M.Sc. Computer Science

Syllabus

UNIVERSITY DEPARTMENT

Program Code: CSEE

2023 – 2024 onwards

BHARATHIAR UNIVERSITY

(A State University, Accredited with "A++" Grade by NAAC,
Ranked 21st among Indian Universities by MHRD-NIRF)

Coimbatore - 641 046, Tamil Nadu, India

BHARATHIAR UNIVERSITY : : COIMBATORE 641046

DEPARTMENT OF COMPUTER SCIENCE
(Effective from the academic Year 2023-2024)

MISSION

- Creating and disseminating of world class knowledge in global context
- Equip students with knowledge on up-to-date technological developments to take part in global software industry
- Promote state of art inter disciplinary research in computer science
- Imbibe entrepreneurial culture through curriculum, pedagogy, research and mentoring

1. **Eligibility for Admission to the Programme**

Candidates for admission to the first year programme leading to the Degree of Master of Science in Computer Science (M.Sc. – CS) will be required to possess:

A pass in B.Sc. Computer Science/ Information Technology/ Computer Applications or its equivalents.

2. **Duration of the Programme**

The programme shall be offered on a full-time basis. The programme will consist of three semesters of course work and laboratory work and the fourth semester consists of project work.

3. **Regulations**

The general Regulations of the Bharathiar University Choice Based Credit System Programme are applicable to this programme.

4. **The Medium of Instruction and Examinations**

The medium of instruction and Examinations shall be in English.

5. **Submission of Record Notebooks for Practical Examinations & Project Viva-Voce.**

Candidates taking the Practical Examinations should submit bonafide Record Note Books prescribed for the Examinations. Otherwise the candidates will not be permitted to take the Practical Examinations.

Candidates taking the Project Viva Examination should submit Project Report prescribed for the Examinations. Otherwise the candidates will not be permitted to take the Project Viva-voce Examination.

Program Educational Objectives (PEOs)	
The **M. Sc. Computer Science** program describe accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO1	Employed in software industry and engaging in understanding and applying new ideas and thoughts as the field evolves
PEO2	Promotion of inter disciplinary research for inventions/innovations for professional careers to meet the needs of the society
PEO3	Enhanced to cope up with the changing technologies in the frontier of computer science and allied field
PEO4	Incorporating Industry 5.0 Technologies in their career based on industry needs

Program Specific Outcomes (PSOs)	
After the successful completion of M.Sc Computer Science program, the students are expected to	
PSO1	Take up higher education in top Institutions
PSO2	Get expertise in developing smart applications
PSO3	Get career opportunities as Data Scientist/ Data Analyst
PSO4	Become an entrepreneur in designing and development
PSO5	Demonstrate proficiency in problem solving techniques using Industry 4.0 and Industry 5.0

Program Outcomes (POs)	
On successful completion of the M. Sc. Computer Science program	
PO1	Gain and apply the knowledge of computer science concepts in appropriate domain of interest
PO2	Ability to analyze the problem, identify the required computing facility and implement it to obtain solutions
PO3	Ability to create a new design for the complex computational problems which meets the specific needs for environmental and societal impact domains
PO4	Students can independently enable to acquire the innovative ideas and solve complex real-time problems by considering professional, ethical, legal and social issues
PO5	Understand and choose the appropriate modern techniques and tools for the complex systems of various domains and understands the advantages and limitations
PO6	Ability to work in a group with an effective rapport building with team members in computer industries to accomplish a common goal
PO7	Ability to communicate effectively in the basis of presenting their research work and gain knowledge on documentation and reports writing in a professional way
PO8	Ability to distinguish the ethical, legal and societal issues of computing surroundings and will take the responsibility by applying computer skill practices
PO9	Ability to analyze the local and global impact of computing on individuals, organizations and society
PO10	Demonstrate the principles of computer science and apply these in the multidisciplinary environments to manage project

BHARATHIAR UNIVERSITY : : COIMBATORE 641 046

M. Sc Computer Science Curriculum (University Department)

(For the students admitted during the academic year 2023-2024onwards)

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
23CS1C1	Advanced Operating System	4	4	-	25	75	100
23CS1C2	Data Structures and Algorithms	4	2	4	25	75	100
23CS1C3	Advanced Java Programming	4	2	4	25	75	100
23CS1C4	Python Programming	4	2	4	25	75	100
23CS1C5	Mathematical Foundations of Computer Science	4	4	-	25	75	100
23CS1EX	Elective – I	4	4	-	25	75	100
Basics of Research	Industry Literacy	1			25		25
	General Supportive - I	2			12	38	50
	Job Oriented Course	2					50
	Total	29					725
SECOND SEMESTER							
23CS2C1	Linux Programming	4	2	4	25	75	100
23CS2C2	Compiler Design	4	4	-	25	75	100
23CS2C3	Internet of Things	4	4	-	25	75	100
23CS2C4	Data Mining Techniques and Tools	4	2	4	25	75	100
23CS2C5	Database Administration and Management	4	2	4	25	75	100
23CS2EX	Elective - II	4	4	-	25	75	100
Basics of Research	Literature Survey	1			25		25
	General Supportive - II	2			12	38	50
	Job Oriented Course	2					50
	Value Added Course	2					50
	Total	31					775
THIRD SEMESTER							
23CS3C1	Visual Programming	4	2	4	25	75	100
23CS3C2	Software Project Management	4	4	-	25	75	100
23CS3C3	Cloud Computing	4	4	-	25	75	100
23CS3C4	Big Data Analytics	4	2	4	25	75	100
23CS3C5	Wireless Networks	4	2	4	25	75	100
23CS3EX	Elective - III	4	4	-	25	75	100
Basics of Research	Gap Analysis	1			25		25
	General Supportive - III	2	2	-	12	38	50
	Value Added Course	2					50
	Total	29					725

FOURTH SEMESTER							
	Project Work	9			135	90	225
	Total	9					
	Grand Total	98					

Online Course

	SWAYAM – MOOC Course*	2					

*Swayam – Mooc online course shall be for duration of atleast 4 weeks with atleast 2 credits. The course shall be mandatory and shall be completed within third semester(i.e., before the beginning of fourth semester)

Elective Papers

Sem	Elective	Group1 with Suggested Code	Group2 with Suggested Code	Group3 with Suggested Code
I	Elective - I	23CS1E1/ Information Security	23CS1E2/ Artificial Intelligence	23CS1E3/ Business Intelligence
II	Elective - II	23CS2E1/ Data Privacy and Security	23CS2E2/ Machine Learning Techniques	23CS2E3/ Health Care Analytics
III	Elective - III	23CS3E1/ Cyber Security	23CS3E2/ Deep Learning Techniques	23CS3E3/ Social Media Analytics

Supportive Papers

Suggested Code	Sem	Title of the paper	Hrs	Credits	Marks
23CSS01	I/II/III	Windows and MS Word	2	2	50
23CSS02		Internet and HTML Programming	2	2	50
23CSS03		Relational Database Management System	2	2	50
23CSS04		Object Oriented Programming	2	2	50
23CSS05		Software Engineering	2	2	50
23CSS06		Multimedia Systems	2	2	50

List of Job Oriented/Value Added Course

1. Mobile Application Development
2. Smart Applications with Internet of Things
3. Remote Sensing and GIS
4. Cyber Security and Digital Forensics

Course Code	23CS1C1	ADVANCED OPERATING SYSTEMS	L	T	P	C
Core/Elective/Supportive		CORE	4	0	0	4
Pre-requisite		Fundamentals of Operating Systems	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are:

1. To review the basic concepts of operating system and to introduce the advanced concepts.
2. To discuss about process synchronization, distributed operating systems, real time operating systems, operating system for handheld systems, LINUX OS and iOS.
3. To inculcate the working principles, features, various services and limitations of different types of operating system.

Expected Course Outcomes:

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

1	Understand the functions, types, advanced concepts in operating system, and the process concepts. Analyze deadlock situations, the reason for deadlock, recovery of deadlocks and how to avoid deadlocks.	K2/K4
2	Understand and analyze the concepts of distributed operating systems, issues and file system coding in distributed system.	K2/K4
3	Analyze the need of Real time operating system and describe about security issues and applications of real time operating system.	K2/K4
4	Understand how to use the Palm OS and Android in handheld devices.	K2/K3/K4
5	Understand the information about the Linux operating system and iOS architecture, layers and their functions.	K2/K3/K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Process Synchronization	12 hours

Overview - Introduction – Functions of an operating system – Design approaches – Why advance operating systems – Types of advanced operating systems. Synchronization mechanisms: Introduction – Concept of a process – Concurrent processes – The critical section problem – Other synchronization problems. Process deadlocks: Introduction – preliminaries – models of deadlocks

Unit:2	Distributed Operating Systems	10 hours

Issues – Communication Primitives – Lamport's 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:3	Real Time Operating Systems	15 hours

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

Unit:4	Operating Systems for Handheld Systems	10 hours

Requirements – Technology Overview – Handheld Operating Systems – Palm OS - Android – Architecture of android – Securing handheld systems

Unit:5	Linux and iOS	11 hours

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

Unit:6	**Contemporary Issues**	**2 hours**
Discussion on case study - Expert lectures - Online seminars – Webinars - Workshops		
	Total Lecture hours	**60 hours**

Text Books	
1	MukeshSinghal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed Database, and Multiprocessor Operating Systems", Tata McGraw-Hill Publishers, 2011
2	Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India Publishers, Second Edition, 2008.
3	Daniel.P.Bovet& Marco Cesati, "Understanding the Linux kernel", O"ReillyPublishers , 3rd edition, 2005
Reference Books	
1	Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Payload media Publishers, Fourth Edition 2011
2	YoonSeokPyo, HanCheol Cho, RyuWoon Jung, TaeHoon Lim, "ROS Robot Programming From the basic concept to practical programming and robot application", ROBOTICS Co., Ltd, 2017.
3	Pramod Chandra P.Bhatt, "An Introduction To Operating Systems, Concept And Practice", PHI publishers, Third edition, 2013.
4	Andrew S. Tanenbaum, "Modern Operating System", Prentice-Hall, Inc, Third edition, 2008
5	AnisKoubaa, "Robot Operating System (ROS) The Complete Reference (Volume 1)", Springer Publishers, First Edition, 2016
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	http://nptel.ac.in/courses/Webcourse-contents/IIScBANG/Operating%20Systems/New_index1.html
2	https://www.tutorialspoint.com/operating_system/index.htm
3	https://www.coursera.org/courses?languages=en&query=operating+system
4	https://in.udacity.com/course/advanced-operating-systems--ud189
5	http://wiki.ros.org/ROS/Tutorials
6	https://www.toptal.com/robotics/introduction-to-robot-operating-system
Course Designed By: **Dr. S.Vijayarani**	

Mapping with programme outcomes:

COS	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**M**	**L**	**L**	**M**	**L**	**L**	**L**	**M**	**L**
CO2	**S**	**M**	**M**	**M**	**L**	**M**	**S**	**M**	**S**	**S**
CO3	**S**	**M**	**M**	**L**	**M**	**M**	**L**	**L**	**M**	**S**
CO4	**S**	**S**	**S**	**L**	**M**	**M**	**M**	**L**	**S**	**S**
CO5	**S**	**L**	**M**	**L**	**M**	**L**	**L**	**M**	**S**	**S**

S- Strong; M-Medium; L-Low

Course code	23CS1C2	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
Core/Elective/Supportive		CORE	2	0	4	4
Pre-requisite		Students should be able to program in any standard programming language	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are to:

1. Provide a good background in data structures and algorithms to prepare the students for job in industry
2. Learn systematic way of solving the problems
3. Solve the problems using data structures and algorithms

Expected Course Outcomes:

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

1	Remember and Understand the fundamental data structures and implement them using programming languages	K1/K2
2	Understand and Apply the time complexity of different problems	K2/K3
3	Understand efficient data structures and apply them to solve the problems	K2/K3
4	Analyze and Evaluate the various algorithms	K4/ K5
5	Understand and Create data structures and algorithms for various domains	K2/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	DATA STRUCTURES BASICS	11 hours

Introduction: Definition, Structure and Properties of algorithms –Development of an algorithm – Data Structures and algorithms –Data Structure definition and classification. Analysis of algorithms: Efficiency of algorithms –Apriori analysis –Asymptotic notations –Time complexity of an algorithm using O notation –Polynomial Vs Exponential algorithms –Average, Best and Worst-case complexities –Analyzing recursive programs.

Unit:2	STACK AND QUEUE	11 hours

Stacks: Introduction -Stack Operations –Applications –Recursion -Evaluation of Expressions. Queues: Introduction -Operations on Queues –Circular queues –Application of a linear queue. Linked Lists: Introduction - Singly linked lists -Circularly linked lists -Doubly linked lists - Applications – polynomial addition

Unit:3	TREES AND GRAPHS	12 hours

Binary Trees: Introduction –Representation of Trees –Binary Tree Traversals. Binary Search Trees: Introduction –Operations. AVL Trees: Definition -Operations. B-Trees: Introduction – m-way search trees -B trees definition and operations. Graphs: Introduction –Definitions – Representation of Graphs –Graph Traversal -Depth-First and Breadth-First Algorithms -Topological

Unit:4	ALGORITHM DESIGN TECHNIQUES I	12 hours
Divide and Conquer: General Method –Binary Search –Merge Sort –Quick Sort. Greedy Method: General Method –Knapsack Problem –Minimum Cost Spanning Tree –Single Source Shortest Path		
Unit:5	**ALGORITHM DESIGN TECHNIQUES II**	**12 hours**
Dynamic Programming: General Method –Multistage Graphs –All Pair Shortest Path –Traveling Salesman Problem. Backtracking: General Method –8-Queens Problem –Sum of Subsets – Hamiltonian Cycles. Branch and Bound: The Method –0/1 Knapsack Problem –Traveling Salesperson		
Unit:6	**CASE STUDY**	**02 hours**
Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops		
	Total Lecture hours	**60 hours**

Text Book(s)

1	GAV Pai, Data Structures and Algorithms Concepts, Techniques and Applications, Tata McGraw Hill, 2008.
2	Robert Sedgewick, Phillipe Flajolet, “An Introduction to the Analysis of Algorithms”, Second Edition, Addison- Wesley Professional, 2013.

Reference Books

1	Jean Paul Tremblay, Paul G. Sorenson, An Introduction to Data Structures with Applications, Tata McGraw Hill, Second Edition.
2	Sartaj Sahni, “Data Structures, Algorithms and Applications in C++”, Second Edition, Universities Press, 2005.
3	Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, Second Edition, Universities Press, 2008.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://swayam.gov.in/nd1_noc20_cs10/preview
2	Hsuan – Hao Hsu, Chen – Hsuan Huang, and Shiang – Tai Lin, 2019, New data structure for computational molecular design with atomic or fragment resolution, J. Chem. Inf. Model, 59 (9), 3703-3713. Available at: https://pubs.acs.org/doi/abs/10.1021/acs.jcim.9b00478

Course Designed By: **Dr.D.Ramyachitra**

List of Programs

1. Creation of Stack and its operations
2. Creation of Queue and its operations
3. Creation of Circular queue and the operations
4. Implementation of Singly linked list
5. Implementation of Circular linked list
6. Implementation of Doubly linked list
7. Implementation of Binary tree
8. Implementation of Binary tree traversal

9. Implementation of Binary search tree
10. AVL tree and the operations
11. B tree and the operations
12. Graph traversal
13. Binary search
14. Merge sort
15. Quick sort
16. Implementation of Knapsack problem
17. Implementation of Minimum cost spanning tree
18. Implementation of Multistage graph
19. Implementation of N Queens problem
20. Implementation of Travelling salesman problem

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	L	L	M	M	M	L	M
CO2	S	M	S	L	M	L	L	L	L	M
CO3	S	S	M	M	M	L	L	M	M	L
CO4	S	M	M	M	L	L	L	M	M	L
CO5	M	S	S	M	L	L	M	M	L	L

*S-Strong; M-Medium; L-Low

Course code	23CS1C3	ADVANCED JAVA PROGRAMMNG	L	T	P	C
Core/Elective/Supportive		CORE	2	0	4	4
Pre-requisite		Basic Java, Object Oriented Programming concepts	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are to:

1. To inculcate the students to understand the advanced JAVA concepts
2. To develop Java based applications by applying these advanced concepts to implement in web based applications

Expected Course Outcomes:

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

1	Create Applications using Swing Components.	K2/K3/K4/ K6
2	Write distributed applications using RMI	K2/K3/K4/ K6
3	Establishing DATABASE Connectivity using JAVA	K2/K3/K4
4	Understand the JavaScript language & the Document Object Model.	K2/K3/K4
5	Understand and apply Well-Formed XML and different types of XML Schemas	K2/K3/K6
6	Understand AJAX	K2/K3/K4
7	Create application using Servlets and JSP	K2/K3/K4/ K6
8	Understand Struts, Spring and Hibernate frameworks	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Java Swing	9 -- hours

Features – Classes and Packages – MVC architecture – Swing basic components – Buttons – Labels – List – Combo box – Menu Simple AWT application using Swing Components.

Unit:2	Remote Method Invocation and JDBC	10-- hours

RMI overview - RMI architecture - Example demonstrating RMI. Database Handling: Accessing Database using JDBC.

Unit:3	JAVA in WEB	12-- hours

Java Scripts: JavaScript language syntax, Built In Functions, HTML Forms, HTML DOM, XML: XML documents, XML schemes, and Extensible Style Language (XSL), Introduction to AJAX.

Unit:4	Servlet And Jsp	18-- hours

Servlet: Introduction to servlet - Developing and Deploying Servlets - Handling Request and Response - Reading Servlet Parameters - Cookies - Session Tracking. Java Server Pages: Basic JSP Architecture - Life Cycle of JSP - JSP Tags and Expressions – Directives- JSP applications. Java Creating and using JavaBean components –Setting and retrieving JavaBean components – Java Server Faces Application.

Unit:5	**Hibernate, Spring, Struts**	**9-- hours**
Introduction to Hibernate – Advantages – Architecture –Spring Framework -Struts Framework: Introduction to Struts- Struts Architecture.		
Unit:6	**Contemporary Issues**	**2 hours**
Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops		
	Total Lecture hours	**60-- hours**

Text Books	
1	Herbert Schildt - JAVA 2 (The Complete Reference)- Ninth Edition, TMH, 2014
2	Jim Keogh, "The Complete Reference J2EE, Tata McGraw-Hill, 2002.
Reference Books	
1	Brian Cole, Robert Eckstein, James Elliott, Marc Loy, David Wood, Java Swing, O'Reilly Publishers, second edition, 2002
2	Patrick Naughton, "The Java Hand Book, Tata McGraw Hill, 1996.
3	Kogent Solutionss, Java Server Programming Java Ee5 Black Book,Dreamtech Press, 2008

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/javascript
2	https://www.tutorialspoint.com/java_xml
3	https://www.tutorialspoint.com/ajax
4	https://www.w3schools.com/

Course Designed By: Dr. K. Geetha

List of Programs

1. Implementing Calculator using Swing Components
2. Develop a Registration form using swing component
3. Calculation of Factorial using RMI
4. Finding Even Number using RMI
5. Handling of Metadata
6. Manipulation of Student Details
7. Create Java program to fill the employee details form using XML
8. Create Java program to draw a cylinder shape using HTML
9. Develop a Multiplication table Using Java Script
10. Write Java Script to Sort array of numbers
11. Write java servlet to handle input from web browser using GET Method

12. Write java servlet using HTML form to accept data, GET and POST methods
13. Write java servlet to Display Information
14. Develop a JSP program for generating factorial number
15. Deploying and Testing the Sample Web Application using JSP

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**S**	**M**	**M**	**S**	**L**	**S**	**L**	**S**
CO2	**S**	**S**	**S**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**L**	**L**	**M**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**M**	**S**	**M**
CO5	**S**	**S**	**S**	**L**	**M**	**S**	**S**	**S**	**S**	**S**
CO6	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**
CO7	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**M**	**S**	**M**
CO8	**S**	**S**	**M**	**M**	**M**	**M**	**S**	**S**	**L**	**S**

*S-Strong; M-Medium; L-Low

Course code	23CS1C4	PYTHON PROGRAMMING	L	T	P	C
Core/Elective/Supportive		CORE	2	0	4	4
Pre-requisite		Comprehensive knowledge and understanding of the basic components of Python programming language.	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are:

1. To provide in depth knowledge about the basic concepts of Python programming.
2. To discuss the principle of algorithm design to most high level programming languages.
3. To design real life situational problems and think creatively about solutions of them.

Expected Course Outcomes:

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

1	Develop python programs for core python and data types using objects and functions. Develop python programs for list and control statements and understand the different loops such as “for”, “while”and “do-while”	K3 / K6
2	Apply the Mapping and the Dictionary technique for the given problem. Implement File Objects and Object-Oriented Programming using python	K3 / K4
3	Explain about the functions and packages involved in modules	K1 / K2
4	Manage Errors and Exceptions and summarize the Network Programming. Be exposed to advanced applications such as Internet Client Programming and GUI Programming	K2 / K3/ K4
5	Explain the basic concepts and need for Graph databases. Create databases and retrieve records using Neo4j. Provide the information about data visualization and its need.	K2 / K4/ K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Core Python	10 hours

Introduction-features-Comparative Study-Comments-Variables and Assignments. Python Objects: Standard types-Built-in-type Internal type-Standard type operator and Built-in functions-Categorizing standard type Unsupported type. Numbers: Introduction- Integer-Floating Point-Complex numbers-Operators-Built-in and factory functions. Sequences- Strings-Strings and Operator-String only operator- Built-in-Functions-Built-in-Methods-String Features-Unicode.

Unit:2	List	12 hours

List-Operators-Built-in-Functions-Built-in-Methods-Features of List. Tuple: Introduction Operators and Built-in-Functions-Features of tuples-Copying Python Objects and shallow and deep copies. Mapping type: Dictionaries- mapping type Operators-Built-in and Factory Functions-Built-in-Methods- Dictionary Keys. Set type: Introduction Operators-Built-in Function-Built-in Methods--Conditional and looping statement.

Unit:3	**File**	**12 hours**
File Objects- Built in Functions-Methods-Attributes-Standard files-Command line Argument-File System-File Execution-Persistent Storage Modules. Object-Oriented Programming: Classes and Instance- Binding and Method Invocation-Static Methods and Class methods-Inheritance. Modules: Modules and Files-Namespace-Importing Modules- Features-Built-in Functions-Packages.		
Unit:4	**Errors and Exceptions**	**12 hours**
Exceptions in python-Detecting and Handling Exceptions- Context Management-Raising Exception-Assertions. Regular Expression: Introduction-Special Symbols and characters-Regexes and Python Examples of Regexes. Network Programming: Introduction-Socket.		
Unit:5	**Internet Client Programming**	**12 hours**
Transferring files-Email. Multi-threaded Programming: Threads and Processes- Global Interpreter Lock-Thread Module- Threading Module. GUI Programming: Introduction-Tkinter and Python. DB Programming: Introduction-Python DB- API-Object Relational Managers (ORM).		
Unit:6	**Industry 4.0**	**2 hours**
Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops		
	Total Lecture hours	**60 hours**

Text Books	
1	Aditya Kanetkar, Let Us Python,bpb publications,2020
2	Harsh Bhasin,Python for Beginners, New Age International (P) Ltd Publishers,2018
Reference Books	
1	Al Sweigart,Automate the Boring Stuff with Python: Practical Programming for Total Beginners, 2015
2	Martin C. Brown,Python The Complete Reference
3	O'Reilly Media,Learning Python, 5th Edition Fifth Edition, 2013
4	Beazley David, Python Essential Reference, Pearson Education (US),2009
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd1_noc19_cs59/preview
2	https://www.python.org/
3	https://www.tutorialspoint.com/python/index.htm
4	https://nptel.ac.in/courses/106/106/106106182/
5	https://www.w3schools.com/python/
Course Designed By: **Dr. D.NAPOLEON**	

List of Programs

1. Write a program to demonstrate different number data types in python
2. Write a program to perform different arithmetic operations on numbers in python.
3. Write a program to create, concatenate and print a string and accessing substring from a given string.
4. Write a python script to print the current date in following format “Sun May 29 02:26:23 IST 2017”
5. Write a python program to create, append and remove lists in python.
6. Write a program to demonstrate working with tuples in python
7. Write a python program to find largest of three numbers.
8. Write a python program to convert temperature to and from Celsius to Fahrenheit.
9. Write a python program to construct the following pattern using nested for loop.
10. Write a python program to print prim numbers less than 20.
11. Write a python program to find factorial of a number using recursion.
12. Write a python program to that accepts length of three sides of a triangle as inputs. The program should indicate whether or not the triangle is a rightangled triangle (use Pythagorean theorem).
13. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
14. Write a python program to define a module and import a specific function in that module to another program.
15. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
16. Write a Python class to convert an integer to a roman numeral.
17. Write a Python class to implement pow(x, n).
18. Write a Python class to reverse a string word by word.
19. Write a python program to print a number is positive/negative using if-else.
    Write a python Program to read a number and display corresponding day using if_elif_else?
    Write a python program to check whether the given string is palindrome or not.
20. Write a Python program to remove the “i” th occurrence of the given word in a list where words repeat.
21. Write a program to count frequency of characters in a given file.
22. Write a program to print each line of a file in reverse order. Write a program to compute the number of characters, words and lines in a file.
23. -Write function to compute GCD, LCM of two numbers.

Mapping with programme outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	L	M	L	S	S	L	M
CO2	S	S	L	M	L	S	S	L	S	M
CO3	S	S	M	L	M	L	M	L	M	L
CO4	S	L	S	L	M	S	L	S	M	S
CO5	S	S	L	S	L	M	M	M	S	L

S- Strong; M-Medium; L-Low

Course code	23CS1C5	MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE	L	T	P	C
Core/Elective/Supportive		CORE	4	4	0	4
Pre-requisite		Higher secondary level of mathematics and statistics	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are to:

1. Introduce the basic mathematical terminologies required to understand the various designing concepts, storage methods and to improve the skill of logical thinking for solving different kinds of problems.
2. Give exposure in matrices, theory and applications of Set theory, probability, and Mathematical Logic. Automata theory helps the learner to use it in practical applications of computer science.

Expected Course Outcomes:

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

1	Understand Matrix operations, determinant of a matrix, its properties and where it can be incorporated in computer applications	K2/K3/K4
2	To introduce the basic of theory of sets, functions and relations and its applications	K2/K3/K4
3	Understand and apply experiments, events, space; to understand Bayse;s Thorem	K2/K3/K4
4	Understand FA, NFA,DFA, Conversion of NFA to DFA, Derivation trees and it applications	K2/K3/K4
5	Understand mathematical Logic to translate natural language sentences into symbolic form, construction of truth table and verification of tautology or contradiction	K2/K3/K4
6	Understand Numerical Methods and to derive appropriate numerical methods to solve algebraic and transcendental equations	K2/K3/K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Matrices, Determinants, Set Theory and Relations & Functions**	**12 hours**

Matrices: Types of Matrices - Matrix Operations - Inverse of a Matrix - Properties of Determinants - Eigen Values - Cayley-Hamilton Theorem. Set Theory: Basic Set Operations - Relations and Functions – Relation Matrices - Principle of Mathematical Induction.

Unit:2	**Introduction to Probability**	**12 hours**

Sample Space and Events - Axioms of Probability - Conditional Probability – Independence of Events - Bayes Theorem. Regression and Correlation : Introduction – Linear Regression – Method of Least Squares – Normal Regression Analysis – Normal Correlation Analysis.

Unit:3	**Grammars and Languages**	**11 hours**

Context Free Grammars – Introduction – Context Free Grammars – Derivation Trees. Finite Automata: Finite State Systems – Basic Definitions – Non Deterministic Finite Automata.

Unit:4	**Mathematical Logic**	**12 hours**
Statements and Notations – Connectives – Consistency of Premises and Indirect Method of Proof – Automatic Theorem Proving.		
Unit:5	**Numerical Methods**	**11 hours**
Finding Roots : Bisection Method - Regula–Falsi Method - Newton–RaphsonMethod. Solution of Simultaneous Linear Equations: Gaussian Elimination - Gauss-Seidal Method. Numerical Integration: Trapezoidal Rule - Simpson s Rule.		
Unit:6	**Contemporary Issues**	**2 hours**
Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops		
	Total Lecture hours	**60 hours**

Text Books	
1	M. K. Venkataraman, “Engineering Mathematics, Volume II, National Publishing Company.
2	John E. Freunds, Irwin Miller, Marylees Miller, “Mathematical Statistics, Pearson Education, Sixth Edition
3	T.T. Soong,” Fundamentals of Probability and Statistics for Engineers” John Wiley & Sons Ltd.
Reference Books	
1	Peter Linz, “An Introduction to Formal Languages and Automata, Jones & Bartlett Learning, Fifth Edition, 2011.
2	Tremblay and Manohar, “Discrete Mathematical Structures with Applications to Computer Science , Tata McGraw-Hill.
3	S.S. Sastry, “Introductory Methods of Numerical analysis, PHI Learning Private Limited, Fifth Edition, 2012
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.math.hmc.edu/calculus/tutorials/matrixalgebra/
2	https://www.tutorialspoint.com/automata_theory/index.htm
Course Designed By: Dr. K. Geetha	

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	M	L	S	S	S	S	M
CO3	S	S	S	M	L	S	S	S	S	M
CO3	S	S	S	M	M	L	S	L	S	M
CO4	S	S	S	M	M	S	L	S	S	M
CO5	S	S	S	M	M	L	S	S	L	M
CO6	S	S	S	M	M	S	S	S	S	M

*S-Strong; M-Medium; L-Low

Course code	23CS2C1	LINUX PROGRAMMING	L	T	P	C
Core/Elective/Supportive		CORE	2	0	4	4
Pre-requisite		Fundamentals of Operating systems and basics of C language.	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are to:

1. Provide the strong foundation to students on open source Linux operating system basics, system calls and library.
2. Enrich their knowledge on handling processes, threads, signals and synchronization.
3. Train the students to equip their knowledge in Inter-process communications and networking using pipes, named pipes, shared memory, message queue, semaphore and TCP and UDP sockets.

Expected Course Outcomes:

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

1	Understand about Unix and Linux history, Unix architecture, GNU, Free software foundation, Distributions, Work with files and directories.	K1/K2
2	Create simple shell scripts, work with files using shell scripts and understand system calls and library functions and create applications using c language.	K2/K3
3	Understand about processes, process structure, Analyze the process states, process controls and process relationships and zombie process	K2/K4/K3
4	Exploring the concepts of signals and threads and illustrate the use of signals and threads and also examine the use of inter-process communication facilities in Linux such as pipes, named pipes and message queues.	K2/K3/K4 /K6
5	Design and develop the client/server applications using shared memory with semaphores and also understand sockets and create network based applications using TCP and UDP sockets.	K3/K2/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Introduction to UNIX and Linux	12 hours

History-Architecture of UNIX operating system- Features of UNIX- Basic commands- Working with files and directories- Commands- File types- File access processes permissions redirection- filters- What is Linux?- Distributions- The GNU Project and the Free Software Foundation

Unit:2	Shell Programming in Linux and System Calls and Library	12 hours

VI editor- Shell syntax- variables- conditions and control structures- command execution- simple programs- System calls and library: Read- Write- File and record locking- Adjusting the position of file I/O- Lseek- Close- File creation- Creation of special files- Changing directory, root, owner, mode- stat and fstat

Unit:3	Processes and Signals	12 hours

Introduction of process- Process structure- Process states- Process termination- command line arguments- Process control- Process identifiers- Process relationships- Zombie process- Signals: Sending signals- Signal sets- Threads: Synchronization- Thread attributes- Cancelling Threads

Unit:4	**Inter Process Communication**	**12 hours**
Communication between related processes - popen() and pclose()- Pipes- Communication between unrelated processes - Named pipes (FIFO)- Message queues- Semaphores, Synchronization- Shared Memory- Developing Client-Server applications using IPC		
Unit:5	**Sockets**	**10 hours**
Introduction to Sockets –Types of socket - Socket Connections- TCP sockets- TCP echo client server- UDP sockets- UDP echo client server- Socket options		
Unit:6	**Contemporary Issues**	**2 hours**
Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops		
	Total Lecture hours	**60 hours**

Text Book(s)	
1	Petersen and Richard, LINUX: The Complete Reference, Sixth edition, McGraw Hill, 2007.
2	Richard Stones, Neil Matthew, Beginning Linux Programming, Fourth edition, Wiley, 2008.
3	W. Richard Stevens, Bill Fenner, Andrew Rudoff, UNIX Network Programming, Vol. 1, The Sockets Networking API, Third Edition, Pearson education, Nov 2003.
Reference Books	
1	Richard Blum, Linux Command Line and Shell Scripting Bible, Wiley Publishing, Inc., Indianapolis, Indiana, 2008.
2	Sean Walton, Linux Socket Programming, Sams Publisher, I edition, 2001.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/unix
2	https://lecturenotes.in/subject/455/linux-programming-lp
3	https://linuxconfig.org/linux-command-line-tutorial
4	https://www.guru99.com/unix-linux-tutorial.html
Course Designed By: Dr. R. Porkodi	

List of Programs

1. Write a shell program to check whether the given file is an ordinary file or directory file. If it is an ordinary file do the following
   (a) Check for read permission, if it has read permission then display the contents of it.
   (b) Check for write permission, if it has write permission then update its content.
2. Write a menu driven shell program with the following options
   a. Count no. of lines, words and characters in the given file
   b. Count no. of users currently working in the UNIX operating system
   c. Identify the current working directory
   d. Display the first 10 lines from the given file
   e. Identify the current user
   f. Check whether the given user has logged in or not
   g. Sort the input file which contains only numbers
   h. Count no. of times the given pattern occurred in the given file
3. Write a shell program to send a mail to multiple users using command line Arguments (send mails to at least 5 users)
4. Write a shell program to implement multiple patterns searching in the given file. Inputs are taken from command line.(Use at least 5 patterns)
5. Write a program to explore the given directory content(scanning of directory)
6. Write a program to create the child process using fork () system call. See that the parent should wait until the completion of the child process and display the exit code of the child process.
7. Write a program to create two child processes with different counts of display statements using fork () system call. See that whether the parent process is waiting until the completion of the two child processes.
8. Write a program that illustrates how to handle Ctl+c interrupt during the execution of the program using signal system call and sigaction function.
9. Write a program that illustrates how parent process sends sigalarm signal to child process during the execution of the program.
10. Write a program that illustrates how does write and read operations are handled in pipes using pipe system call.
11. Write a program that illustrates how does write and read operations are handled in pipes using popen and pclose functions.

12. Write a program to create client-server application that illustrates the use of named pipes/FIFOs.
13. Write a program to create client-server application that illustrates the use of shared memory
14. Write a program to create client-server application that illustrates the use of Message queue.

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**M**	**M**	**M**	**L**	**L**	**S**	**S**	**L**	**S**	**S**
CO2	**S**	**S**	**S**	**L**	**L**	**S**	**S**	**M**	**S**	**L**
CO3	**S**	**S**	**S**	**M**	**M**	**S**	**S**	**M**	**M**	**L**
CO4	**S**	**S**	**S**	**L**	**M**	**S**	**S**	**L**	**M**	**L**
CO5	**S**	**S**	**S**	**M**	**M**	**S**	**S**	**M**	**M**	**M**

*S-Strong; M-Medium; L-Low

Course Code	23CS2C2	COMPILER DESIGN	L	T	P	C
Core/Elective/Supportive		CORE	4	0	0	4
Pre-requisite		Basic knowledge on computational theory (Automata and Grammar).	Syllabus Version			2023-2024

Course Objectives:

At the end of the course, the student should be able to do:

- Parsing techniques and different levels of translation.
- Apply the various optimization techniques.
- Use the different compiler construction tools
-

Expected Course Outcomes:

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

1	Remember the different phases of a compiler and the principles behind each phase.	K1/K2
2	Understand the concepts of regular expressions, automata and apply the same to implement lexical analyzer using LEX tool.	K1/K2/K3
3	Understand the concepts of context free grammars and able to know the LR parsers and various methods to generate intermediate code.	K2/K3/K4
4	Analyze semantic rules into a parser that performs attribution while parsing.	K1/K3
5	Understand how the code is optimized and the target code is generated.	K3 /K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate;

Unit:1	Introduction to Compilers	8 hours

Translators-Compilation and Interpretation-Language processors –The Phases of Compiler-Errors Encountered in Different Phases-The Grouping of Phases Compiler Construction Tools – Programming Language basics.

Unit:2	Lexical Analysis	10 hours

Need and Role of Lexical Analyzer-Lexical Errors-Expressing Tokens by Regular Expressions Converting Regular Expression to DFA- Minimization of DFA Language for Specifying Lexical Analyzers-LEX-Design of Lexical Analyzer for a sample Language.

Unit:3	Syntax Analysis	1 8 hours

Need and Role of the Parser-Context Free Grammars –Top Down Parsing –General Strategies Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser- LR (0)Item Construction of SLR Parsing Table –Introduction to LALR Parser – Error Handling and Recovery in Syntax Analyzer-YACC-Design of a syntax Analyzer for a Sample Language.

Unit:4	Syntax Directed Translation & Run Time Environment	13 hours
Syntax directed Definitions Construction of Syntax Tree-Bottom-up Evaluation of S-Attribute Definitions- Design of predictive translator – Type Systems-Specification of a simple type checker Equivalence of Type Expressions-Type Conversions – Run-Time Environment: Source Language Issues Storage Organization-Storage Allocation Parameter Passing-Symbol Tables-Dynamic Storage Allocation.		
Unit:5	**Code Optimization and Code Generation**	**9 hours**
Optimization-DAG Optimization of Basic Blocks-Global Data Flow Analysis Efficient Data Flow Algorithms Issues in Design of a Code Generator – A Simple Code Generator Algorithm.		
Unit:6	**Applications and Case Studies**	**2 hours**
Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops		
	Total Lecture hours	**60 hours**

Text Book(s)

1	Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers – Principles, Techniques and Tools", Edition, Pearson Education, 2014.

Reference Book(s)

1	Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers an imprint of Elsevier 2014

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1.	**http://nptel.ac.in/downloads/106108113/**
2.	https://www.intel.com/content/dam/www/programmable/us/en/pdfs/literature/hb/hls/ug-hls.pdf
3.	https://hal.archives-ouvertes.fr/hal-02423363/file/hal-hls-arith-v2.pdf

Course Designed By: Dr.P.B.Pankajavalli

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	L	L	L	L	L	L	L
CO2	M	L	L	M	L	M	L	L	L	M
CO3	L	M	M	L	S	L	L	L	M	M
CO4	M	L	M	M	L	L	L	M	L	L
CO5	M	L	M	S	M	L	L	L	L	S

*S-Strong; M-Medium; L-Low

Course Code	23CS2C3	INTERNET OF THINGS	L	T	P	C
Core/Elective/Supportive		CORE	4	0	0	4
Pre-requisite		Basic knowledge on Sensors, Network Reference Model	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are:
1. To understand the fundamentals of Internet of Things
2. To learn about the basics of IoT protocols
3. To apply the concept of Internet of Things in the real world scenario.

Expected Course Outcomes:

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

1	Understand the basics of IoT and its characteristics	K1/K2
2	Analyze the building blocks of IoT from physical and logical context	K2/K4
3	Apply the functionality of various architectures and protocols of IoT	K2/K3
4	Analyze the importance of Web of Things and Cloud of Things	K1/K4
5	Analyze the applications of IoT in various domains and analyze the real-world design constraints	K3/K4/K5
6	Create a low-cost embedded system	K2/K3/K5/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Wireless Networks Introduction	12 hours

Fundamentals of IoT and Design Methodology

Introduction to Internet of Things: Definition & Characteristics of IoT-Physical Design of IoT- Logical Design of IoT-IoT Enabling Technologies- IoT Levels & Deployment Templates- Four Pillars of IoT. IoT and M2M: Introduction- M2M- Difference between IoT and M2M – SDN and NFV for IoT. IoT Platforms Design Methodology: Introduction- IoT Design Methodology.

Unit:2	Architecture	12 hours

IoT Architecture: M2M High-Level ETSI Architecture - OGC Architecture - IoT Reference Model - Domain Model - Information Model - Functional Model - Communication Model – IoT Reference Architecture.

Unit:3	Internet of Things Protocols and Standards	1 2 hours

Introduction- IoT Ecosystem -IoT Data Link Protocol-Network Layer Routing Protocols- Network Layer Encapsulation Protocols- Session Layer Protocols- Transport Layer Protocols- IoT Management Protocol- Security in IoT Protocols-IoT Challenges

Unit:4	Web of Things and Cloud of Things	1 2 hours

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards– Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

Unit:5	Industry 4.0	10 hours
Introduction- IIoT, Industry 4.0 – IIoT architecture – IIoT Connectivity- Standardization of IIoT - Opportunities – Challenges.		
Unit:6	**Applications and Case Studies**	**2 hours**
Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops		
	Total Lecture hours	**60 hours**

TextBooks	
1	Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.
2	Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
Reference Books	
1	Hwaiyu Geng, "Internet of Things and Data Analytics Handbook", John Wiley & Sons, 2017.
2	Honbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 2015.
3	HYPERLINK "https://www.wiley.com/en-us/search?pq=%7Crelevance%7Cauthor%3AQusay+F.+Hassan" Qusay F. Hassan . (2018). Internet of Things A to Z: Technologies and Applications. Wiley-IEEE Press.
4	Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols‖, Wiley, 2012
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	http://nptel.ac.in/courses/106105166/
2	https://www.edx.org/course/iot-networks-protocols-curtinx-iot3x
3	https://www.coursera.org/learn/iot
4	Emiliano Sisinn, Abusayeed Saifullah, Song Han, Ulf Jennehag, Mikael Gidlund, Industrial Internet of Things: Challenges, Opportunities, and Directions, IEEE Transactions on Industrial Informatics, April 2018
Course Designed By: Dr.P.B.Pankajavalli	

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	L	L	L	L	L	L	L
CO2	M	L	L	M	L	M	L	L	L	M
CO3	L	M	L	L	S	M	M	L	L	L
CO4	M	L	M	M	L	M	L	M	L	M
CO5	M	L	M	S	L	L	L	L	L	S
CO6	L	M	S	M	L	L	L	L	L	L

Course code		DATA MINING TECHNIQUES AND TOOLS	L	T	P	C
Core			2	6	4	4
Pre-requisite		Fundamentals of Database management	Syllabus Version			

Course Objectives:

The main objectives of this course are:

1. To understand the concepts of data mining, KDD process, issues and applications.
2. To know the working of different data mining techniques and its uses.
3. To learn the usage of data mining tools WEKA and R.

Expected Course Outcomes:

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

1	Understand about data mining basics, issues and the working principle of classification technique.	K2
2	Analyze the working of different clustering algorithms.	K2/K3/K4
3	Understand the basic concepts of Association Rule Mining and evaluate the working of various Association Rule Mining algorithms	K2/K3/K4
4	Understand the difference between Web mining, Text mining and Sequence mining.	K2/K3/K4
5	Understand and analyze the working of WEKA and R Tools	K2/K3/K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Data Mining	10 hours

Introduction – Definitions - KDD vs. Data Mining – Data Mining Techniques – Issues and Challenges in Data Mining – Data Mining Application Areas. Classification Technique: Introduction – Decision Trees: Tree Construction Principle - Decision Tree Construction Algorithm – CART – ID3 – Rainforest –CLOUDS.

Unit:2	Clustering Techniques	12 hours

Clustering Paradigms – Partitioning Algorithm - K-Means – K-Medoid Algorithms – CLARA – Hierarchical Clustering - DBSCAN – BIRCH – Categorical Clustering Algorithms – STIRR - Other Techniques. Introduction to Neural Networks - Learning in Neural Networks – Unsupervised Learning - Genetic Algorithm.

Unit:3	Association Rules	15 hours

Concepts - Methods to Discover Association Rules - Apriori Algorithm – Partition Algorithm - Dynamic Item Set Counting Algorithm - FP-Tree Growth Algorithm - Incremental Algorithm - Generalized Association Rule.

Unit:4	Web mining	10 hours

Basic Concepts – Web Content Mining – Web Structure Mining – Web Usage Mining – Text Mining: Text Clustering - Sequence Mining: The GSP Algorithm – SPADE.

Unit:5	**Tools**	**11 hours**
Tools: Need for Data Mining Tools - Introduction to WEKA – The Explorer – The Experimenter – Classification – Regression – Clustering - Nearest Neighbor - Introduction to R - Data Types-Variables Operators - Decision Making - Loop Control – Function – Strings - Vectors - Lists-Matrices – Arrays – Factors - Data Frames – Packages - Charts and graphs - Statistics.		
Unit:6	**Contemporary Issues**	**2 hours**
Discussion on Case Study - Expert Lectures - Online Seminars – Webinars – Workshops.		
	Total Lecture hours	**60 hours**

Text Books	
1	Arun K. Pujari, Data Mining Techniques, Third Edition, Universities Press (India) Limited. Hyderabad, 2009
2	Margaret H. Dunham, Data Mining Introductory and Advanced Topics, Pearson Education 2004.
3	Ian H. Witten, Eibe Frank, Mark A. Hall, Data Mining: Practical Machine Learning Tools and Techniques. Elsevier, 2011.
4	Norman Matloff, “The Art of R Programming a Tour of Statistical Software Design”, William Pollock, 2011.
5	Emmanuel Paradis, “R for Beginners”, Institutes Sciences Evolution, 2005.
Reference Books	
1	Pieter Adriaans, DolfZantinge, Data Mining, Addison Wesley, 2008
2	Jaiwei Han and MichelineKamber, Data Mining Concepts and Techniques, MorganKaufmann Publishers, 2011, 3rd Edition.
3	Dr. Matthew A. North, “Data Mining for the Masses”, A Global Text Project Book, 18 August 2012
4	Roger D. Peng, “R Programming for Data Science”, Lean Publishing, 2015
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec20_cs12/preview
2	https://onlinecourses.nptel.ac.in/noc19_ma33/preview
3	https://www.futurelearn.com/courses/data-mining-with-weka
4	https://onlinecourses.nptel.ac.in/noc21_cs06/preview
5	https://www.coursera.org/specializations/data-mining
6	https://www.mygreatlearning.com/academy/learn-for-free/courses/data-mining1
Course Designed By: **Dr. S. Vijayarani**	

List of Programs

I. WEKA

1. Installation of WEKA Tool
2. Creating new ARFF File
3. Preprocessing
4. Classification – Simple CART, Decision Tree, J48, Random Forest, ID3
5. Clustering – K-means, Hierarchical, DBSCAN
6. Association Rule Mining – Apriori, FP-Growth

II. R

1. Installation of R and packages in R
2. Basic Programs – Data Types, Built-in Functions, Operators, Conditional Statements, Looping Statements, Vectors, Matrix, Factors, Data Frames, Lists
3. Classification – Decision Tree, Random Forest, Naïve Bayes
4. Clustering – K-Means, K-Medoids, CLARA, Hierarchical
5. Association Rule Mining – Apriori

Mapping with programme outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	L	L	M	S	L	M	L
CO2	S	M	S	L	M	M	S	M	M	S
CO3	S	L	S	M	M	M	S	S	M	S
CO4	S	M	S	M	M	S	S	M	L	M
CO5	S	L	S	M	S	S	S	M	S	S

S- Strong; M-Medium; L-Low

Course Code	23CS2C5	DATABASE ADMINISTRATION AND MANAGEMENT	L	T	P	C
Core/Elective/Supportive		CORE	2	0	4	4
Pre-requisite		Knowledge on Programming Logics and Data Storage Systems	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are:

- To teach the basic database concepts, applications, data models, schemas and instances.
- To demonstrate the use of constraints and relational algebra operations.
- To describe the basics of SQL and construct queries using SQL.
- To demonstrate the basic concepts of transaction processing and concurrency control.
- To emphasize the importance of normalization in databases.
- To learn the concepts of distributed database management system

Expected Course Outcomes:

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

1	Demonstrate the basic elements of a relational database management system.	K1/K2/K3
2	Build and manipulate relational database using Structured Query Language.	K1/K2/K3/K4
3	Apply normalization on database design to eliminate anomalies	K2/K4/K5/K6
4	Analyze the issues in transaction processing and concurrency control	K3/K4/K5
5	Design and create Distributed database applications	K2/K3/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	INTRODUCTION TO DATABASE SYSTEM	11 Hours

Introduction to Database Management Systems, Purpose of Database Systems, View of Data, Database Languages, Database System Structure, Data Models, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys.

Unit:2	STRUCTURED AND RELATIONAL QUERY LANGUAGES	12 Hours

SQL Overview: Data Types and Literals, DDL, DML, DCL, TCL. Data Definitions, Basic Structure Operations, Additional Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-Queries. Modifications of Database: Deletion, Insertion and Updates. Joins Expressions, Views, Transactions. Relational Integrity: Domain, Referential Integrities, Enterprise Constraints. Data Types and Schemas, Authorizations, Functions and Procedures, Triggers. Relational Algebra, Tuple relational Calculus, Design Process, ER Diagram, Design Issues, Extended E-R Features, converting E-R & EER diagram into tables.

Unit:3	NORMALIZATION	1 1 hours

Relational Database Design Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Algorithms for Decomposition, 2NF, 3NF, BCNF.

Unit:4	TRANSACTION PROCESSING AND SECURITY	12 hours
Advanced transaction processing and recovery: Defining a transaction in DBMS-Defining a concurrent transaction in DBMS- Serializability and Recoverability- Enhanced lock-based and timestamp-based concepts-Multiple granularity-Multi version schemes-optimistic concurrency control techniques-Deadlock handling-Recovery in DBMS-write Ahead logging protocol-Advanced recovery techniques-Use of SQL in recovery -RAID. Data security: Data security issues - Discretionary access control- Mandatory access control-Role based access control- SQL injection - Statistical databases- Introduction to flow control		
Unit: 5	**DISTRIBUTED DATABASE MANAGEMENT SYSTEM**	**12 hours**
Distributed Database Management Systems: The Evolution of Distributed Database Management Systems - DDBMS Advantages and Disadvantages -Distributed Processing and Databases - Characteristics of Distributed DBMS -DDBMS Components -Levels of Data and Process Distribution -Distribution Transparency -Transaction Transparency-Distributed Database Design - Client/Server vs. DDBMS		
Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Online Courses, Webinars and Case studies		
	Total Lecture hours	**60 hours**

	Text Book(s)
1	Abraham Silberchatz, Henry K.Forth, Sudharshan, Database System Concepts, 7th edition, McGraw Hill, 2020
2	Rini Chakrabarti, Shilbadra Dasgupta, Subhash K. Shinde, Advanced Database Management System", KLSI, Dreamtech press, 2014.
	Reference Books
1	R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems",Seventh Edition, Pearson Education, 2016.
2	Bipin C Desai, "An introduction to Database Systems", Galgotia Publications, 2015.
3	Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill, Third Edition 2004.
4	Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Fifth Edition, McGraw Hill, 2006.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.futurelearn.com/courses/introduction-to-databases-and-sql
2	https://alison.com/courses/diploma-in-databases-and-t-sql-revised/content
3	https://onlinecourses.nptel.ac.in/noc20_cs60/preview
Course Designed By: Dr. D.RAMYACHITRA	

List of Programs

1. Creation of database for the following and writing SQL queries for information retrieval
    a. Employee details
    b. Student details
    c. Hospital management
    d. Railway reservation
    e. Hostel management
2. Performing DML queries on the database
3. Implementation of views and synonyms
4. Implementation of indexes, joins and subqueries
5. Pl/SQL block for implementation of control statements
6. PL/SQL block for implementation of exceptions
7. Implementation of cursor
8. Creation of procedures
9. Creation of functions
10. Creation of triggers

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	L	M	S	L	L	L	M	S
CO2	S	S	M	M	S	L	L	M	M	S
CO3	S	S	S	S	S	L	L	M	S	S
CO4	S	S	S	S	S	L	L	M	S	S
CO5	S	S	S	S	S	L	M	M	S	S

*S-Strong; M-Medium; L-Low

Course code	23CS3C1	VISUAL PROGRAMMING	L	T	P	C
Core/Elective/Supportive		CORE	2	0	4	4
Pre-requisite		Basics of VB language and ASP	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are to:

1. Provide in depth knowledge on VB.NET and ASP.NET to students and making them to develop dynamic web applications, websites using VB and C# object oriented way of programming an elegant way using window controls and web controls.
2. Train the students to enrich their knowledge in ASP.NET user controls, custom controls, data management with ADO.NET.
3. Provide knowledge in developing LINQ related applications and also in developing AJAX application and ASP.NET web services.

Expected Course Outcomes:

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

1	**Understand about .NET framework, .NET features, common language runtime, .NET framework libraries and** the Visual Studio Integrated Development Environment and Programming in C#	K1/K2
2	**Write a console application using classes and objects, constructor, overloading, inheritance, polymorphism, interface, array, exceptions, delegates and events in C# and VB Scirpts. Create window applications using window controls,** Menus and graphics in VB and C#.	K2/K3/K6
3	**Understand the ASP.NET features, ASP.NET page directives and,** To build the application using Web server Controls, Validation Server Controls, Rich Web Controls, Custom Controls, Collections and Lists.	K1/K2
4	**Understand ADO.NET and to** develop the application using **ADO.NET** with VB.NET and ASP.NET, and also LINQ queries.	K2/K3/K4 /K6
5	Building ASP.NET 3.5 Enterprise Applications using ASP.NET Ajax applications and ASP.NET web services.	K2/K3/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction to .NET and C#	10 hours

The .NET Framework – Benefits of .NET - Common Language Runtime – Features of CLR - Compilation and MSIL – The .NET Framework libraries – The Visual Studio Integrated Development Environment – Introduction to C#: Basics of C# - Data types - variable declarations – Implicit & Explicit type casting – Branching and Looping.

Unit:2	Introduction to VB.NET and Object Oriented Concepts in C#.NET & VB.NET	13 hours

Introduction to VB.NET – VB.NET fundamentals – Branching and Looping Statements - Object Oriented Programming in C#.NET and VB.NET: Objects and Functions – Encapsulation – Inheritance - Constructors – Overloading - Inheritance and Polymorphism – Exception - Delegates and Events Arrays – Strings – Exceptions.

Unit:3	**Building Windows Applications and Deployments**	**10 hours**
Building Windows Applications – Creating a Windows Applications using window controls - Windows Forms, Text Boxes, Rich Text boxes, Labels, and link labels – Buttons, Check boxes, Radio buttons, Panels and Group Boxes, List Boxes, Checked List boxes, Combo boxes and Picture boxes, Scroll bars – Calendar control, Timer control – Handling Menus – Dialog boxes – Deploying an Application – Graphics.		
Unit:4	**Basics of ASP.NET, Types of Controls and Collections**	**12 hours**
ASP.NET Basics: Features of ASP.NET – ASP.NET page directives - Building Forms with Web server Controls – Validation Server Controls - Rich Web Controls - Custom Controls – Collections and Lists.		
Unit:5	**ADO.NET and Web Services**	**13-- hours**
Data Management with ADO.NET - Introducing ADO.NET - ADO.NET features - Using SQL Server with VB.NET – Using SQL Server with ASP.NET – LINQ queries – Building ASP.NET 3.5 Enterprise Applications: Developing ASP.NET Ajax applications – ASP.NET web services.		
Unit:6	**Contemporary Issues**	**2 hours**
Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops		
	Total Lecture hours	**60 hours**

Text Book(s)

1	Bill Evjen, Scott Hanselman, Devin Rader, Professional ASP.NET 4 in C# and VB I Edition, 2010, Wiley Publishing, Inc.
2	Steven Holzner, Visual Basic.NET Programming Black Book, 2005 Edition, Paraglyph press USA&Dreamtech Press, India.
3	KoGENT Solutions Inc., ASP.NET 3.5 (Covers C# and VB 2008 codes) Black Book, Platinum Edition, Dreamtech press, 2010
4	Jesse Liberty, Programming C#, Fourth Edition, Building .NET Applications with C#, O'Reilly Media publication, 2005

Reference Books

1	Jonas Fagerberg, ASP.NET Core 1.1 Web API For Beginners: How To Build a Web API, The Tactical Guide Book, CSharpSchool.com, 2017.
2	Jesse Liberty, Programming Visual Basic.NET 2003, Second Edition, O Reilly, Shroff Publishers and Distributors Pvt. Ltd. .
3	Andrew Troelsen, „C# and the .NET Platform“, A Press, 2001.
4	Bill Evjen, JasonBeres, et al. Visual Basic.NET Programming Bible, 2002 Edition, IDG books India (p) Ltd.
5	Mridula Parihar et al., ASP.NET Bible, 2002 Edition, Hungry Minds Inc, New York, USA.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.w3schools.com/asp/
2	https://www.tutorialspoint.com/vb.net
3	https://www.tutorialspoint.com/ASP.net
Course Designed By: Dr. R. Porkodi	

List of programs

1. Design an ASP.NET application for Student Registration form. Use all possible controls in form designing.
2. Design an ASP.NET application for Blood donors form. Use all possible controls in form designing.
3. Design an ASP.NET application for Login Registration form. Use all possible controls in form designing.
4. Design an ASP.NET application for Library book issue and return forms. Use all possible controls in form designing.
5. Design an ASP.NET application to implement the scientific calculator .Use at least 15 functions.
6. Design an ASP.NET application to implement the Horoscope details .Use Image button control.
7. Design an ASP.NET application to prepare the schedule of programs for October month using calendar control.
8. Design an ASP.NET application to create advertisements for three companies' products using Adrotator control.
9. Design an ASP.NET application for manipulating employee database with insert, update, delete, count, search and display functions. Use oledb namespace.
10. Design an ASP.NET application for manipulating product database with insert, update, delete, count, search and display functions. Use oledb namespace.
11. Design an ASP.NET application for manipulating library database with insert, update, delete, count, search and display functions. Use oledb namespace.
12. Design an ASP.NET application for manipulating product database with insert, update, delete, count, search and display functions. Use sqlclient namespace.
13. Design an ASP.NET application for manipulating employee database with insert, update, delete, count, search and display functions. Use sqlclient namespace.

14. Design an ASP.NET application for manipulating library database insert, update, delete, count, search and display functions. Use sqlclient namespace.
15. Write a shell program to implement multiple patterns searching in the given file. Inputs are taken from command line.(Use at least 5 patterns)
16. Write a program to explore the given directory content(scanning of directory)
17. Write a program to create the child process using fork () system call. See that the parent should wait until the completion of the child process and display the exit code of the child process.
18. Write a program to create two child processes with different counts of display statements using fork () system call. See that whether the parent process is waiting until the completion of the two child processes.
19. Write a program that illustrates how to handle Ctl+c interrupt during the execution of the program using signal system call and sigaction function.
20. Write a program that illustrates how parent process sends sigalarm signal to child process during the execution of the program.
21. Write a program that illustrates how does write and read operations are handled in pipes using pipe system call.
22. Write a program that illustrates how does write and read operations are handled in pipes using popen and pclose functions.
23. Write a program to create client-server application that illustrates the use of named pipes/FIFOs.
24. Write a program to create client-server application that illustrates the use of shared memory
25. Write a program to create client-server application that illustrates the use of Message queue.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	L	M	S	S	L	L	L
CO2	S	S	S	L	S	S	S	M	L	M
CO3	S	S	S	M	M	S	S	M	M	L
CO4	S	S	S	L	M	S	S	L	M	M
CO5	S	S	S	M	S	S	S	S	M	M

*S-Strong; M-Medium; L-Low

Course code	23CS3C2	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
Core/Elective/Supportive		CORE	4	0	0	4
Pre-requisite		Fundamentals of Software Project Management	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are:

1. To provide in depth knowledge about the basic concepts of software project management, project planning and Step Wise framework in project planning
2. To discuss the Project planning, cost benefit
3. To inculcate continual training and learning to improve group working

Expected Course Outcomes:

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

1	Understand the fundamentals of Software Project Management, Software Project Versus Other Project, Requirement Specification, Information and Control in Organization. Understand the Introduction to step wise Project Planning, Select, Identify Scope and Objectives, Identify Project Infrastructure, Analyse Project Characteristics, Products and Activities.Understand the estimateEffort for each Activity , Identify Activity Risks , Allocate Resources , Review / Publicize Plan , Execute Plan and Lower Levels of Planning.	K2/ K4
2	Understand the Project Evaluation: Introduction , Strategic Assessment, Technical Assessment , Cost Benefit Analysis , Cash Flow Forecasting , Cost Benefit Evaluation Techniques. Understand the Risk Evaluation , Selection of an Appropriate Project App roach, Choosing Technologies, Choice of Process Models , Structured Methods , Rap id Application Development , Waterfall Model, V-Process Model ,Spiral Model. Understand the Software Prototyping , Ways of Categorizing Prototypes, Tools , Incremental Delivery, Selection Process Model.	K2/ K4
3	Understand the fundamentals of Software Effort Estimation : Introduction, Problems with Over and Under Estimates, Basis for Software Estimating, Software Effort Estimation Technique. Understand the fundamental of Albrecht Function Point Analysis, Function Points, Object Points, Procedural Code Oriented Approach. Understand the various types of passes like Forward Pass , Backward Pass, Identifying the Critical Path , Activity Float ,Shortening Project Duration , Identifying Critical Activities, Precedence Networks.	K2/ K4
4	Understand the introduction of Risk Management : Nature of Risk Managing Identification, Analysis, Reducing, Evaluating Z values, Resource Allocation, Nature of Resources. Understand the Requirements of Scheduling, Critical Paths, Counting the Cost, Resource Schedule, Cost Schedule, Scheduling Sequence, Monitoring and Control, Creating the Frame Work. Understand the Collecting the Data, Visualizing the Progress, Cost Monitoring, Prioritizing Monitoring, Change Control.	K2/ K4

5	Understanding the various types of contracts, Managing Contracts, Stages in Contract Placement ,Terms of Contract, Contract Management, Acceptance, Managing People and Organizing Teams. Understand the Organizational Behavior Background, Selecting the Right Person for the Job, Instruction in the Best Methods, Motivation, Decision Making, Leadership, Organizational Structures, Software Quality, Importance, Practical Measures, Product.	K2/ K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Introduction**	**10 hours**

Software Project Management -Software Project Versus Other Project –Requirement Specification –Information and Control in Organization –Introduction to step wise Project Planning –Select –Identify Scope and Objectives -Identify Project Infrastructure –AnalyseProject Characteristics –Products and Activities –Estimate Effort for each Activity –Identify Activity Risks –Allocate Resources -Review / Publicize Plan –Execute Plan and Lower Levels of Planning.

Unit:2	**Project Evaluation**	**12 hours**

Introduction –Strategic Assessment –Technical Assessment –Cost Benefit Analysis –Cash Flow Forecasting –Cost Benefit Evaluation Techniques –Risk Evaluation –Selection of an Appropriate Project App roach –Choosing Technologies –Choice of Process Models –Structured Methods – Rap id Application Development –Waterfall Model –V-Process Model –Spiral Model – Software Prototyping –Ways of Categorizing Prototypes –Tools –Incremental Delivery – Selection Process Model

Unit:3	**Software Effort Estimation**	**15 hours**

Introduction –Problem s with Over and Under Estimates –Basis for Software Estimating – Software Effort Estimation Technique –Albrecht Function Point Analysis –Function Points – Object Points –Procedural Code Oriented Approach –COCOMO –ActivityPlanning –Project Schedules -Projects and activities –Sequencing and Scheduling Activities –Network Planning Models –Formulating a Network Planning –Adding Time Dimension –Forward Pass – Backward Pas s –Identifying the Critical Path –Activity Float -Shortening Project Duration – Identifying Critical Activities –Precedence Networks.

Unit:4	**Risk Management**	**10 hours**

Introduction –Nature of Risk Man aging Identification –Analysis –Reducing –Evaluating –Z values –Resource Allocation –Nature of Resources –Requirements –Scheduling –Critical Paths – Counting the Cost –Resource Schedule –CostSchedule –Scheduling Sequence –Monitoring and Control –Creating the Frame Work -Collecting the Data –Visualizing the Progress –Cost Monitoring –Prioritizing Monitoring –Change Control

Unit:5	**Managing Contracts**	**11 hours**

Introduction –Types of Contract –Stages in Contract Placement –Terms of Contract –Contract Management –Acceptance –Managing People and Organizing Teams –Organizational Behavior Background –Selecting the Right Person for the Job –Instruction in the Best Methods – Motivation –Decision Making –Leadership –Organizational Structures –Software Quality – Importance –Practical Measures –Product.

Unit:6	**Contemporary Issues**	**2 hours**
Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops		
	Total Lecture hours	**60 hours**

Text Books	
1	Bob Hughes (Author), Mike Cotterell (Author), Rajib Mall (Author)- 2 October 2017
2	Software Engineering Project Management, Richard Thayers 2nd Edition 2014
3	Effective Software Project Management, Robert K. Wysocki - 2010
Reference Books	
1	Walker Royce, "Software Project Management , Addition Wesley.
2	DerrelInce, H. Sharp and M. Woodman, "Introduction to Software Project Management and Quality Assurance , Tata McGraw Hill, 1995
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/105/106105218/
2	https://swayam.gov.in/nd1_noc19_cs70/preview
3	https://freevideolectures.com/course/4071/nptel-software-project-management
4	https://www.nptelvideos.com/video.php?id=918
5	https://www.classcentral.com/course/swayam-software-project-management-14294
6	https://www.w3schools.in/sdlc-tutorial/software-development-life-cycle-sdlc/
Course Designed By: **Dr. D. NAPOLEON**	

Mapping with programme outcomes:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**L**	**M**	**M**	**M**	**L**	**L**	**S**	**S**	**L**
CO2	**S**	**M**	**M**	**S**	**S**	**L**	**M**	**S**	**M**	**S**
CO3	**S**	**L**	**L**	**S**	**L**	**M**	**S**	**M**	**M**	**S**
CO4	**S**	**M**	**L**	**L**	**M**	**M**	**S**	**M**	**L**	**M**
CO5	**S**	**L**	**L**	**S**	**M**	**M**	**M**	**S**	**L**	**M**

S- Strong; M-Medium; L-Low

Course code	23CS3C3	CLOUD COMPUTING	L	T	P	C
Core/Elective/Supportive		CORE	4	0	0	4
Pre-requisite		Basic knowledge on software system specifically on operating system	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are to:

1.Understand the different concepts of cloud computing and its services

2.Store and retrieve the data from cloud and can provide the security to the data in cloud

Expected Course Outcomes:

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

1	Articulate the main concepts, key technologies of cloud computing in terms of strengths, limitations and applications.	K1
2	Categorize the architecture and infrastructure of cloud computing such as IaaS and SaaS	K1/K3
3	Explain the concept of virtual machines and virtualization	K3/K4
4	Apply suitable storage algorithms in cloud computing	K3
5	Be expose in broad approaches of migrating into a cloud and mobile cloud computing	K2/K3/K4
6	Describe about the data security concepts in cloud computing	K2/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Introduction	12 hours

Introduction: Cloud Computing Basics: Cloud Computing Overview - Applications of cloud computing - Intranets and the cloud – First movers in the cloud - Benefits - limitations of cloud computing – Security Concerns – Cloud Computing Services – Salesforce.com

Unit:2	Cloud Computing Technology	12 hours

Hardware and Infrastructure – Clients – Security – Network – Services - Cloud Storage – Standards – Cloud Computing at work: Software as a Service – Software Plus Services – Developing Applications

Unit:3	Virtual Machines and Virtualization	12 hours

Introduction - Understanding Virtualization - History of Virtualization – Leveraging Blade Servers – Server Virtualization – Desktop Virtualization – Virtual Networks – Data Storage Virtualization. Data Storage in Cloud: Evolution of Network Storage – Cloud based data Storage – Advantages and disadvantages of Cloud based data storage- Cloud based Backup systems - File Systems – Cloud based Block Storage

Unit:4	Migrating into a Cloud	12 hours

Introduction – Broad approaches of Migrating into cloud – The Seven Step Models of Migrating into a Cloud. Mobile Cloud Computing: Evolution of Mobile Computing – Mobile Cloud EcoSystem – Mobile Players

Unit:5	**Data security in cloud**	**10 hours**
Introduction – Current state of data security – Homo sapiens and Digital Information – Cloud Computing and Data security Risk – Cloud Computing and Identity – The Cloud, Digital Identity and Data Security- Content Level Security- Pros and Cons		
Unit:6	**Introduction to Industry 5.0**	**02 hours**
Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops		
	Total Lecture hours	**6 0 hours**

Text Books

1	Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, " Cloud Computing: A Practical Approach", McGraw Hill
2	Kris Jamsa, " Cloud Computing" Jones and Barlett Student Edition 2014

Reference Books

1	RajkumarByya, James Broberg, AndrzejGoscinski, " Cloud Computing Prnciples and Paradigms", Wiley & sons
2	E-Resources

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://swayam.gov.in/nd1_noc20_cs55/
2	https://nptel.ac.in/courses/106/105/106105223/

Course Designed By: Dr.E.Chandra

Mapping with Programme Outcomes

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	L	L	M	L	L	S	S
CO2	M	M	M	M	M	M	L	S	S	S
CO3	S	S	M	M	M	M	M	S	M	L
CO4	S	S	S	S	L	S	M	S	M	M
CO5	S	S	M	S	L	S	M	M	S	S
CO6	S	S	L	S	S	S	S	M	S	M

S- Strong; M-Medium; L-Low

Course code	23CS3C4	BIG DATA ANALYTICS	L	T	P	C
Core/Elective/Supportive		CORE	2	0	4	4
Pre-requisite		Fundamentals of Database management and Data Mining	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are:

1. To provide in depth knowledge about the basic concepts of Big Data, characteristics and industry examples.
2. To discuss the Hadoop framework, HDFS and MapReduce.
3. To inculcate HBase, Cassandra, HiveQL, Pig, and Neo4j data models.

Expected Course Outcomes:

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

1	Understand about basics of Big Data, Technologies and Applications in various domains.	K2
2	Understand the foundations of Hadoop andHadoopDistributed File System. Design of HDFS and file-based data structures.	K2/K3/K4
3	Analyze the working of Map Reduce and YARN for job scheduling.	K2/K3/K4
4	Evaluate the need and fundamentals of HBase. Apply the Cassandra data model for different applications. Understand the basic commands in HiveQL, Pig and Pig Latin.	K2/K3/K4
5	Analyze the basic concepts and need for Graph databases, create databases and retrieve records using Neo4j. Understand the data visualization and its need.	K2/K3/K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction to Big Data	10 hours

Introduction: What is big data – why big data – convergence of key trends - unstructured data – industry examples of big data – Web analytics - big data and marketing – fraud and big data - risk and big data – credit risk management – big data and algorithmic trading - big data and healthcare – big data in medicine – advertising and big data – big data technologies - cloud and big data– mobile business intelligence – crowd sourcing analytics.

Unit:2	Hadoop	12 hours

History of Hadoop - The Hadoop Distributed File System – components of Hadoop - Analyzing the Data with Hadoop - Design of HDFS – HDFS concepts - Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.

Unit:3	MapReduce	15 hours

MapReduce: MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution –MapReduce types – input formats – output formats.

Unit:4	**Hadoop Eco System**	**10 hours**
HBase – data model and implementations – HBase clients – HBase examples. Cassandra – Cassandra data model –Cassandra examples – Cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation –HiveQL queries-case study.		
Unit:5	**Graph Databases**	**11 hours**
Introduction - Neo4J - Key concept and characteristics -Modeling data for neo4j - Importing data into neo4j - visualizations - neo4j - Cypher Query Language –data visualization.		
Unit:6	**Contemporary Issues**	**2 hours**
Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops		
	Total Lecture hours	**60 hours**

Text Books	
1	Tom White, “Hadoop: The Definitive Guide”, Fourth Edition, O′Reilly Publishers, 2012.
2	Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3	Rik Van Bruggen, “Learning Neo4j”, Second Edition, PacktPubishers, 2014.
Reference Books	
1	Andreas Francois Vermeulen, Ankurgupta, Cindy Gross, David Kjerrumgaard and Scott Shaw, “Practical Hive: A Guide to Hadoop’s Data Warehouse System”, Apress Media publishers, 2016
2	Eric Lubow and Russell Baradberry, Practical Cassandra: A Developer’s Approach, Addison Wesley publishers, 2014.
3	Dirk deRoos, Paul Zikopoulos, Bruce Brown, Roman B. Melnyk,RafaelCoss, “Hadoop For Dummies”, John Wiley & Sons publishers, 2014
4	Hunger, Michael, and Oliver Gierke. Good Relationships: The Spring Data Neo4j Guide Book. C4Media, 2012.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/104/106104189/
2	http://statweb.stanford.edu/~tibs/ElemStatLearn/
3	https://www.edureka.co/blog/big-data-tutorial
4	https://www.coursera.org/learn/big-data-introduction
5	https://cognitiveclass.ai/courses/what-is-big-data
6	https://www.tutorialspoint.com/hbase/index.htm
7	https://www.guru99.com/hive-query-language-built-operators-functions.html

Course Designed By: **Dr. S. Vijayarani**

List of Programs

1. Installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration files.
2. Hadoop Implementation of file management tasks, such as adding files and directories, retrieving files and deleting files.
3. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
4. Hive Installation and Table Operations.
5. Hive Databases, Tables, Views, Functions and Indexes.
6. Neo4j - Crud operations using datasets; Find a relationship between datasets; Construct a graph; String and aggregation operations.
7. Pig Latin scripts - sort, group, join, project, and filter operations.
8. Installation of Cassandra and perform key space and table operation; Crud operations
9. Installation of Hbase and simple operations.

Mapping with programme outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	L	M	L	M	L
CO2	S	M	M	S	S	M	S	L	M	M
CO3	S	L	S	M	S	L	L	M	S	M
CO4	S	M	S	M	M	M	S	S	M	M
CO5	S	L	S	M	M	S	M	S	S	M

S- Strong; M-Medium; L-Low

Course Code	23CS3C5	WIRELESS NETWORKS	L	T	P	C
Core/Elective/Supportive		CORE	2	0	4	4
Pre-requisite		To introduce the students to state of the art wireless network conventions and models	Syllabus Version		22 - 23	

Course Objectives:

The main objectives of this course are to:

1. Learn state-of-the-art wireless technologies and the fundamental principles of electromagnetic wave propagation, and the parameters that dictate its performance.
2. Acquire knowledge in routing protocols for wireless networks.
3. Explore and understand the basic network performance metrics for evaluating and maintaining Quality of Service (QoS) in broadband mobile and wireless communication systems.
4. Comprehend the time synchronization, localization, energy management in wireless sensor network

Expected Course Outcomes:

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

1	Understand the basic WSN technology and supporting protocols, with emphasis place on standardization basic sensor systems and provide a survey of sensor technology.	K1/K2
2	Understand the medium access control protocols and address physical layer issues.	K2/K4
3	Evaluate key routing protocols for sensor networks and main design issues.	K2/K5
4	Analyze transport layer protocols for sensor networks, and design requirements.	K2/K3/K4
5	Understand the Sensor management, sensor network middleware, operating systems.	K2/K3/K4
6	Create and analyze low-power devices equipped with sensing, computation, and wireless communication capabilities.	K4/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Wireless Networks Introduction	10 hours

Evolution of wireless networks – Challenges - Transmission fundamentals: Analog and digital data transmission - Transmission media - Modulation techniques for wireless systems - Multiple access for wireless systems - Performance increasing techniques for wireless networks.

Unit:2	Wireless LAN	12 hours

Introduction to Wireless LANs – WLAN Equipment, Topologies, Technologies, IEEE 802.11 WLAN – Architecture and Services - Physical Layer - MAC Sub Layer –MAC Management Sub Layer, Other IEEE 802.11 Standards.

Unit:3	Wireless Personal Area Networks	1 2 hours
Introduction – Bluetooth: Architecture - Protocol Stack - Physical Connection – Mac mechanism – Frame format – Connection management –Low Rate and High Rate WPAN, ZigBee Technology IEEE 802.15.4: Components – Network topologies – PHY – MAC.		
Unit:4	**Ad-hoc Wireless Networks**	**12 hours**
Introduction- Characteristics of Adhoc Networks - Classifications of MAC Protocols: Connection Based protocols, Reservation Mechanism - Table driven Routing protocols: DSDV, WRP - On Demand routing protocols: DSR,AODV,TORA –Routing Protocol with Efficient Flooding Mechanism: OLSR - Hierarchical routing protocols – CBRP, FSR.		
Unit:5	**Wireless Sensor Networks**	**12 hours**
Introduction - Challenges for wireless sensor networks - Comparison of sensor network with ad-hoc network - Single node architecture: Hardware components - Energy consumption of sensor nodes - Network architecture: Sensor network scenarios - Design principles – Operating systems.		
Unit:6	**Case Studies**	**2 hours**
Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops		
	Total Lecture hours	**60 hours**

Text Books	
1	Nicopolitidis P, "Wireless Networks", John Wiley and Sons, New York, 2010.
2	Vijay K Garg, Wireless Communication and Networking, Morgan Kaufmann Publishers 2010.
3	Siva Ram Murthy C.,Manoj B S, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall, 2012.
Reference Books	
1	Holger Karl and Andreas Willig, "Protocol and Architecture for Wireless Sensor Networks", John Willey Publication, 2011.
2	Kaveh Pahlavan, "Principles of wireless networks", Prentice-Hall of India, 2013.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.te.com/usa-en/industries/sensor-solutions/insights/sensors-sleep-apnea-white-paper.html
2	https://www.bluetooth.com/blog/smart-building-use-cases/
3	https://wballiance.com/wp-content/uploads/2019/03/Case-Study_VAST-Networks-Mobile-Data-Offload.pdf
4	https://www.postscapes.com/agtech/#case-studies
Course Designed By: Dr.P.B.Pankajavalli	

List of Programs

1. Implement the scenario of Pinging Two Machines using Cisco Packet Tracer.
2. Implement the Dynamic Host Configuration Protocol using Cisco Packet Tracer.
3. Implement the scenario of Multilayer Switching using Cisco Packet Tracer.
4. Implement the scenario of connecting IoT Devices using Cisco Packet Tracer.

5. Perform the operation of connecting two machine using Home Group/ Wi-Fi.
6. Write a TCL Script to calculate Packet Delivery Ratio (PDR) of WSN Protocols under using NS2.
7. Write a TCL Script to implement the scenario of data transmission under Wireless Environment using NS2.
8. Write a TCL Script to implement Multicast Networks concept using NS2.
9. Write a TCL Script to implement TCP/UDP connection using NS2.
10. Write a menu driven program for implementing network commands using shell script.

Mapping with programme outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	L	M	S	L	L	M	M	L
CO2	S	L	L	L	S	L	L	L	L	M
CO3	S	M	L	L	S	M	L	L	M	M
CO4	S	M	S	L	M	L	M	M	M	L
CO5	S	S	M	L	M	L	M	L	M	S
CO6	M	M	L	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Elective Papers

Course code	23CS1E1	INFORMATION SECURITY	L	T	P	C
Core/Elective/Supportive		ELECTIVE	4	0	0	4
Pre-requisite		Knowledge in the field of computers and Internet	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are to:

1. Inculcate the student knowledge in information security.
2. To familiarize them about possible threats and vulnerabilities to the system.
3. Enhance their skill in handling risks and ability to advise an individuals seeking protection to their data.

Expected Course Outcomes:

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

1	Understand Information Security, the various phases of the security systems development life cycle and the issues facing by software developers	K2
2	Understand the functions of and relationships among laws, regulations, and professional organizations in information security and to differentiate between laws and ethics	K2
3	Understand risk identification, risk management and risk control Analyze risks based on probability of occurrence Understand the existing conceptual frameworks for evaluating risk controls Do benefit analysis	K2/K4
4	Understand information security blueprint, identify its major components Understand how an organization institutionalizes its policies, standards, and practices using education, training, and awareness programs Understand what contingency planning is and how it relates to incident response planning, disaster recovery planning, and business continuity plans	K2
5	Understand role of access control in computerized information systems, and to identify and discuss widely-used authentication factors Understand and the use of virtual private networks	K2/K3
6	Understand the basic principles of cryptography and the most popular cryptographic tools Analyze the nature and execution of the dominant methods of attack used against cryptosystems	K2/K3/K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction to Information Security	12-- hours

History, What is Security, CNSS Security Model, Components of an Information System, Balancing Information Security and Access, The Systems Development Life Cycle, The Security Systems Development Life Cycle. Communities of interest-Need for security: Threats, Attacks.

Unit:2	**Legal, Ethical and Professional Issues**	**12-- hours**
Law and Ethics in Information Security, International Laws and Legal Bodies, Ethics and Information Security, Codes of Ethics and Professional Organizations Risk Management: An Overview of Risk Management, Risk Identification, Risk Assessment, Risk Control Strategies, Selecting a Risk Control Strategy.		
Unit:3	**Planning for Security**	**11-- hours**
Information Security Policy, Standards and Practices, The Information Security Blueprint, Security Education, Training and Awareness Program, Continuity Strategies.		
Unit:4	**Security Technology**	**11-- hours**
Firewalls and VPNs- Intrusion Detection and Prevention Systems, Honeypots, Honeynets and padded cell systems -Scanning and Analysis Tools- bio metric access control.		
Unit:5	**Cryptography**	**12-- hours**
Cipher Methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for secured communication-Attacks on Cryptosystems.		
Unit:6	**Contemporary Issues**	**2 hours**
Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops		
	Total Lecture hours	**60-- hours**

Text Books	
1	Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, 4th Edition, Course Technology, Cengage Learning.
2	William Stallings, Cryptography and Network Security, Pearson Education, 2000.
Reference Books	
1	Nina Godbole, Information Systems Security, Wiley-2009
2	Micki Krause, Harold F. Tipton, “Handbook of Information Security Management”, Vol 1-3 CRC Press LLC, 2008.
3	Stuart McClure, Joel Scrambray, George Kurtz, “Hacking Exposed”, Tata McGraw- Hill,
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.coursera.org/learn/information-security-data
2	https://nptel.ac.in/courses

Course Designed By:Dr. K. Geetha

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO2	**S**	**S**	**M**	**M**	**M**	**S**	**L**	**S**	**S**	**S**
CO3	**S**	**S**	**M**	**S**	M	**M**	**S**	**S**	**S**	**M**
CO4	**S**	**L**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**M**
CO6	**S**	**M**	**S**	**M**	**M**	**S**	**L**	**S**	**S**	**M**

*S-Strong; M-Medium; L-Low

Course Code	23CS1E2	ARTIFICIAL INTELLIGENCE	L	T	P	C
Core/Elective/Supportive		Elective	4	0	0	4
Pre-Requisite		Basic knowledge on understanding and analyzing the problems strategies.	Syllabus Version		2023-2024	

Course Objective:

The main objectives of this course are:

1. To inculcate the knowledge on approaching and solving the problems using intelligent approach.
2. To provide depth understanding on knowledge representation, inference and learning.
3. To understand the control strategies in planning and production system.
4. To motivate the students to develop models for AI with Expert systems for real world problems.

Expected Course Outcomes:

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

1	Understand the AI foundations, problem-solving strategies using agents and search strategies	K1/K2
2	Present the search strategies for complex environment, game playing and different knowledge representations.	K1/K2
3	Provide knowledge on knowledge reasoning and planning, handling uncertainty and knowledge inference methods.	K2/K4
4	Understand the production control strategies and algorithms for planning.	K2/K3/K4
5	Design and Implement expert systems by building the knowledge base and the inferencing engine.	K3/K4/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	PROBLEM SOLVING	10

Introduction to AI- Foundations of AI – Risks and benefits of AI - Agents and Environments – Structure of Agents - Uninformed Search Strategies- Informed Search Strategies- Heuristic functions - Local Search Algorithm.

Unit:2	SEARCH IN COMPLEX ENVIRONMENT, GAMES AND KNOWLEDGE REPRESENTATION	12

Introduction to Game Playing-Alpha Beta Pruning- Constraint Satisfaction Problems - Knowledge Representation using First order logic- Knowledge Engineering in First Order Logic-Proportional vs First Order Logic.

Unit:3	KNOWLEDGE REASONING AND PLANNING	13

Inference- Forward and Backward Chaining-Unification-Uncertainty-Inference in Bayesian Network – Inference in Temporal models – Hidden Markov Models – Kalman Filters – Dynamic Bayesian Networks – Combining Beliefs and desires under uncertainty – Decision Networks.

Unit:4	PRODUCTION SYSTEM AND PLANNING	13
Introduction to Production system-control strategies-Rete Algorithm-Planning-STRIPS-Planning with state space search-Partial Order Planning-Planning Graphs-Planning, acting in the real world.		
Unit:5	**EXPERT SYSTEM**	**12**
Expert System- Architecture and Roles of Expert System-Typical Expert System-MYCIN-XOON-DART Case Study-Construction of simple reflex agent with sensor and actuator using Arduino.		
	Total Lectures	**60**

Text Books	
1	Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 3rd Edition, Pearson Education / Prentice Hall of India, 2010.
2	Joseph C. Giarratano, Gary D. Riley," Expert Systems: Principles and Programming",4th Edition, 2015.
Reference Books	
1	Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.
2	Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill-2008.
3	W. Patterson, 'Introduction to Artificial Intelligence and Expert Systems', Prentice Hall of India, 2007
4	Prateek Joshi, "Artificial Intelligence with Python", Packt Publishing, 2017.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://onlinecourses.swayam2.ac.in/cec21_cs08/preview
2	https://www.tutorialspoint.com/artificial_intelligence/index.htm
3	https://www.coursera.org/learn/introduction-to-ai
4	https://www.udacity.com/course/intro-to-artificial-intelligence--cs271
Course Designed By: **Dr.R.Porkodi**	

Mapping with programme outcomes:

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**S**	**L**	**M**	**M**	**L**	**L**	**L**	**M**	**M**
CO2	**S**	S	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**
CO3	**S**	**S**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**L**
CO4	**S**	**S**	**M**	M	**M**	**M**	**L**	**L**	**M**	**L**
CO5	**S**	**S**	**M**	**M**	**M**	**L**	**L**	**M**	**M**	**L**

S- Strong; M-Medium; L-Low

Course Code	20CS1E3	BUSINESS INTELLIGENCE	L	T	P	C
Core/Elective/Supportive		Elective	4	0	0	4
Pre-Requisite		No pre-requisite	Syllabus Version		2023-2024	

Course Objective:

The main objectives of this course are:

1. To gain knowledge on business intelligence system, life cycle and techniques used in it.
2. To become familiar with the knowledge delivery and modeling aspects.
3. To learn how to use and apply machine learning models to solve the business problems.

Expected Course Outcomes:

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

1	Understand the concepts of Business Intelligence cycle to take the correct decision at right time.	K1/K2/K4
2	Demonstrate various Business knowledge representations and reporting features.	K2/K3/K4
3	Identification of good operating practices in business environments.	K3/K4
4	Demonstrates the Business Intelligence models in logistics and production domain.	K3/K4/K5
5	Communicate technologies going to rule the future of Business Intelligence.	K3/K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	INTRODUCTION	10

Business Intelligence: Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.

Unit:2	BUSINESS INTELLIGENCE KNOWLEDGE DELIVERY	13

Knowledge Delivery: The business intelligence user types, Standard reports, Interactive Analysis and Adhoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.

Unit:3	ANALYSING EFFICIENCY	12

Efficiency: Efficiency measures – The CCR model: Definition of target objectives- Peer groups – Identification of good operating practices; cross efficiency analysis – virtual inputs and outputs – Other models. Pattern matching – cluster analysis, outlier analysis.

Unit:4	BUSINESS INTELLIGENCE APPLICATIONS	13

Business Intelligence Applications: Marketing models – Logistic and Production models – Case studies.

Unit:5	FUTURE OF BUSINESS INTELLIGENCE	12
Future of Business Intelligence: Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.		
	Total Lectures	**60**
Text Books		
1	Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9th Edition, Pearson 2013.	
Reference Books		
1	Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making", Addison Wesley,	
2	David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager"s Guide", Second Edition, 2012.	
3	Cindi Howson, "Successful Business Intelligence: Secrets to Making BI a Killer App", McGraw-Hill, 2007.	
4	Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2009	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.classcentral.com/course/swayam-business-analytics-for-management-decision-10050	
2	https://www.coursera.org/specializations/business-analytics	
3	https://www.udacity.com/course/business-analytics-nanodegree--nd098	
4	https://www.tutorialspoint.com/business_analysis/business_analysis_quick_guide.htm	
Course Designed By: **Dr.R.Porkodi**		

Mapping with programme outcomes:

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**S**	**L**	**S**	**M**	**L**	**L**	**L**	**M**	**M**
CO2	**S**	S	**M**	**M**	**M**	**M**	**L**	**M**	**S**	**S**
CO3	**S**	**S**	**M**	**S**	**M**	**M**	**L**	**L**	**M**	**S**
CO4	**S**	**S**	**S**	**S**	**M**	**M**	**L**	**L**	**S**	**S**
CO5	**S**	**L**	**S**	**S**	**M**	**L**	**L**	**M**	**S**	**S**

S- Strong; M-Medium; L-Low

Course code	23CS2E1	DATA PRIVACY AND SECURITY	L	T	P	C
Core/Elective/Supportive		ELECTIVE	4	0	0	4
Pre-requisite		Basic knowledge about databases, data structures and networking concepts	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are:

1. To understand the importance of data privacy and security.
2. To learn about the privacy preservation methods for protecting various kinds of data
3. To study the significant privacy regulations.
4. To implement security policies and security controls for information and system protection

Expected Course Outcomes:

1	Understand the need for data sharing. Analyze the necessity of different privacy-preserving methods	K1 / K4
2	Apply the privacy-preserving methods for various types of data and evaluate their performance	K2/K3/K5
3	Understand the privacy regulations formed by the different countries	K2 / K3
4	Remember and evaluate the security policies. Identify the system vulnerabilities	K1/K5/K6
5	Assess the security using tools. Apply the information security policies and standards for device management	K5/K4/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction	10 hours

Data Privacy and its Importance - Need for Sharing Data - Methods of Protecting Data - Importance of Balancing Data Privacy and Utility – Introduction to Anonymization Design Principles - Nature of Data in the Enterprise Static Data Anonymization on Multidimensional Data: Introduction - Classification of Privacy Preserving Methods - Classification of Data in a Multidimensional Data Set - Group-Based Anonymization

Unit:2	Static Data Anonymization on Complex Data Structures	12 hours

Introduction - Privacy Preserving Graph Data - Privacy Preserving Time Series Data - Privacy Preservation of Longitudinal Data - Privacy Preservation of Transaction Data - Static Data Anonymization: Threats to Anonymized Data - Threats to Data Structures - Threats by Anonymization Techniques

Unit:3	Privacy Regulations	12 hours

Introduction - UK Data Protection Act 1998. - Federal Act of Data Protection of Switzerland 1992 - Payment Card Industry Data Security Standard (PCI DSS) - The Health Insurance Portability and Accountability Act of 1996 (HIPAA): Effects of Protection - Anonymization Considerations - Anonymization Design for HIPAA - Explicit Identifiers - Quasi-Identifiers - Sensitive Data. - Anonymization Design Checklist

Unit:4	**Data Security**	**12 hours**
Securing Unstructured Data: Structured Data vs. Unstructured Data – At Rest, in Transit and in Use – Approaches to secure Unstructured Data – Newer Approaches to Secure Unstructured Data. Information Rights Management: Overview – IRM Technology Details – Getting Started with IRM. Encryption: History of Encryption – Symmetric Key Cryptography - Public Key Cryptography		
Unit:5	**Storage and Database Security**	**12 hours**
Storage Security: Evolution – Modern Storage Security – Risk Remediation – Best Practices. Database Security: General Concepts – Database Security Layers – Database-Level Security – Database Backup and Recovery – Database Auditing and Monitoring		
Unit:6	**Contemporary Issues**	**2 hours**
Discussion on case study - Expert lectures - Online seminars − Webinars − Workshops		
	Total Lecture hours	**60 hours**

Text Books	
1	Venkataramanan, Nataraj, and Ashwin Shriram. Data Privacy: Principles and Practice. CRC Press, 2017.
2	Rhodes-Ousley, Mark. Information Security: The Complete Reference, Second Edition, Information Security Management: Concepts and Practice. New York, McGraw-Hill, 2013.
Reference Books	
1	David Salomon, Data Privacy and Security, Springer, 2003
2	Andrew Vladimirov Michajlowski, Konstantin, Andrew A. Vladimirov, and Konstantin V. Gavrilenko. Assessing Information Security: Strategies, Tactics, Logic and Framework. IT Governance Ltd, 2010
3	William Stallings, Lawrie Brown, Computer Security: Principles and Practice, 3rd edition, Pearson, 2014.
4	Serge Gutwirth, Ronald Leenes, Paul De Hert, Data Protection on the Move – Current Developments in ICT and Privacy/Data Protection, Springer, 2016
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://onlinecourses.nptel.ac.in/noc22_cs37/preview
2	https://onlinecourses.nptel.ac.in/noc21_cs28/preview
3	https://www.coursera.org/learn/privacy-law-data-protection
4	https://www.coursera.org/learn/data-security-privacy
5	https://www.edx.org/learn/data-privacy
6	https://www.udemy.com/course/data-security-and-privacy-training/
Course Designed By: **Dr. S. Vijayarani**	

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**S**	**M**	**M**	**M**	**S**	**S**	**L**	**M**	**L**
CO2	**S**	**M**	**S**	**S**	**M**	**S**	**L**	**M**	**S**	**S**
CO3	**S**	**S**	**M**	**S**	**S**	**M**	**M**	**S**	**L**	**M**
CO4	**S**	**M**	**S**	**M**	**L**	**S**	**L**	**M**	**S**	**S**
CO5	**S**	**M**	**L**	**S**	**S**	**M**	**S**	**S**	**M**	**M**

S- Strong; M-Medium; L-Low

Course code	23CS2E2	MACHINE LEARNING TECHNIQUES	L	T	P	C
Core/Elective/Supportive		ELECTIVE	2	0	4	4
Pre-requisite		Basic knowledge on mathematics, statistics and good analytical skills	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are to:

1. Introduce the concepts of machine learning
2. Understand supervised and unsupervised learning algorithms
3. Gain knowledge on evaluation of the performance of the machine learning techniques
4. Learn about the advanced learning techniques

Expected Course Outcomes:

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

1	Analyze and apply the machine learning concepts for different problems	K3/K4
2	Understand and implement the supervised learning algorithms	K1/K2
3	Apply the clustering algorithms for various problems	K3
4	Evaluate and test the performance of the learning algorithms	K5
5	Design and create a learning model for real time applications	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	INTRODUCTION	9 hours

Introduction – Definition of learning systems – Goals and applications of Machine Learning – Types of Machine Learning – Machine Learning process – Hypothesis space and Version space

Unit:2	SUPERVISED LEARNING	12 hours

Linear models for Regression – Linear models for Classification – Decision Tree Learning – Bayesian Learning – Naïve Bayes – Ensemble Methods – Bagging – Boosting – Support Vector Machines.

Unit:3	EVALUATION	11 hours

Performance Evaluation metrics – ROC Curves – Validation methods – Bias-variance decomposition – Model complexity

Unit:4	UNSUPERVISED LEARNING	12 hours
Clustering – K-means – K-mode- K-median – Hierarchical clustering – DBSCAN – Principal Component Analysis – Independent Component Analysis		
Unit:5	**ADVANCED LEARNING**	**14 hours**
Sampling – Basic sampling methods – Monte Carlo – Gibbs Sampling – Computational Learning theory – Reinforcement learning – Markov Decision Processes.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars - webinars		
	Total Lecture hours	**60 hours**

Text Book(s)

1	Tom Mitchell, "Machine Learning, McGraw-Hill, UK, 2017
2	Ethem Alpaydin, "Introduction to machine learning", MIT Press, Third Edition, 2014.

Reference Books

1	Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Chapman and Hall, CRC Press, Second Edition, 2014.
2	Shalev-Shwartz, Shai, Shai Ben-David, Understanding Machine Learning: From theory to algorithms, Cambridge University Press, 2014.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://onlinecourses.nptel.ac.in/noc20_cs29/preview
2	https://www.coursera.org/learn/machine-learning

Course Designed By:**Dr.D.RAMYACHITRA**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	L	M	S	L	L	L	M	S
CO2	S	S	M	M	S	M	L	M	L	S
CO3	S	S	S	S	M	M	M	L	L	S
CO4	S	S	S	M	S	L	L	M	M	S
CO5	S	S	S	S	S	L	M	L	M	S

*S-Strong; M-Medium; L-Low

Course Code	23CS2E3	HEALTH CARE ANALYTICS	L	T	P	C
Core/Elective/Supportive		Elective	4	0	0	4
Pre-Requisite		Fundamentals of Data mining	Syllabus Version		2023-2024	

Course Objective:

The main objectives of this course are:

1. To understand the various formats of electronic health care information and its challenges.
2. To learn depth knowledge on the techniques used to analyse health care data.
3. To understand the various analytical methods on processing healthcare data and privacy preservation of health care data.

Expected Course Outcomes:

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

1	Understand the different formats of healthcare data, resources and its challenges while processing it.	K1/K2
2	Analysis of healthcare data from various data sources like imaging, sensing, signalling and genomic data.	K2/K3/K4
3	Apply analytics in natural language clinical text, biomedical literature and social media text for decision making in healthcare services.	K3/K5
4	Apply clinical predictive models to healthcare data to provide health outcomes in relevant populations of interest.	K3/K4
5	Understand and apply the relevant data analytic models to build decision support systems for healthcare domain.	K3/K4/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	INTRODUCTION TO HEALTHCARE ANALYSIS	10

Introduction to Healthcare Data Analytics- Applications and practical systems for Healthcare – Resources for healthcare data analytics - Electronic Health Records - Components of HER - Coding Systems - Benefits of EHR- Barrier to Adopting HER Challenges- Phenotyping Algorithms.

Unit:2	HEALTHCARE DATA SOURCES AND ANALYSIS	12

Biomedical Image Analysis: Imaging Modalities – Object detection – Segmentation - Mining of Sensor Data in Healthcare: Challenges – Sensor data mining applications – Nonclinical healthcare applications – Biomedical Signal Analysis- Genomic Data Analysis for Personalized Medicine – Types of computational genomics.

Unit:3	HEALTH CARE ANALYTICS	13

Natural Language Processing and Data Mining for Clinical Text- Challenges in processing in clinical reports – Clinical applications - Mining the Biomedical literature – Named entity recognition and extraction - Social Media Analytics for Healthcare – analytics on public health research.

Unit:4	ADVANCED DATA ANALYTICS ON HEALTHCARE	13
Advanced Data Analytics for Healthcare: Review of Clinical Prediction Models- Temporal Data Mining for Healthcare Data- Visual Analytics for Healthcare- Predictive Models for Integrating Clinical and Genomic Data- Information Retrieval for Healthcare- Privacy-Preserving Data Publishing Methods in Healthcare.		
Unit:5	**CASE STUDIES: HEALTHCARE APPLICATIONS**	**12**
Applications: Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health- Fraud Detection in Healthcare- Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems- Computer-Assisted Medical Image Analysis Systems- Mobile Imaging and Analytics for Biomedical Data.		
	Total Lectures	**60**
Text Books		
1	Chandan K.Reddy, Charu C. Aggarwal, “Health Care data Analysis”, First edition, CRC, 2015.	
2	Vikas Kumar, “Health Care Analysis Made Simple”, Packt Publishing, 2018.	
Reference Books		
1	Nilanjan Dey, Amira Ashour, Simon James Fong, Chintan Bhatl, “Health Care Data Analysis and Management, First Edition, Academic Press, 2018.	
2	Hui Jang, Eva K.Lee, “HealthCare Analysis : From Data to Knowledge to Healthcare Improvement”, First Edition, Wiley, 2016.	
3	Kulkarni, Siarry, Singh, Abraham, Zhang, Zomaya, Baki, “Big Data Analytics in HealthCare”, Springer, 2020.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.coursera.org/courses?query=healthcare%20analytics	
2	https://onlinecourses.nptel.ac.in/noc22_hs40/preview	
3	https://www.udacity.com/course/health-informatics-in-the-cloud--ud809	
Course Designed By: **Dr.R.Porkodi**		

Mapping with programme outcomes:

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	L	S	M	L	L	L	M	M
CO2	S	S	M	M	M	M	L	M	S	S
CO3	S	S	M	S	M	M	L	L	M	S
CO4	S	S	S	S	M	M	L	L	S	S
CO5	S	S	S	S	M	L	L	M	S	S

S- Strong; M-Medium; L-Low

Course code		CYBER SECURITY	L	T	P	C
Core/Elective/Supportive			4	0	0	4
Pre-requisite		Basic knowledge about information, networking concepts	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are:

1. To understand the importance of data privacy and security.
2. To learn the basics of cyber security.
3. To study the security objectives and guidance.
4. To know the security policies and cyber management issues

Expected Course Outcomes:

1	Understand the basic concepts of cyber security. Analyze the necessity of data privacy-preserving methods	K1 / K4
2	Understand the cyberspace and law. Analyze the need for cyber forensic.	K2/K3/K5
3	Remember the security threats and vulnerabilities on data.	K2 / K3
4	Apply the crypto algorithms over data to avoid the cyber theft.	K1/K5/K6
5	Assess the risk management and cost-benefit analysis.	K5/K4/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction	10 hours

Cyber Security – Cyber Security policy – Domain of Cyber Security Policy – Laws and Regulations – Enterprise Policy – Technology Operations – Technology Configuration - Strategy Versus Policy – Cyber Security Evolution – Productivity – Internet – E-commerce – Counter Measures - Challenges.

Unit:2	Cyberspace and the Law & Cyber Forensics	12 hours

Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

Unit:3	Security Threats and Vulnerabilities	12 hours

Virus - Trojan - Rootkits - Backdoors – Botnets - Man in the middle attack - Dos and DDos - Replay attack - Spoofing - Spam - Phishing - privilege escalation - DNS poisoning - Brute force - Dictionary attack - Cross-site scripting - SQL injection - Zero-day attack - Session hijacking - Vulnerability scanning vs Port Scanning - Honeypots - Banner grabbing - Social Engineering.

Unit:4	**Cryptographic Techniques**	**12 hours**
Symmetric key cryptographic techniques: Introduction to Stream cipher, Block cipher: DES, AES, IDEA Asymmetric key cryptographic techniques: principles, RSA, ElGamal, Elliptic Curve cryptography, Key distribution and Key exchange protocols.		
Unit:5	**Risk Analysis & Risk Management**	**12 hours**
Risk Analysis Process - Asset Definition - Threat Identification - Determine Probability of Occurrence - Determine the Impact of the Threat - Controls Recommended - Risk Mitigation - Control Types/Categories - Cost/Benefit Analysis.		
Unit:6	**Contemporary Issues**	**2 hours**
Discussion on case study - Expert lectures - Online seminars − Webinars − Workshops		
	Total Lecture hours	**60 hours**

Text Books	
1	Cryptography and Network security, William Stallings, Pearson Education, 7th Edition, 2016.
2	Cyber Security, Understanding cybercrimes, computer forensics and legal perspectives, Nina Godbole,Sunit Belapure, Wiley Publications, Reprint 2016.
3	Jennifer L, Bayuk J, Heale P, Rohmeyer, Marcus Sachs, Jeffrey Schmidt and Joseph Weiss "Cyber Security Policy Guidebook", John Wiley & Sons ,2012.
Reference Books	
1	Rick Howard, "Cyber Security Essentials", Auerbach Publications, 2011.
2	Cryptography and Network security, Behrouz A. Forouzan, Debdeep Mukhopadhyay, Mcgraw Hill Education, 2nd Edition, 2011
3	Dan Shoemaker, "Cyber security The Essential Body of Knowledge", Cengage Learning, 2011
4	Richard A, Clarke, Robert Knake, "Cyber war: The Next Threat to National Security & What to Do About It", Ecco, 2010.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https:// nptel.ac.in/courses/106106129
2	https:// nptel.ac.in/courses/106105031
3	https://www.coursera.org/specializations/intro-cyber-security
4	https://www.coursera.org/learn/cybersecurity-for-everyone
5	https://www.edx.org/learn/cybersecurity
6	https://www.udemy.com/topic/cyber-security/
Course Designed By: **Dr. R. Porkodi**	

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**S**	**M**	**M**	**M**	**S**	**S**	**L**	**M**	**L**
CO2	**S**	**M**	**S**	**S**	**M**	**S**	**L**	**M**	**S**	**S**
CO3	**S**	**S**	**M**	**S**	**S**	**M**	**M**	**S**	**L**	**M**
CO4	**S**	**S**	**M**	**S**	**L**	**L**	**L**	**S**	**M**	**M**
CO5	**S**	**M**	**M**	**M**	**L**	**L**	**L**	**M**	**M**	**S**

Course code	20CS3E2	DEEP LEARNING TECHNIQUES	L	T	P	C
Core/Elective/Supportive		ELECTIVE	2	0	4	4
Pre-requisite		Basic knowledge on mathematics, statistics and machine learning concepts	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are to:

1. Understand the principles of neural networks
2. Understand the basic concepts of deep learning
3. Understand and implement the architectures of deep learning.
4. Familiarize with the applications of deep learning

Expected Course Outcomes:

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

1	Understand the deep learning concepts and apply for different problems	K2/K3
2	Design and apply Convolutional and Recurrent Neural Networks	K1/K3
3	Understand and evaluate different deep learning architectures	K2/K5
4	Design and create deep learning applications	K6
5	Analyze the role of deep learning models in image processing	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	BASICS OF NEURAL NETWORKS	9 hours

Basics of neural networks - Basic concept of Neurons – Perceptron Algorithm – Feed Forward and Back Propagation Networks.

Unit:2	INTRODUCTION TO DEEP LEARNING	12 hours

Introduction to deep learning - Feed Forward Neural Networks – Gradient Descent – Back Propagation Algorithm – Vanishing Gradient problem – Mitigation – RelU Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Nestors Accelerated Gradient Descent – Regularization – Dropout.

Unit:3	CONVOLUTIONAL & RECURRENT NEURAL NETWORK	11

Convolutional neural networks - Kernel Filters – Multiple Filters - CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning - Introduction to RNNs, Unfolded RNNs, Seq2Seq RNNs, LSTM, RNN applications

Unit:4	DEEP LEARNING ARCHITECTURES	12

LSTM, GRU, Encoder/Decoder Architectures – Autoencoders – Standard- Sparse – Denoising – Contractive- Variational Autoencoders – Adversarial Generative Networks – Autoencoder and DBM

Unit:5	**APPLICATIONS OF DEEP LEARNING**	**14**
Applications of deep learning - Image Segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative Adversarial Networks – Video to Text with LSTM Models – Attention Models for Computer Vision		
Unit:6	**Contemporary Issues**	**2**
Expert lectures, online seminars - webinars		
	Total Lecture hours	**60**

Text Book(s)	
1	Ian Good Fellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2017.
2	Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.

Reference Books	
1	Francois Chollet, “Deep Learning with Python”, Manning Publications, 2018.
2	Phil Kim, “Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial
3	Ragav Venkatesan, Baoxin Li, “Convolutional Neural Networks in Visual Computing”, CRC
4	Navin Kumar Manaswi, “Deep Learning with Applications Using Python”, Apress, 2018.
5	Joshua F. Wiley, “R Deep Learning Essentials”, Packt Publications, 2016.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://onlinecourses.nptel.ac.in/noc20_cs11/preview
2	https://www.coursera.org/specializations/deep-learning

Course Designed By: **Dr.D.RAMYACHITRA**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	L	M	S	L	L	L	M	S
CO2	S	S	M	M	S	L	L	M	L	M
CO3	S	M	S	S	M	M	M	L	M	S
CO4	S	S	S	S	S	L	L	M	M	S
CO5	S	S	S	S	M	L	M	L	S	S

*S-Strong; M-Medium; L-Low

Course Code	23CS3E3	SOCIAL MEDIA ANALYTICS	L	T	P	C
Core/Elective/Supportive		ELECTIVE	4	0	0	4
Pre-requisite		Foundations of Data Science Big data framework	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are:

1. To provide an overview of common text mining and social media data analytic activities.
2. To understand the complexities of processing text and network data from different data sources.
3. To enable students to solve complex real-world problems for recommendation systems.
4. To enable the learners to develop skills required for analyzing the effectiveness of social media for business purposes.
5. To familiarize the learners with the concept of social media analytics and understand its significance.
6. To familiarize the learners with the tools of social media analytics.

Expected Course Outcomes:

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

1	Understand the terminologies, metaphors and perspectives of social media analytics	K1/K2
2	Apply a wide range of classification, clustering, estimation and prediction algorithms on Textual data.	K3/K4
3	Perform social network analysis to identify important social actors, subgroups and network properties in social media sites.	K2/K4
4	Apply state of the art web mining tools and libraries on realistic data sets as a basis for business decisions and applications.	K2/K3/K4
5	Provide solutions to the emerging problems with social media such as behavior analytics and Recommendation systems	K2/K3/K4
6	Design new ontology-based solutions for opinion extraction, sentiment classification and data summarization problems.	K2/K3/K4/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Foundation for Social Media Analytics	7 hours

Foundation for Analytics: – Digital Gap – Social Media Data Sources – Defining Social Media Data –Data Sources – Estimated vs. Factual Data Sources – Data Gathering in Social Media Analytics. From Data to Insights: Actionable Analytics – Focus on objective – Plan to shape data to insights –Choosing a good analytics tool – Data Aggregation calculations and display – Data display – Social-Media and Big data – Potential Challenges. Data Identification: Professional networking sites - social sites – information sharing sites – micro blogging sites – blogs /wikis.

Unit:2	Social Media Analytics Types, Tools and Social Network Landscape	8 hours

Analytics in social media: Types of analytics. Dedicated Vs. Hybrid Tools – Dedicated tools – Hybrid tools – Data Integration Tools – Best Setup. Social Network Landscape: Concept and UX on social networks – Interactivity of social network –Content flow on social network – Interaction Pattern between users – Social-Media as a two-way channel.

Unit:3	Analytic Process and Metrics	1 0 hours
Analytics Process: Analysis – Insight – Investigation beyond social analytics – Shaping a method –analysis cycle – Community Activity – Resources – Attention span – Dynamic cycles – Short Periods –Long Periods – Analyst Mindset – Instinctive Analyst. Metrics: Introduction – Default and custom metrics – Metrics Categories – Graph Types – Metric Capabilities – Metrics and Strategy – Estimated Metrics – Metrics and Tactics.		
Unit:4	**Semantic Web and Social Network Analysis**	**9 hours**
Introduction to Semantic Web: Limitations of current Web, Development of Semantic Web, Emergence of the Social Web. Social Network analysis: Development of Social Network Analysis -Key concepts and measures in network analysis. Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks.		
Unit:5	**Semantic Web and Ontology**	**11 hours**
Knowledge representation on the Semantic web: Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language.		
Unit:6	**Contemporary Issues**	**2 hours**
Online Courses, Webinars and Case studies		
	Total Lecture hours	**60 hours**

	Text Book(s)
1	Alex Goncalves, “Social Media Analytics Strategy - Using Data to Optimize Business Performance”, Alex Goncalves, APress 2017.
2	Peter Mika, “Social Networks and the Semantic Web”, First Edition, Springer 2007.
	Reference Books
1	Ganis, Kohirkar (2016). Social media Analytics, IBM Press PTG, 1st Edition.
2	Nancy Flynn (2012). The Social Media Hand book Policies, and Best Practices, Wiley.
3	Guandong Xu ,Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, First Edition Springer, 2011.
4	Dion Goh and Schubert Foo, “Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively”, IGI Global Snippet, 2008.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.coursera.org/learn/social-media-data-analytics
2	https://www.classcentral.com/course/social-media-analytics-introduction-6916
3	https://und.edu/academics/online/enroll-anytime/comm499.html
Course Designed By: Dr. P.B.Pankajavalli	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	M	L	L	M	M	M
CO2	S	S	S	S	M	L	M	M	S	S
CO3	S	S	S	S	S	M	M	M	S	S
CO4	S	S	S	S	S	M	M	M	S	S
CO5	S	S	S	S	M	M	M	S	S	S
CO6	S	S	S	S	S	M	M	S	S	S

*S-Strong; M-Medium; L-Low

SUPPORTIVE PAPERS

Course code	23CSS01	WINDOWS AND MS WORD	L	T	P	C
Core/Elective/Supportive		SUPPORTIVE	2	0	0	2
Pre-requisite		Knowledge in Basics of Computer	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are:

1. To provide in depth knowledge about the basic concepts of operating system
2. To discuss the file operations and document creation
3. To inculcate knowledge on office tools and techniques, graphics and toolbars

Expected Course Outcomes:

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

1	Understand the basics of operating system and various menus	K2/K3
2	Learn the windows operation and file management	K2/K3/K4
3	Understand and learn the document creation	K2/K3
4	Analyze the usage various tools and macros	K3/K4
5	Create and evaluate the reports generated	K5/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Introduction**	**5 hours**

Getting started –about OS – types of OS – mouse handling – Windows

Unit:2	**File operations**	**6 hours**

Office User Interface – Creating, Saving, Closing and Opening Office files, Working with files

Unit:3	**Document creation and Customization**	**6 hours**

Creating and Editing Documents – Formatting and Customizing Documents.

Unit:4	**Graphics and toolbars**	**8 hours**

Tabs – tables and sorting – graphics – templates writer tools – macros – keyboard shortcuts – means – custom toolbars.

Unit:5	**Report Writing**	**5 hours**

Collaborating with others and Working with reports

	Total Lecture hours	**30 hours**

Text Book(s)

1	Randy Nordell, Microsoft Office 365: In Practice, 2019 Edition
2	Joan Lambert and Curtis Frye, Microsoft Office 2016 Step By Step, Microsoft Press, 2015.

Reference Book(s)

1	Woody Leonhard, Microsoft office 2000, Que 1999.

Course Designed By: **Dr. D.Ramyachitra**

Course Code	23CSS02	INTERNET AND HTML PROGRAMMING	L	T	P	C
Core/Elective/Supportive		SUPPORTIVE	2	0	0	2
Pre-requisite		Basic knowledge in Computer Science	Syllabus Version			2023-2024

Course Objectives:

The main objectives of this course are:
1. To understand the fundamentals of Internet and WWW
2. To learn about the basics of internet services
3. To develop basic web pages using HTML

Expected Course Outcomes:

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

1	Remember the basic concepts of Internet and its connectivity.	K1/K2
2	Understand the concepts of World wide web	K1/K2
3	Gain knowledge on internet services, its address and basic understanding on HTML	K2/K3
4	Understand and apply html tag for web page creation.	K1/K3
5	Create tables, forms and frames in HTML.	K3 /K4 /K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate;

Unit:1	Introduction to Internet	5 hours

Internet Basics –Origin Of Internet – Arpanet - Gateway- Internet Service Providers- Servers- Modems - Dialup Networking - Web Browsers- Routers .

Unit:2	The World Wide Web	5 hours

Introduction to World Wide Web, Web Pages and Contents, Web Clients, Web Servers, Web Applications, Websites – Home Pages –URL - Search Engines.

Unit:3	Internet Services & HTML	1 0 hours

Electronic Mail- FTP- Newsgroups- TCP/IP- DNS - IP addressing- Classification of IP address- History of HTML - Structure of HTML document - Switching between Editor and Browser- Paragraph and Line Break Tags - Adding Comments.

Unit:4	HTML Tags :	**10 hours**
Formatting Text - Ordered List - Unordered List Tag - Creating Links using text and images. Tables: Tables: Creating Columns and Rows- Adding a Border- Adding Column Headings - Adding Spacing and Padding - Adding a Caption - Setting the Table Width and Height.		
Unit:5	HTML Frames & Forms	**10 hours**
Frames : Percentage dimensions - Relative dimensions - Creating two rows Frames - Creating two columns frames - Creating two rows and the second row containing two columns. Forms: Form Tag- Method – Action - Input Tag - Type Attribute: Check box, Hidden, Image, Radio, Reset, Submit, Text.		
	Total Lecture hours	**30 hours**

Text Book(s)

1	Hohn Levine and Margaret Levine , "Internet for Dummies ", Wiley, 14th Edition.

Reference Book(s)

2	John Duckett, "Beginning Web Programming with HTML, XHTML, CSS & JavaScript", Wiley DreamTech Second Edition.

Related Online Contents

1.	https://ncert.nic.in/textbook/pdf/kect107.pdf
2.	https://ftms.edu.my/v2/wp-content/uploads/2019/02/csca0101_ch09.pdf

Course Designed By: Dr.P.B.Pankajavalli

Course code	23CSS03	RELATIONAL DATABASE MANAGEMENT SYSTEMS	L	T	P	C
Core/Elective/Supportive		SUPPORTIVE	2	0	0	2
Pre-requisite		Knowledge in Basics of Computer	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are:

1. To provide in depth knowledge about the basic concepts database systems
2. To discuss the database models and relational database
3. To inculcate knowledge on normalization and query processing

Expected Course Outcomes:

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

1	Understand the basics of database systems and transaction management	K2/K3
2	Learn different database models	K2/K3/K4
3	Understand and learn the structure of relational databases	K2/K3
4	Analyze the application of normalization to tables	K3/K4
5	Create and evaluate the queries for the applications	K5/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction to Database Systems	5 hours

Introduction – purpose of database system data models – database languages – Transaction management – Storage management – DBA – database users – system structure

Unit:2	Database Models	6 hours

E-R model – Hierarchical model – Network Model.

Unit:3	Relational Database	6 hours

Structure of Relational databases – Relational Commercial Languages SQL – Integrity Constraints.

Unit:4	Normalization	8 hours

Normalization – Indexing and Hashing

Unit:5	Query Processing	5 hours

Query Processing – Concurrency Control – Security

	Total Lecture hours	30 hours

Text Book(s)	
1	Abraham Silberchatz, Henry K.Forth, Sudharshan, Database system Concepts, McGraw Hill, 7th Edition, 2020.
Reference Book(s)	
1	Navethe/Elmasri," Fundamentals of Database Systems", Addition Wesley, Sixth Edition, 2010.
Course Designed By: **Dr. D.Ramyachitra**	

Course code	23CSS04	OBJECT ORIENTED PROGRAMMING	L	T	P	C
Core/Elective/Supportive		SUPPORTIVE	2	0	0	2
Pre-requisite		Knowledge in Basics of Computer	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are:

1. To provide knowledge on introductory concepts on object oriented programming
2. To discuss the control statements, classes and the characteristics of object oriented programming
3. To inculcate knowledge on files and exception handling

Expected Course Outcomes:

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

1	Understand the basics of object oriented programming	K2/K3
2	Learn different control statements and objects and classes	K2/K3/K4
3	Understand and learn the characteristics of object oriented programming	K2/K3
4	Understand the application of files and templates	K2/K3
5	Analyze the concepts, evaluate and create object oriented programs	K4/K5/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction to Object Oriented Programming	5 hours

Drawback of structured programming – object oriented language characteristics and fundamentals – programming basics

Unit:2	Control Statements and Classes	6 hours

Loops, decisions – structures and functions – object and classes.

Unit:3	OOPs Characteristics	6 hours

Overloading – Inheritance – Polymorphism

Unit:4	Files and Templates	8 hours

Files – Streams – Templates

Unit:5	Exception and String Handling	5 hours

Exception handling – String handling

	Total Lecture hours	30 hours

Text Book(s)

1	Strongstrup, “The C++ Programming Languages”, Addison Wesley, 4th Edition, 2013

Reference Book(s)	
1	Robert Lafore, “Object Oriented Programming in Turbo C++,” Galgotha publications Ltd , 2001.
Course Designed By: **Dr. D.Ramyachitra**	

Course code	23CSS05	SOFTWARE ENGINEERING	L	T	P	C
Core/Elective/Supportive		SUPPORTIVE	2	0	0	2
Pre-requisite		Knowledge in Basics of Computer	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are:

1. To provide knowledge on introductory concepts on Software Engineering
2. To discuss system analysis and design methods
3. To inculcate knowledge on software testing

Expected Course Outcomes:

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

1	Understand the basics of software engineering	K2/K3
2	Learn requirement analysis and data modeling	K2/K3/K4
3	Understand the design concepts and modular design	K2/K3
4	Understand the application of design methods for real time systems	K2/K3
5	Analyze the analysis, design and testing concepts, evaluate and create software products	K4/K5/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction to Software Engineering	5 hours

Introductions: Evolving role of software – Software characteristics, components and its applications – Generic view of software engineering – Software process models.

Unit:2	System Analysis	6 hours

Systems Analysis: Requirements analysis – Analysis principles – Prototyping Software requirement specification – Data modeling, functional modeling and behavioral modeling

Unit:3	System Design	6 hours

Design concepts: Design and software quality, Design concepts: Abstraction, refinement, modularity, and software architecture control hierarchy structural partitioning and information hiding, Effective modular design: functional independence, cohesion and coupling – design documentation.

Unit:4	Design Methods	8 hours

Design Methods: Data design – Architectural design process: transform mapping and transaction mapping – interface design – procedural design. Design for Real – Time Systems: System considerations -– Real time systems – analysis and simulation of real time systems.

Unit:5	Software Testing	5 hours

Software Testing Methods: Software testing fundamentals. White box testing: basis path testing and

control structure testing – black box testing – testing for specialized environments. Software Testing Strategies: A strategic approach to software testing – unit testing – Integration testing – Validation testing-– System Testing.		
	Total Lecture hours	**30 hours**
Text Book(s)		
1	Roger.S.Pressman, Software Engineering: A Practitioners Approach, Tata McGraw Hill, 2014.	
Course Designed By: **Dr. D.Ramyachitra**		

Course code	23CSS06	MULTIMEDIA SYSTEMS	L	T	P	C
Core/Elective/Supportive		SUPPORTIVE	2	0	0	2
Pre-requisite		Knowledge in Basics of Computer	Syllabus Version		2023-2024	

Course Objectives:

The main objectives of this course are:

1. To provide knowledge on introductory concepts on multimedia
2. To discuss about sound and graphics in multimedia systems.
3. To inculcate knowledge on operations on video, animation and special visual effects.

Expected Course Outcomes:

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

1	Understand the basics of Multimedia systems	K2/K3
2	Learn sound, editing sound files and graphics	K2/K3/K4
3	Understand and learn the video concepts and digital filters	K2/K3
4	Understand the application of animation tools	K2/K3
5	Analyze, evaluate and create systems using special visual effects	K4/K5/K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction to Multimedia	5 hours

Introduction to Multimedia PCs – Components of Multimedia – Multimedia Tools

Unit:2	Sound and Graphics	6 hours

Digital Sound - Editing and Mixing Sound Files – MIDI Creation – Tracking Procedure – Interactive and Non-Interactive Graphics

Unit:3	Video Concepts	6 hours

Digital Image Concepts - Video Capturing – Scanning Images – Digital Filters – Morphing and Warping

Unit:4	Animation	8 hours

Two dimensional and Three-dimensional animation – Animation tools

Unit:5	Imaging Special Visual Effects	5 hours

Bitmap – Brushes – Dissolve – Hotspot Editor - Scrolling

	Total Lecture hours	30 hours

Text Book(s)	
1	TayVaughan, Multimedia Making it Work, Tata McGrawHill Publishing Company, Eigth Edition, 2011.
2.	Kaliyaperumal Karthikeyan, Introduction to Multimedia System, Lambert Academic Publishing, 2011.
Reference Book(s)	
1	Parag Havaldar, Gerald Medioni, Multimedia Systems, Cengage Learning, 2011
2	S.K.Bansal , Multimedia Systems, Aph Publishing Corporation, 2011.
Course Designed By: **Dr. D.Ramyachitra**	

Job Oriented Course

MOBILE APPLICATION DEVELOPMENT	
Name of the Department	**Computer Science**
Name of the Faculty Member i/c With Complete Address with Phone and e-mail	**Dr. R. Porkodi** **Associate Professor** **Department of Computer Science** **Bharathiar University** **Coimbatore – 46** **0422-2428349** **porkodi_r76@buc.edu.in**
Inter / Intra Department Course	**Intra Department Course**
Duration of the Course	**30 Hours**
Eligibility	U.G. in Computer Science/Computer Applications/Information Technology or its equivalent
Number of Candidates to be Admitted	**40**
Mode of the Course	**Both Regular and Online**
Collaboration if any with Companies (if Yes, Full Address of the Company Address , Name of the Contact Person, Phone, e-mail etc.)	---
Registration Procedure	
Job Opportunities:	
• To become mobile app developer in Retail, healthcare sector, Travel and tourism industry, Entertainment industry, Financial services and Media organizations.	
The objectives of the Course are:	
1	Provides a comprehensive overview and focuses on developing multiplatform mobile applications using the Web skills.
2	Strengthen the skills of students in learning hybrid application framework to develop and target multiple mobile platforms with a single codebase.
3	Enrich the knowledge of students in Ionic one of fastest growing mobile application framework.
Course Outcomes:	
On the successful completion of the course, student will be able to:	
1	Understand the basics of mobile devices, app store, development environments, characteristics, history of mobile application frameworks.

2	Understand the mobile application frameworks and setting up java, eclipse, android development components. Creating user interface design for mobile applications and managing application data.
3	Understanding the enterprise requirements and testing methodologies for mobile applications.
4	Understanding the hybrid mobile app development frameworks: CSS3, HTML 5, Iconic, Angular JS, Node.JS and developing the hybrid mobile applications
5	Understanding the mobile app deployment process, Usage of Sqlite, mongo DB and Mysql and IBM BlueMix.

Course Content	Lecture / Practical / Project / Internship

Module 1	Introduction to Mobile Devices: Introduction - Mobile vs. Desktop devices - App Store, Google Play, Windows Store - Development environments - PhoneGAP	**3 hours**
Module 2	Native vs. web applications - Mobile Connectivity Evolution - Characteristics of mobile applications - History of mobile application frameworks	**3 hours**
Module 3	Application models of mobile application frameworks - Setting up an android development environment: setting up java, eclipse, android development components, verify the development environment	**3 hours**
Module 4	User interface design for mobile applications - Managing application data	**3 hours**
Module 5	Addressing enterprise requirements in mobile applications: performance, scalability, modifiability, availability, and security	**3 hours**
Module 6	Testing methodologies for mobile applications - Publishing, deployment, maintenance and management	**3 hours**
Module 7	Hybrid Mobile App Development Frameworks: Introduction to CSS3.HTML5 - Full-Stack Web Development	**3 hours**
Module 8	Hybrid Mobile App Development: Ionic and AngularJS - node.JS	**3 hours**
Module 9	APP deployment: Angular ui-router and Resolve - Using Local Storage(Sqlite) -Databases - mongoDB, MySQL	**3 hours**
Module 10	Ionic Adding Platforms - Building and Deploying the App - Hybrid Mobile Development and IBM BlueMix	**3 hours**

Text Book(s)	
1	Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, Android Programming: The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 3rd edition, 2017.
2	Rajiv Ramnath, Roger Crawfis, and Paolo Sivilotti, Android SDK 3 for Dummies, Wiley.
3	Brian Fling, Mobile Design and Development, O'Reilly Media, Inc., 2009.
Reference Book(s)	
1	Maximiliano Firtman, Programming the Mobile Web, O'Reilly Media, Inc., 2nd ed., 2013.
Related Online Contents	
1	https://developer.android.com/
2	https://www.w3schools.in/category/android-tutorial/
3	https://www.tutorialspoint.com/android/index.htm

SMART APPLICATIONS WITH INTERNET OF THINGS			
Name of the Department		**Computer Science**	
Name of the Faculty Member i/c With Complete Address with Phone and e-mail		Dr.P.B.Pankajavalli Assistant Professor Dept. of Computer Science Bharathiar University, Coimbatore Phone : 2428603, pankajavalli@buc.edu.in	
Inter / Intra Department Course		Intra Department Course	
Duration of the Course		30 Hours	
Eligibility		U.G. in Computer Science/Computer Applications/Information Technology or its equivalent	
Number of Candidates to be Admitted		40	
Mode of the Course		**Both Regular and Online**	
Collaboration if any with Companies (if Yes, Full Address of the Company Address , Name of the Contact Person, Phone, e-mail etc.)		**No**	
Registration Procedure			
Job Opportunities:			
Hardware and device development, Sensor networking professionals			
IoT cloud engineer, Product Manager			
The objectives of the Course are:			
The main objectives of this course are to:			
1	To understand the concept of sensors and microcontrollers		
2	To remember basic syntax in C programming		
3	To apply sensor on microcontrollers		
4	To understand the interfacing of cloud with sensors		
5	To evaluate and visualize the data in the cloud		
Expected Course Outcomes:			
1	Understand the basics of sensors and sensor networks	K2/K3	
2	Create basic arduino code and to gain knowledge on built in code	K1/K2/K4	
3	Develop small IoT prototype using different sensors.	K3/K4	
4	Explore the usage of buzzers, motors, relays and LED lights	K3/K4	
5	Deploy interface with cloud and to visualize data	K2/K3/K5	
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5- Create			
Course Content	**Lecture / Practical** / Project / Internship		
Smart Applications with Internet of Things (30 Hours, 2 credits)			
Module 1	Anatomy of Sensors Networks – Topology of Sensor Network – Type of Sensor Nodes – Sensors- Sensors measures		**2 hours**
Module 2	Analog Sensors- Digital Sensors – Storing senor data – Examples		**2 hours**

Module 3	Understanding the Arduino board – Arduino Board types- Virtronics Simulator for Arduino- Tinkercad -Arduino IDE - Installing and Setting up the Arduino IDE - Connecting the Arduino IDE with devices	**3 hours**
Module 4	Program Structure in C - Basic Syntax - Data Types / Variables / Constants - Operators, Conditional Statements and Loops - Functions, Array and Pointers - Strings and I/O - Arduino C Library functions - Working with Arduino inbuilt examples.	**4 hours**
Module 5	Understanding Sensors and Devices - Understanding basic electronic components and power elements - Understanding the Inputs from Sensors - Working with Temperature Sensors, Ultrasound Sensor, Humidity sensor, Motion Sensor	**3 hours**
Module 6	Working with IR Sensor - Working with Proximity Sensor - Working with Photo Diode - Working with Accelerometer and vibration sensor - Introduction to Raspberry Pi.	**3 hours**
Module 7	Understanding the Outputs - Activating LED Lights - Activating Relays - Activating Buzzer	**3 hours**
Module 8	Running DC Motors - Running - Stepper Motors and Servo Motors	**3 hours**
Module 9	Introduction to cloud – Thingspeak IoT Analytics Platform – API key – Thingspeak login – API Key Process	**3 hours**
Module 10	ESP8266 WI-FI Module – Installation of ESP8266 board package to Arduino IDE – Circuit Diagram – Graph visualization – Introduction to Adafruit, Bolt, Blynk, and IFTTT	**4 hours**

Text Book(s)

1	Michael Margolis, “Arduino Cookbook” 2nd Edition, O'Reilly Media, 2011.
2	Charles Bell, “Beginning Sensor Networks with Arduino and Raspberry Pi”, 1st Edition, Technology in Action, 2013.

Reference Book(s)

1	Arvind Ravulavaru, Enterprise Internet of Things Handbook: Build end-to-end IoT solutions using popular IoT platforms, Packt Publishing Limited, 2018.

Related Online Contents

1	https://electronics-project-hub.com/send-data-to-thingspeak-using-esp8266/
2	https://virtronics.com.au/Simulator-for-Arduino.html
3	https://www.instructables.com/id/ESP8266-to-IFTTT-Using-Arduino-IDE/

Course Designed by: Dr.P.B.Pankajavalli

Value Added Course

REMOTE SENSING AND GIS			
Name of the Department		**Computer Science**	
Name of the Faculty Member i/c With Complete Address with Phone and e-mail		**Dr.D.Napoleon** Assistant Professor Department of Computer Science Bharathiar University Coimbatore – 641 046. Phone **: 9655162717** E mail **: mekaranapoleon@yahoo.co.in**	
Inter / Intra Department Course		**Intra Department Course**	
Duration of the Course		**30 Hours**	
Eligibility		U.G. in Computer Science/Computer Applications/Information Technology or its equivalent	
Number of Candidates to be Admitted		40	
Registration Procedure			
Job Opportunities: GIS Analysts/Sr. GIS Analyst, GIS Engineer, Senior GIS Executive, Sr. Modeling Analyst			
The objectives of the Course are:			
The main objectives of this course are to:			
1	Explain the basics of geographic information systems (GIS) and related areas such as geodesy and remote sensing		
2	Select and acquire both primary and secondary spatial data for use in GIS		
3	Manage, and analyze digital data in raster and vector formats		
4	Describe how common analytical methods and techniques work		
5	Create and present a GIS project.		
Course Content	Lecture / Practical / Project / Internship		
Expected Course Outcomes			
On the successful completion of the course, student will be able to:			
1.	Understand and Remember the basic concepts of remote sensing		K1/K2
2.	Understand and Remember the functionalities of GIS-Photogrammetry		K1/K2
3.	Analyze the Statistical Concepts based on the Images		K2/K4
4.	Analyze and Evaluate the case studies		K3/K4/k5
5.	Create and analyze environmental Monitoring and Assessment		K2/K4/K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create			

Module 1	Fundamentals & Physics of Remote Sensing- Platforms and Sensors-Fundamentals of Geographic Information System-Digital Cartography-Photogrammetry-Surveying and Global Positioning System	**2 hours**
Module 2	Fundamentals of GIS-Photogrammetry, Surveying& GPS-Information Extraction from Satellite Images-Thermal and Microwave Remote Sensing-Hyper spectral Remote Sensing	**2 hours**
Module 3	GIS Data Analysis-Geodesy-Fundamental Statistical Concepts-Geo-statistics & Statistical applications in GIS	**4 hours**
Module 4	Advance Remote Sensing: Data Processing & Applications-Fundamental Statistical Concepts & Geo-Statistics	**4 hours**
Module 5	Application of Geo-informatics-Spatial decision support system	**6 hours**
Module 6	Fundamental of Research-Research Methodology and Project Management	**6 hours**
Module 7	Application of Geo-Informatics and Spatial Decision Support System	**4 hours**
Module 8	Generation of Case Studies(Compulsory Field study)	**4 hours**
Module 9	Environmental Monitoring and Assessment- QGIS Customization Using Python	**4 hours**
Module 10	Customization of Geospatial Tools-GIS Customization Using ArcGIS	**4 hours**

Text Book(s)	
1	George Joseph and C Jeganathan, Fundamentals of Remote Sensing,3rd Edition, January 2018
2	Lillesand , Kiefer, Chipman ,Remote Sensing and Image Interpretation, 6th Edition, January 2011
3	Basudeb Bhatta, Remote Sensing and GIS, 2nd Edition, August 2011

Related Online Contents	
1	https://onlinecourses.nptel.ac.in/noc19_ce41/preview
2	https://www.coursera.org/lecture/spatial-analysis-satellite-imagery-in-a-gis/what-is-remote-sensing-27nfo
3	https://gisgeography.com/remote-sensing-earth-observation-guide/

VALUE ADDED COURSE: CYBER SECURITY AND DIGITAL FORENSICS	
Name of the Department	**Department of Computer Science**
Name of the Faculty Member i/c With Complete Address with Phone and e-mail	**Dr. R. Porkodi** **Associate Professor** **Department of Computer Science** **Bharathiar University** **Coimbatore – 46** **0422-2428349** **porkodi_r76@buc.edu.in**
Inter / Intra Department Course	**Intra Department Course**
Duration of the Course	**30 hrs**
Eligibility	
Number of Candidates to be Admitted	**40**
Mode of the Course	**Both Regular and Online**
Collaboration if any with Companies (if Yes, Full Address of the Company Address , Name of the Contact Person, Phone, e-mail etc.)	---
Registration Procedure	

Job Opportunities:

To become cyber security expert to identify IT breaches, vulnerabilities and threats facing companies in today's digital world.

The objectives of the Course are:

1	To learn the impact of Cyber security risk in an Ethical, Social, and Professional Manner
2	To provide knowledge on data acquisition methods, tools, collecting, preserving and seizing of various digital evidences.
3	To understand the security services for email

Course Outcomes:

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

1	Understand the basics of cyber space, ethical hacking and attacks in cyber world.
2	Understand unauthorized access to digital devices and cyber psychology.
3	Study of Collection of evidences, preservation and forensic analysis.
4	Describe the digital forensics software and hardware, tools, technologies, and practices in forensics.
5	Understanding the email tracking, IP tracking, cracking of passwords and forensic analysis of different artifacts.

Course Content	Lecture / Practical / Project / Internship	
Module 1	Ethical hacking, Attack Vectors, Cyberspace and Criminal Behaviour, Traditional Problems associated with Computer Crimes, brief history of the internet, contaminants and destruction of data, unauthorized access.	**3 hrs**
Module 2	Computer intrusions, white-collar crimes, viruses and malicious code, virus attacks, pornography, software piracy, mail bombs, exploitation, stalking and	**3 hrs**

	obscenity in internet.	
Module 3	Introduction to Digital forensics, Forensic software and handling, forensic hardware and handling. Forensic analysis and its advanced tools, forensic technology and practices.	**3 hrs**
Module 4	Biometrics: face, iris and fingerprint recognition, Audio-video evidence collection, Preservation and Forensic Analysis.	**3 hrs**
Module 5	Investigation Tools, e-discovery, EDRM Models, digital evidence collection and preservation.	**3 hrs**
Module 6	Email investigation, email tracking, IP tracking, email recovery,	**3 hrs**
Module 7	searc and seizure of computer systems, password cracking.	**3 hrs**
Module 8	Forensic Analysis of OS artifact, Internet Artifacts, File System Artifacts, Registry Artifacts, Application Artifacts.	**3 hrs**
Module 9	Report Writing, Mobile Forensic- identification, collection and preservation of mobile evidences.	**3 hrs**
Module 10	Social media analysis, data retrieval, Email analysis from mobile phones.	**3 hrs**

Book(s) for Study	
1	M.T.Britz, Computer Forensics and Cyber Crime, Pearson Education, 2012.
2	Charles P. Fleeger, "Security in Computing", Prentice Hall, New Delhi, 2009.
3	BehrouzA.Forouzan, Cryptography & Network Security, Tata McGraw Hill, India, New Delhi, 2009.
Book(s) for reference	
1	Bruce Schneier, Applied Cryptography, John Wiley & Sons, New York, 2004.
2	William Stallings, Cryptography and Network Security, Prentice Hall, New Delhi, 2006.
3	Neal Krawetz, Introduction to Network Security, Thomson Learning, Boston, 2007.
Related Online Contents	
1	https://www.w3schools.com › cybersecurity
2	https://www.javatpoint.com/cyber-security-tutorial
3	https://www.tutorialspoint.com/python_digital_forensics