisite: Basics of AI & An Introduction about ML

Objectives of the Course:

The main objectives of this course are to:

- Enable the students to learn the basic functions of AI, Heuristic Search Techniques.
- Provide knowledge on concepts of Representations and Mappings and Predicate Logic.
- Introduce Machine Learning with respect Data Mining, Big Data and Cloud.
- Study about Applications & Impact of ML.

Course Learning Outcomes: (for mapping with PO's and PSO's)

On the successful completion of the course, student will be able to:

CO1: Demonstrate AI problems and techniques

CO2: Understand machine learning concepts

CO3: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning

CO4: Analyze the impact of machine learning on applications

CO5: Analyze and design are all world problem for implementation and understandthe dynamic behavior of a system

Mapping with Programme Outcomes and Programme Specific Outcomes:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	2	3	3	3	2	2	2	2	3
CO2	2	2	2	1	2	2	2	2	2	1
CO3	2	2	3	3	3	2	2	3	1	3
CO4	2	2	1	2	1	2	1	2	3	2
CO5	2	1	1	2	1	1	2	2	2	2
Total Contribution of COs to POs	**9**	**9**	**10**	**11**	**10**	**9**	**9**	**11**	**10**	**11**
Weighted Percentage of COs Contribution to POs	**60**	**60**	**66**	**73**	**66**	**60**	**60**	**73**	**66**	**73**

Strong-3; Medium-2; Low-1

Course Content

UNIT I **L-11 HOURS**

Introduction: AI Problems - Al techniques - Criteria for success. Problems, Problem Spaces, Search: State space search - Production Systems - Problem Characteristics - Issues in design of Search.

UNIT II **L-11 HOURS**

Heuristic Search techniques: Generate and Test - Hill Climbing- Best-First, Problem Reduction, Constraint Satisfaction, Means-end analysis. Knowledge representation issues: Representations and mappings -Approaches to Knowledge representations -Issues in Knowledge representations - Frame Problem.

UNIT III **L-11 HOURS**

Using Predicate logic: Representing simple facts in logic - Representing Instance and Isa relationships - Computable functions and predicates - Resolution - Natural deduction. Representing knowledge using rules: Procedural Vs Declarative knowledge- Logic programming-Forward Vs Backward reasoning -Matching-Control knowledge.

UNIT IV **L-11 HOURS+T-3 HOURS**

Understanding Machine Learning: What Is Machine Learning? - Defining Big Data - Big Data in Context with Machine Learning - The Importance of the Hybrid Cloud - Leveraging the Power of Machine Learning - The Roles of Statistics and Data Mining with Machine Learning-Putting Machine Learning in Context-Approaches to Machine Learning.

UNIT V **L-11 HOURS+T-2 HOURS**

Looking Inside Machine Learning: The Impact of Machine Learning on Applications - Data Preparation -The Machine Learning Cycle. **Contemporary Issues:** Expert lectures, online seminars –webinars.

Text Books

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Publisherscompany Pvt Ltd, Second Edition, 1991.
2. George F Luger, "Artificial Intelligence", 4thEdition, Pearson Education Publ,2002.

Reference Book

1. Machine Learning For Dummies ®, IBM Limited Edition by Judith Hurwitz,Daniel Kirsch.

Website Resources:

1. https://www.ibm.com/downloads/cas/GB8ZMQZ3
2. https://www.javatpoint.com/artificial-intelligence-tutorial
3. https://nptel.ac.in/courses/106/105/106105077/

M.Sc. Computer Science / Semester – II /

Elective Course II: Internet of Things

(Elective - P23CS2E2B)

Lecture Hours	**: 55**	**Tutorial Hours**	**: 5**
Contact Hours per Semester	**: 60**	**No. of Credit**	**: 3**
Contact hours per Week	**: 4**		
Internal Marks	**: 25**		
External Marks	**: 75**		
Total Marks	**: 100**		

Pre-requisite: Basics of Sensors & its Applications

Objectives of the Course:

The main objectives of this course are to:

- To get familiar with the evolution of IOT with its design principles.
- To outline the functionalities and protocols of internet communication.
- To analyze the hardware and software components needed to construct IOT applications.
- To identify the appropriate protocol for API construction and writing embedded code.
- To realize various business models and ethics in Internet of Things.

Course Learning Outcomes: (for mapping with PO's and PSO's)

On the successful completion of the course, student will be able to:

CO1: Understand about IoT, its Architecture and its Applications

CO2: Comprehend the IoT evolution with its architecture and sensors

CO3: Assess the embedded technologies and develop prototypes for the IoT products

CO4: Evaluate the use of Application Programming Interface and design an API for IoT in realtime

CO5: Design IoT in real time applications using today's internet & wireless Technologies

Mapping with Programme Outcomes and Programme Specific Outcomes:

POs / COs	PO 1	PO 2	PO3	PO4	PO5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	1	2	3	3	2	3
CO2	2	2	2	2	2	2	2	1	2	1
CO3	3	2	2	3	2	2	3	3	1	3
CO4	1	2	1	2	2	2	1	2	3	2
CO5	1	1	2	2	2	1	1	2	2	2
Total Contribution of COs to POs	**10**	**9**	**9**	**11**	**9**	**9**	**10**	**11**	**10**	**11**
Weighted Percentage of COs Contribution to POs	**66**	**60**	**60**	**73**	**60**	**60**	**66**	**73**	**66**	**73**

Strong-3; Medium-2; Low-1

Course Content

UNIT I **L-11 HOURS**

Internet of Things: An Overview : IoT Conceptual Framework - IoT Architectural View - Technology Behind IoT - Sources of IoT - M2M Communication - Examples of IoT - Design Principles for Connected Devices : IoT/M2M Systems Layers and Designs Standardization - Communication Technologies - Data Enrichment, Data Consolidation and Device Management at Gateway.

UNIT II **L-11 HOURS**

Communication Protocols for Connected Devices – Message Communication Protocols for Connected Devices – Web Connectivity for Connected Devices – Network Using Gateway , SOAP, REST, HTTP, RESTful and WebSockets -Internet Connectivity Principles : Internet Connectivity - Internet Based Communication – IP Addressing in theIoT – Media Access Control – Application Layer Protocols: HTTP, HTTPS, FTP, Telnet and Others.

UNIT III **L-11 HOURS**

Data Acquiring and Storage – Organising the Data – Transactions, Business Processes, Integration and Enterprise Systems – Analytics – Knowledge Acquiring, Managing and Storing Processes - DataCollection, Storage and Computing Using a Cloud Platform: Cloud Computing Paradigm for Data Collection, Storage and Computing – Everything as a Service and Cloud Service Models.

UNIT IV **L-11 HOURS+T-2 HOURS**

Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks: Sensor Technology – Wireless Sensor Networks Technology - Prototyping the Embedded Devices for loT and M2M: Embedded Computing Basics – Embedded Platforms for Prototyping.

UNIT V **L-11 HOURS+T-3 HOURS**

Prototyping Embedded Device Software - Devices, Gateways, Internet and Web/Cloud Services Software Development – Prototyping online Component APIs and Web APIs – Security for IoT : Vulnerabilities, Security Requirements and Threat Analysis – IoT Security Tomography and Layered Attacker Model – Security Models, Profiles and Protocols for IoT – IoT Application Case Study : Design Layers, Design Complexity and Designing using Cloud PaaS – IoT / IIoT Applications in the premises, Supply – Chain and Customer Monitoring – Connected Car and its Applications andServices.

Text Book

1. Raj Kamal , " Internet of Things Architecture and Design Principles", McGraw Hill, 2017.

Reference Books

1. Ovidiu Vermesan and Peter Friess, "Internet of Things – From Research and Innovation to MarkDeployement" , River Publishers, 2014.
2. Peter Waher, "Learning Internet of Things" ,Packt Publishing, 2015.
3. Donald Norris, "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and Beagle Bone Black", Mc Graw Hill, 2015

Website Resources:

1. https://onlinecourses.nptel.ac.in/noc20_cs66/preview
2. https://www.javatpoint.com/iot-internet-of-things