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(Permanent Affiliation by Andhra University & Approved by AICTE
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R20 – IV YEAR

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

WITH ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

ANITS- B Tech CSE (AI & ML) CURRICULUM – REGULATIONS –R20

Semester – I	I Year Course structure – CSE(AI & ML)											
Course Code	**Title of the course**	**Category**	**Periods**						**Sessional Marks**	**Semester end Exam marks**	**Total Marks**	**Credits**
			L	**T**	**P**	**E**	**O**	**Total**				
CSM111	Engineering Mathematics – I	BS	3	0	0	1	6	10	40	60	100	3
CSM112	Communicative English	HS	3	0	0	1	3	6	40	60	100	3
CSM113	BASIC ELECTRONICS	ES	3	0	0	1	3	7	40	60	100	3
CSM114	Digital Logic Design	ES	3	0	0	1	3	6	40	60	100	3
CSM115	PROBLEM SOLVING WITH C	ES	3	0	0	1	3	7	40	60	100	3
CSM116	English Language Lab	HS	0	0	3	0	3	6	50	50	100	1.5
CSM117	Problem solving with C – lab.	ES	0	0	3	0	3	6	50	50	100	1.5
CSM118	Environmental Science (Mandatory non-credit course)	BS	3	0	0	0	1	4	50	-	50	-
Total			**18**	**0**	**6**	**3**	**25**	**52**	**350**	**400**	**750**	**18**

Semester - II	I Year Course structure – CSE (AI & ML)											
Course Code	**Title of the course**	**Category**	**Periods**						**Sessional Marks**	**Semester end Exam marks**	**Total Marks**	**Credits**
			L	**T**	**P**	**E**	**O**	**Total**				
CSM121	Engineering Mathematics – II	BS	3	0	0	1	6	10	40	60	100	3
CSM122	Engineering Physics	BS	3	0	0	1	4	8	40	60	100	3
CSM123	Engineering Chemistry	BS	3	0	0	1	4	8	40	60	100	3
CSM124	ELEMENTS OF ELECTRICAL ENGINEERING	ES	3	0	0	1	4	8	40	60	100	3
CSM125	Engineering Drawing	ES	2	0	3	1	3	9	40	60	100	3.5
CSM126	Engineering Physics Lab.	BS	0	0	3	0	1	4	50	50	100	1.5
CSM127	Engineering Chemistry Lab.	BS	0	0	3	0	1	4	50	50	100	1.5
CSM128	Engineering Workshop	ES	0	0	3	0	1	4	50	50	100	1.5
CSM129	Human Values and Professional Ethics(Mandatory non-credit course)	HS	3	0	0	0	1	4	50	-	50	-
Total			**17**	**0**	**12**	**5**	**25**	**59**	**400**	**450**	**850**	**20**

Semester – I	II Year Course structure – CSE(AI & ML)											
CODE	SUBJECT NAME	Category	Periods						Sessional Marks	Semester end Exam marks	Total Marks	Credits
			L	T	P	E	O	Total				
CSM211	DATA STRUCTURES&ALGORITHMS	PC	2	1	0	1	4	8	40	60	100	3
CSM 212	COMPUTER ORGANIZATION AND MICROPROCESSORS	PC	3	0	0	1	4	8	40	60	100	3
CSM 213	JAVA PROGRAMMING	PC	3	0	0	1	4	8	40	60	100	3
CSM 214	DATA COMMUNICATION AN D COMPUTER NETWORKS	PC	3	0	0	1	4	8	40	60	100	3
CSM 215	DISCRETE MATHEMATICAL STRUCTURES	BS	3	0	0	1	4	8	40	60	100	3
CSM 216	DESIGN THINKING & PRODUCT INNOVATION	ES	2	0	2	1	3	8	40	60	100	3
CSM 217	JAVA PROGRAMMING LAB	PC	0	0	3	0	2	5	50	50	100	1.5
CSM 218	DATA STRUCTURES LAB USING C	PC	0	0	3	0	2	5	50	50	100	1.5
CSM 219	Constitution of India & - Intellectual Property Rights	HS	2	0	0	0	1	3	50	-	50	-
Total			**18**	**1**	**8**	**6**	**28**	**61**	**390**	**460**	**850**	**21**

Semester – II	II Year Course structure – CSE(AI & ML)											
CODE	SUBJECT NAME	Category	Periods						Sessional Marks	Semester end Exam marks	Total Marks	Credits
			L	T	P	E	O	Total				
CSM 221	PROBABILITY , STATISTICS AND QUEUING THEORY	BS	3	0	0	1	6	10	40	60	100	3
CSM 222	ARTIFICIAL INTELLIGENCE	PC	2	1	0	2	4	9	40	60	100	3
CSM 223	OPERATING SYSTEMS	PC	3	0	0	1	4	8	40	60	100	3
CSM 224	PYTHON PROGRAMMING	PC	3	0	0	1	4	8	40	60	100	3
CSM 225	THEORY OF COMPUTATION AND COMPILERS	PC	2	1	0	1	4	8	40	60	100	3
CSM 226	DESIGN & ANALYSIS OF ALGORITHMS	PC	2	1	0	1	4	8	40	60	100	3
CSM 227	***PYTHON PROGRAMMING LAB***	PC	0	0	***3***	***0***	***1***	4	***50***	***50***	100	1.5
CSM 228	***COMPUTER ORGANIZATION & MICRO PROCESSOR INTERFACING LAB***	***PC***	0	0	***3***	***0***	***1***	4	***50***	***50***	***100***	1.5
CSM 229	***OPERATING SYSTEM LAB***	***PC***	0	0	***3***	***0***	***1***	4	***50***	***50***	***100***	1.5
Total			**15**	**3**	**9**	**7**	**29**	**63**	**390**	**510**	**900**	**22.5**

Semester – I	III Year Course structure – CSE(AI & ML)											
CODE	SUBJECT NAME	Category	Periods						Sessional Marks	Semester end Exam marks	Total Marks	Credits
			L	T	P	E	O	Total				
CSM 311	OPEN ELECTIVE -I*(Block Chain as EC)	OE	3	0	0	1	2	6	40	60	100	3
CSM 312	PROFESSIONAL ELECTIVE -I	PE	3	0	0	1	2	6	40	60	100	3
CSM 313	MACHINE LEARNING	PC	3	0	0	1	2	6	40	60	100	3
CSM 314	COMPETITIVE PROGRAMMING	SOC	2	1	0	1	5	9	40	60	100	3
CSM 315	DATA BASE MANAGEMENT SYSTEMS	PC	3	0	0	1	4	8	40	60	100	3
CSM 316	***MACHINE LEARNING LAB***	***PC***	0	0	***3***	***0***	1	4	***50***	***50***	100	1.5
CSM 317	***DATA BASE MANAGEMENT SYSTEMS LAB***	***PC***	0	0	***3***	***0***	1	4	***50***	***50***	100	1.5
CSM 318	***COMPETITIVE PROGRAMMING LAB***	***SOC***	0	0	3	0	1	4	***50***	***50***	100	1.5
CSM 319	**QA-I &SOFT SKILLS**	HS	0	0	3	0	1	4	***100***	***0***	100	1.5
CSM 31A	***SUMMER INTERNSHIP-INDUSTRY -1***	***PR***	0	0	***0***	***0***	***1***	1	***100***	***0***	***100***	2
Total			**14**	**1**	**12**	**5**	**20**	**52**	**550**	**450**	**1000**	**23**

Semester - II	III Year Course structure – CSE(AI & ML)											
CODE	SUBJECT NAME	Category	Periods						Sessionals Marks	Semester end Exam marks	Total Marks	Credits
			L	T	P	E	O	Total				
CSM 321	OPEN ELECTIVE -II*	OE	3	0	0	1	2	6	40	60	100	3
CSM 322	PROFESSIONAL ELECTIVE -II	PE	3	0	0	1	2	6	40	60	100	3
CSM 323	PROFESSIONAL ELECTIVE -III	PE	2	1	0	1	5	9	40	60	100	3
CSM 324	OBJECT ORIENTED SOFTWARE ENGINEERING	PC	3	0	0	1	4	8	40	60	100	3
CSM 325	WEB TECHNOLOGIES	PC	2	1	0	1	4	8	40	60	100	3
CSM 326	DEEP LEARNING	PC	3	0	0	1	4	8	40	60	100	3
CSM 327	***WEB TECHNOLOGIES LAB***	***PC***	0	0	***3***	***0***	***1***	4	***50***	***50***	100	1.5
CSM 328	***DEEP LEARNING LAB***	***PC***	0	0	***3***	***0***	***1***	4	***50***	***50***	100	1.5
CSM 329	**QA-II&VERBAL ABILITY**	HS	0	0	3	0	1	4	***100***	***0***	100	1.5
Total			**16**	**2**	**9**	**6**	**24**	**57**	**440**	**460**	**900**	**22.5**

Semester I	IV Year Course structure – CSM(AI & ML)											
CODE	SUBJECT NAME	Category	Periods						Sessionals Marks	Semester end Exam marks	Total Marks	Credits
			L	T	P	E	O	Total				
CSM 411	OPEN ELECTIVE -III* (React JS)	OE	3	0	0	1	2	6	40	60	100	3
CSM 412	PROFESSIONAL ELECTIVE -IV	PE	3	0	0	1	2	6	40	60	100	3
CSM 413	PROFESSIONAL ELECTIVE -V/MOOC	PE	3	0	0	1	3	7	40	60	100	3
CSM 414	INTRODUCTION TO INTELLIGENT SYSTEMS	HS	3	0	0	0	2	5	40	60	100	3
CSM 415	ARTIFICIAL INTELLIGENCE IN ROBOTICS	SOC	2	1	0	1	4	8	40	60	100	3
CSM 416	***OOSE LAB***	***PC***	0	0	***3***	***0***	***1***	4	***50***	***50***	***100***	1.5
CSM 417	***ARTIFICIAL INTELLIGENCEIN ROBOTICS- LAB***	***SOC***	0	0	***3***	***0***	***1***	4	***50***	***50***	***100***	1.5
CSM 418	***PROJECT PHASE 1***	***PR***	0	0	***3***	***0***	***1***	4	***100***	***0***	***100***	2
CSM 419	***SUMMER INTERNSHIP-INDUSTRY -2***	***PR***	0	0	***0***	***0***	***1***	1	***100***	***0***	***100***	2
Total			**14**	**1**	**9**	**4**	**17**	**45**	**500**	**400**	**900**	**22**

Semester II	IV Year Course structure – CSM(AI & ML)											
CODE	SUBJECT NAME	Category	Periods						Sessionals Marks	Semester end Exam marks	Total Marks	Credits
			L	T	P	E	O	Total				
CSM 421	OPEN ELECTIVE -IV*	OE	3	0	0	1	3	7	40	60	100	3
CSM 423	***PROJECT PHASE 2/ INTERNSHIP IN INDUSTRY***	***PR***	0	0	9	0	2	11	***100***	***100***	***200***	8
Total			**3**	**0**	**9**	**1**	**5**	**18**	**140**	**160**	**300**	**11**

Total Credits **160**

*Open Elective can be Inter Department Disciplinary Course, Emerging Courses or MOOC. Final decision will be taken by the department.

PROFESSIONAL ELECTIVES	
PE1	•CSM 312(A) Smart Systems Design & Programming •CSM312(B) Advanced Data Structures •CSM312(C) No SQL Data Bases •CSM 312(D) Big Data Analytics
PE2	•CSM322(A) Computer vision •CSM 322(B) Mobile Computing •CSM322(C) Digital Image Processing •CSM322(D) Data warehousing and Data mining
PE3	• CSM323(A) Distributed Operating Systems • CSM323(B) Embedded Systems • CSM323(C) Human Computer Interaction • CSM323(D) Pattern Recognition
PE4	•CSM412(A) Augmented Reality • CSM412(B) Information Retrieval System •CSM 412(C) High Performance Computing • CSM415(D) Natural Language Processing
PE5	• CSM413(A) Internet of Things • CSM413(B) Fuzzy Computing • CSM413 (C) AI&ML in Cyber Security • CSM413(D) Cloud Computing

OPEN ELECTIVES	
OE 1 3rd Yr-Sem -1	Block Chain (as an emerging course)
OE2 3rd Yr-Sem -2	Introduction to Machine Learning
OE3 4th Yr-Sem -1	React JS (as an emerging course) Introduction to Data Analytics(non core)
OE4 4th Yr-Sem -2	MOOCS

REACT JS	
CSM 411	**Credits: 3**
Instruction : 3 Periods/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Pre-requisites:

- Web Technologies (HTML, CSS Java Script)
- Database Management System

Course Objectives:

- To enable the students to make use of React Js Library.
- To build front end user interface using React Js
- To enable the students to build Server rendered applications.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Use and get familiar with installation, components, JSX, Developer Console, Babel, props, events and states.
2.	Utilize framework for developing a React app from scratch.
3.	Build Advanced component functionalities and creating server APIs for performing create, update and delete operations.
4.	Analyze the need for JSX and the Virtual DOM and create forms for accepting user input.
5.	Examine the need for routing and react router components along with dynamic routing.

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	2	-	3	-	-	-	2	-	1	2	-	-
2	2	2	2	-	3	-	-	-	2	-	1	2	-	-
3	2	2	2	-	3	-	-	-	2	-	1	2	-	-
4	2	2	2	-	3	-	-	-	2	-	1	2	-	-
5	2	2	2	-	3	-	-	-	2	-	1	2	-	-

SYLLABUS

UNIT- I **10 Periods**

Introduction to React JS

Case Study: Creating simple voting application.

Setting up your Development environment, Getting started , What is a component, Building product, Making product data driven, React the vote, Updating state and immutability, Refactoring with the Babel plugin transform-class-properties .

Learning Outcomes: At the end of this unit the student will be able to

1. Set up the executing environment for React Js.
2. Work with Developer Console and Apply basic React Js concepts.

UNIT-II: **10 Periods**

Components (Part – I)

Case Study: time-logging app

Getting started, Breaking the app into components , Build a static version of the app, Determine what should be stateful, Determine in which component each piece of state should live, Hard-code initial states, Add inverse data flow .

Learning Outcomes: At the end of this unit the student will be able to

1. Build a static version of the app
2. Determine the components state.

UNIT-III: **10 Periods**

Components and Servers

Components Part II

Case Study: Time-logging app

Updating timers, Deleting timers, Adding timing functionality, Add start and stop functionality.

Servers:

Introduction , server.js, The Server API, Playing with the API, Loading state from the server, client, Sending starts and stops to the server , Sending creates, updates, and deletes to the server .

Learning Outcomes: At the end of this unit the student will be able to

1. Add timing functionality to the components.
2. Work with Server API.

UNIT-IV: **10 Periods**

JSX and the Virtual DOM, Forms:
Case Study: Accepting Data from the user using Forms.
JSX and the Virtual DOM
React Uses a Virtual DOM, Why Not Modify the Actual DOM?, What is a Virtual DOM?, Virtual DOM Pieces, React Element, JSX.
Forms: Forms, Text Input, Remote Data, Async Persistence, Redux

Learning Outcomes: At the end of this unit the student will be able to

1. Use Virtual Dom
2. Implement Forms in React

UNIT-V: **10 Periods**

Routing
What's in a URL? , Building the components of react-router, Dynamic routing with React Router, Supporting authenticated routes.

Learning Outcomes: At the end of this unit the student will be able to

1. Construct routing with React Router.
2. Perform the authentication in Routing.

Text Books:

1. Anthony Accomazzo, "Fullstack React - The Complete Guide to ReactJS and Friends", 2017, Fullstack.io, San Francisco, California

Reference Books :

1. Alex Banks and Eve Porcello "Functional Web Development with React and ReduxLearning React",O'REILLY, 2017
2. Stoyan Stefanov "React Up and Running", O'REILLY, 2022
3. Robin Wieruch "The Road to Learn React", 2017.

Web Resources:
- https://reactjs.org/tutorial/tutorial.html
- https://www.simplilearn.com/tutorials/reactjs-tutorial/how-to-create-a-youtube-clone-using-react

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AUGMENTED REALITY	
CSM 412(A)	**Credits : 3**
Instruction **:** 3 Periods /Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

- Basic knowledge on C and C++
- Basic knowledge on computer graphics Basic mathematical knowledge

Course Objectives:

- To make the candidate understand the importance of augmented reality and its future as an aiding tool
- To check out various hardware and software components for augmented reality applications.
- Learn to build different types of objects that can act as contents for augmented reality.
- To understand various application like of augmented reality and build a small application that works on AR Marker or QR Code.

Course outcomes:

By the end of the course, the student will be able to:	
1.	Explain augmented reality, technologies and its working functionalities.
2.	Use different hardware and software components to build an augmented reality application.
3.	Design 3D or 2D objects that can act as contents for augmented reality application and also to make these objects interact with the real world.
4.	Build a small mobile augmented reality app that works on AR Marker.
5.	Develop various applications in augmented reality.

Mapping of Course Outcomes with Program Outcomes:

CO	**PO**												**PSO**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	1	-	-	-	-	2	2	-	1	-	-	2	1	3
2	2	-	3	3	3	1	-	-	2	-	1	1	-	3
3	3	-	2	1	3	-	-	-	-	-	1	-	-	3
4	2	2	2	2	3	-	-	-	1	-	-	2	-	3
5	3	-	3	2	1	-	-	-	-	-	-	1	-	3

SYLLABUS

UNIT I **10 periods**

Argument that reality: Introduction, origins of augmented reality, explanation of augmented reality with different scenarios, relationship between augmented reality and other technologies. **Augmented reality concepts**: Introduction, how does augmented reality work, concepts related to augmented reality, ingredients of an argument reality experience?

Learning Outcomes: At the end of this unit, Students are able to

1. Explain the origin and history of the augmented reality.
2. Compare the relationship between augmented reality and other related techniques like Multimedia, 3D-Modelling, Real-time Tracking and Registration, Intelligent Interaction, Sensing

UNIT 2 **10 periods**

Augmented reality hardware and software: Introduction, major hardware components for argument a reality systems, major software components for argument that reality systems, software is used to create content for augmented reality applications.

Learning Outcomes: At the end of this unit, Students are able to

1. Discuss about hardware and software components used in AR.
2. Describe the software involved directly with the AR application include environmental acquisition (sensors), sensor integration, application engine, and rendering software (visual, audio, etc.).

UNIT 3 **10 periods**

Augmented reality content and interaction in Augmented reality: what is content, creating visual content like 3-D dimensional objects and today dimensional images, interaction in the real world, Manipulation, navigation.

Learning Outcomes: At the end of this unit, Students are able to

1. Explore the meaning of interaction and how it is carried out in AR environments.
2. Compares interaction in AR with interaction in other interactive media and how that affects participant expectations in AR environments.

UNIT 4 **10 periods**

Mobile augmented reality: Introduction, what is mobile augmented reality, advantages and disadvantages of mobile augmented reality.

Learning Outcomes: At the end of this unit, Students are able to

1. Describe the technologies involved in mobile AR and different architectures for supporting mobile AR.
2. Explain the idea of mobile augmented reality.

UNIT 5 **10 periods**

Augmented reality applications: Introduction, what makes a good documented reality application, application areas.

Learning Outcomes: At the end of this unit, Students are able to

1. Illustrate different application areas as well as different application styles.
2. List and explain different augmented reality applications.

TEXT BOOKS:

1. Alan B Craig, "Understanding Augmented Reality – Concepts and Applications", 1st Edition, Elsevier Publications, 2013

REFERENCES BOOKS:

1. Gregory Kipper," Augmented Reality – An Emerging Technologies Guide to AR", Elsevier Publications, 2012.

Prepared By

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INFORMATION RETRIEVAL SYSTEMS	
CSM 412(B)	**Credits: 3**
Instruction : 3 Periods / Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

Data Structures, Relational Database Systems.

Course Objectives:

- Study fundamentals of DBMS, Data Warehouse and Digital Libraries.
- Learn various pre-processing techniques and indexing approaches in text mining
- Understand various clustering approaches and similarity measures
- Study various search techniques in information retrieval systems
- Explore various cognitive approaches used in text retrieval systems and evaluation approaches

Course Outcomes:

By the end of the course, the student will be able to:	
1	Demonstrate the functional overview and capabilities of the Information Retrieval System.
2	Apply indexing and various types of data structures for Information Retrieval.
3	Demonstrate and analyze the Automatic Indexing and Clustering.
4	Explain different user search techniques.
5	Describe the Text Searching Techniques and measures that can be used in evaluating Information Retrieval Systems

Mapping of course outcomes with program outcomes:

CO	**PO**												**PSO**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2	1	-	-	-	-	-	-	1	1	-	1	-	-
2	2	2	2	2	1	1	-	-	1	1	-	1	2	2
3	2	2	2	2	1	1	-	-	1	1	-	1	2	2
4	2	1	1	1	1	1	-	-	1	1	-	1	2	2
5	2	2	2	2	1	1	-	-	1	1	-	1	2	2

SYLLABUS

UNIT-I: **10 Periods**

Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management System, Digital Libraries and Data Warehouses.

Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities.

Learning Outcomes:

1. Focus on the functions available in an Information Retrieval System.
2. Demonstrate various information retrieval system capabilities.

UNIT-II: **10 Periods**

Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction.

Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models

Learning Outcomes:

1. Apply the indexing and cataloging for information System
2. Apply various types of data structures.

UNIT-III: **10 Periods**

Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages.

Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters.

Learning Outcomes:

1. Demonstrate the various indexing techniques that stores the information.
2. Analyze the techniques that can be used to cluster the terms and documents

UNIT-IV: **10 Periods**

User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, weighted searches of Boolean systems, Searching the Internet and hypertext.

Learning Outcomes:

1. Apply various searching techniques that map between the user search needs and the documents.
2. Explore the importance of ranking and relevance feedback in expanding the user's query.

UNIT-V: **10 Periods**

Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems.

Information System Evaluation: Introduction, Measures used in system evaluation, Measurement example – TREC results.

Learning Outcomes:

1. Describes the hardware and software approaches to text search
2. Describes how to evaluate Information Retrieval Systems focusing on the theoretical and standard metrics used to evaluate information systems.

Text Books:

1. Kowalski, Gerald, Mark T May bury: Information Storage and Retrieval Systems: Theory and Implementation, Second Edition, Kluwer Academic Press, 2002.

Reference Books:

1. Finding Out About: Search Engine Technology from a cognitive Perspective, by Richard, K. Belew, Cambridge University Press, 2000. (for Case Studies)
2. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval data Structures and Algorithms, Prentice Hall, 1992.

Online Resources:

1. https://nlp.stanford.edu/IR-book/information-retrieval.html
2. https://resources.mpi-inf.mpg.de/d5/teaching/ss04/is04/links.htm
3. https://www.lisedunetwork.com/information-retrieval-syste/

HIGH PERFORMANCE COMPUTING	
CSM 412(C)	**Credits : 3**
Instruction : 3 Periods / Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

- Basic fundamentals of Data Structures
- Knowledge on Computer Organization, Computer Networks
- Exposure to Programming skills in C/C++

Course Objectives:

- Introducing different parallel machines
- Describe high performance computing in the context of scientific computing.
- Understand the concepts of parallel processing as it pertains to high-performance computing

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Explain the benefits of Parallel Computing and different parallel computing platforms.
2.	Design efficient Parallel Algorithms for scientific computations.
3.	Program computers with shared memory architecture
4.	Use GPU Computing efficiently for scientific computations.
5.	Apply High Performance Computing to solve real world Problems.

Mapping of course outcomes with program outcomes:

Mapping		**PO**												**PSO**	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	3	3	1	-	-	-	-	1	-	-	1	2	1
	2	3	2	2	2	-	-	-	-	1	-	-	1	1	3
	3	3	3	2	2	2	1	-	-	1	-	-	-	2	1
	4	3	3	3	2	2	2	-	-	1	-	-	-	2	3
	5	3	3	3	3	-	2	-	-	1	-	1	1	2	2

SYLLABUS

UNIT I: Introduction: 10 Periods

Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing, Implicit Parallelism: Trends in Microprocessor Architectures, Dichotomy of Parallel Computing Platforms . (Text Book 1)

Learning Outcomes: At the end of this unit, the students will be able to

1. Explain the impact of Parallel Computing
2. Compare different Parallel Computing Platforms.

UNIT II: Principles of Parallel Algorithm Design: 10 Periods

Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions. Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads Parallel Algorithm Models.

Analytical Modeling of Parallel Programs: Sources of Overhead in Parallel Programs Performance Metrics for Parallel Systems, the Effect of Granularity on Performance, Scalability of Parallel Systems.

(Text Book1)

Learning Outcomes: At the end of this unit, the students will be able to

1. Design parallel algorithms
2. Compare different variety of overheads associated with parallelism.

UNIT III: Programming Shared Address Space Platforms: 10 Periods

Thread Basics, Why Threads?, The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads Controlling Thread and Synchronization Attributes, Thread Cancellation.

(Text Book1)

Learning Outcomes: At the end of this unit, the students will be able to

1. Apply Shared address Space Programming
2. Develop programs using POSIX threads for high performance computing.

UNIT IV: GPU Computing: 10 Periods

Introduction: Heterogeneous Parallel Computing, Architecture of a Modern GPU, Why More Speed or Parallelism, SPEEDING UP REAL APPLICATIONS,

Data parallel computing: Data Parallelism, CUDA C Program Structure, A Vector Addition Kernel, Device Global Memory and Data Transfer, Kernel Functions and Threading, Kernel Launch, CUDA Thread Organization, Mapping Threads to Multidimensional Data.

Learning Outcomes: At the end of this unit, the students will be able to (Text Book2)

1. Explain the impact of GPUs for achieving high performance
2. Develop programs using CUDA threads for high performance computing.

UNIT V: **10 Periods**

Case Studies

Dense Matrix Algorithms: Matrix-Vector Multiplication, Sorting, Quick sort, Bubble Sort and its Variants, Parallel Depth-First Search.

(Text Book1)

Learning Outcomes: At the end of this unit, the students will be able to

1. Multiply dense matrices in parallel.
2. Compare different parallel sorting algorithms.

Text Book:

1. Ananth Grama, George Karypis , Vipin Kumar, Anshul Gupta, "Introduction to Parallel Computing", 2nd edition , Addison Wesley publishers,2003
2. David B. Kirk and Wen-mei W. Hwu, Programming Massively Parallel Processors A Hands-on Approach, 3rd edition, MK Publishers,2016

Reference Book:

1. Gerassimos Barlas , " Multicore and GPU Programming An Integrated Approach " 1st Edition, MK Publishers,2015

Web Resources:

- http://nptel.ac.in/courses/106108055/#
- http://cs.nyu.edu/courses/fall10/G22.2945-001/lectures.html
- http://www.hpc.cam.ac.uk/
- http://www.hpc.cam.ac.uk/getting-help/introtohpc-course/view
- https://hpc.llnl.gov/training/tutorials
- https://www.wolfram.com/training/courses/hpc/
- https://www.epcc.ed.ac.uk/online-courses/courses/online-courses/practical-introduction-hpc

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Prepared By
Mr. S Ratan Kumar, Associate Prof, Dept of CSE
Dr. P.E.S.N. Krishna Prasad, Prof, Dept of CSE

NATURAL LANGUAGE PROCESSING	
CSM 412(D)	**Credits: 3**
Instruction : 3 Periods / Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

- Formal-language/automata theory, Artificial Intelligence, Machine learning

Course Objectives:

- Learn about the lexical, syntactic, and semantic analysis of natural language processing.
- Explore N-gram Language Models for language processing.
- Understand the statistical models for Natural language processing.
- Study the machine translation principles.

Course Outcomes:

By the end of the course, the student will be able to:	
1	Demonstrate Parsing Techniques for Natural Language, Text preprocessing and Tokenization Techniques.
2	Evaluate Language Models through probability distribution and word sequence.
3	Apply word embedding's to find similarity and semantics of the language.
4	Apply Sequence labeling for POS Tagging and Select the appropriate method to evaluate the named entity recognition.
5	Examine Machine Translations and Encoder-Decoder Models for language processing.

Mapping of course outcomes with program outcomes:

CO	**PO**												**PSO**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2	1	-	-	-	-	-	-	-	1	-	2	-	1
2	3	2	2	2	2	-	-	-	-	1	-	1	2	2
3	2	2	2	2	2	-	-	-	1	1	-	1	2	2
4	3	2	2	2	2	1	-	-	1	1	-	1	2	2
5	2	2	1	2	2	1	-	-	1	1	-	1	2	2

SYLLABUS

UNIT-I: Classical Approaches to NLP **12 periods**

Context, The Classical Toolkit-Text preprocessing, Lexical Analysis, Syntactic Parsing, Semantic Analysis, Natural Language Generation.
Text preprocessing-Introduction, Challenges of Text Preprocessing-Character-Set Dependency, Language Dependency, Corpus Dependency, Application Dependency.
Tokenization-Tokenization in space-Delimited Languages, Tokenization on unsegmented languages, Sentence Segmentation-Sentence Boundary Punctuation.

Learning Outcomes: At the end of this unit, the students will be able to

1. Interpret the steps of Natural Language Processing.
2. Summarize the challenges of Text preprocessing- Tokenization, Sentence Segmentation.

UNIT-II: N-gram Language Models **12 periods**

N-Grams, Evaluating Language Models, Generalization and Zeros, Smoothing Kneser-Ney Smoothing, Huge Language Models and Stupid Back off, Advanced: Perplexity's Relation to Entropy.

Learning Outcomes: At the end of this unit, the students will be able to

1. Find the probability distribution over word sequences.
2. Explore N- Gram Evaluating Language Models.

UNIT-III: Vector Semantics and Embedding's **12 periods**

Lexical Semantics, Vector Semantics, Words and Vectors, Cosine for measuring similarity, TF-IDF: Weighing terms in the vector, Pointwise Mutual Information (PMI), Applications of the tf-idf or PPMI vector models, Word2vec, Visualizing Embeddings, Semantic properties of embeddings, Bias and Embeddings, Evaluating Vector Models.

Learning Outcomes: At the end of this unit, the students will be able to

1. Apply similarity measures for language processing
2. Illustrate word embedding techniques for semantic text processing

UNIT-IV: Sequence Labeling for Parts of Speech and Named Entities **12 periods**

English Word Classes, Part-of-Speech Tagging, Named Entities and Named Entity Tagging, HMM Part-of-Speech Tagging, Conditional Random Fields (CRFs), Evaluation of Named Entity Recognition.

Learning Outcomes: At the end of this unit, the students will be able to

1. Construct Sequence labeling for POS Tagging
2. Evaluate Named Entity Recognition for text classification.

UNIT-V: Machine Translation and Encoder-Decoder Models **12 periods**

Language Divergences and Typology, The Encoder-Decoder Model, Encoder-Decoder with RNNs, Attention Beam Search, Encoder-Decoder with Transformers, Some practical details on building MT systems, MT Evaluation, Bias, and Ethical Issues.

Learning Outcomes: At the end of this unit, the students will be able to

1. Identify the benefits of Encoder- Decoder.
2. Evaluate Machine Translation Models.

Textbooks:

1. Nitin Indurkhya and Fred J.Damerau,"Handbook of Natural Language Processing", Second Edition, CRC Press,2010.(UNIT-I)
2. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2020.(UNIT-II, UNIT-III, UNIT-IV, UNIT-V)

Reference Books:

1. Manning, Christopher D., and Hinrich Schütze, "Foundations of Statistical Natural Language Processing." Cambridge, MA: MIT Press, 1999. ISBN: 0262133601.

Web Resources:

- https://nptel.ac.in/courses/106105158
- https://www.mit.edu/~jda/teaching/6.864/sp21/

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Dr. M. Rama Krishna Murthy, Professor, Dept of CSE
Mr. P. Krishnanjaneyulu, Assistant Professor, Dept of CSE

INTERNET OF THINGS	
CSM413(A)	**Credits: 3**
Instruction:3 Periods /Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites: Computer Networks

Course Objectives:

- Assess the genesis and impact of IoT applications, architectures in real world.
- Illustrate diverse methods of deploying smart objects and connect them to network.
- Compare different Application protocols for IoT.
- Infer the role of Data Analytics and Security in IoT
- Identify sensor technologies for sensing real world entities and understand the role of IoT in variousdomains of Industry.

Course Outcomes:

By the end of the course, the student will be able to:	
1	Discuss the foundations of IoT, challenges and issues, architectures and its functionality
2	Apply and use of Sensors, actuators and its connected components in designing models
3	Explain various protocols and configurations of IoT and discuss different layers and its protocols.
4	Discuss the need data analytics and cloud services in order to transform the data through IoT to Datastorage media.
5	Design and build the real-time applications(Smart applications).

Mapping of Course Outcomes with Program Outcomes:

Mapping		**PO**												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1	2	2	2	-	-	-	-	1	1	-	-	2	-
	2	1	2	2	2	2	-	-	-	1	1	-	-	2	-
	3	1	2	2	2	2	-	-	-	1	1	-	-	2	-
	4	1	2	2	2	2	-	-	-	2	2	-	-	2	-
	5	1	2	3	3	3	-	-	-	2	2	-	-	2	-

SYLLABUS

UNIT I: **10 Periods**

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

Learning Outcome: At the end of this Unit the students will be able to

1. Discuss what IoT is and how it works today
2. analyze the factors that contributed to the emergence of IoT

UNIT II: **10 Periods**

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting
Smart Objects, Communications Criteria, IoT Access Technologies.

Learning Outcome: At the end of this Unit the students will be able to

1. Analyze and discuss the deployment of sensors and its connected components and technologies to connect them to the network.
2. Build IoT models by connecting with IoT components and case study.

UNIT III **10 Periods**

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

Learning Outcome: At the end of this Unit the students will be able to

1. Discuss the role of IoT protocols for efficient network communication.
2. Apply the Protocols for developing the applications.

UNIT IV: **10 Periods**

Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Securing IoT.

IoT Cloud Platform: Data Collection, Storage and Computing Using a Cloud Platform for IoT Applications/Services, Everything as a service and Cloud Service Models.

Learning Outcome: At the end of this Unit the students will be able to

1. Discuss the need for Data Analytics and data streaming tools in IoT
2. Analyze and apply the Cloud platform in connection with IoT tools.

UNIT V: **10 Periods**

IoT Physical Devices –Micro Controllers
Arduino UNO: Introduction to Arduino, Installation, Fundamentals of Arduino Programming.
Raspberry Pi: Introduction, Hardware and Software Layout, Configuration, Basic Raspberry Pi Programming with Python.

Learning Outcome: At the end of this Unit the students will be able to

1. Explain different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.
2. Choose the sensors and actuators for designing IoT applications.

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1 stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill
   Education, 2017. (ISBN: 978-9352605224).

Reference Books:

1. Adrian McEwen,"Designing the Internet of Things", Wiley Publishers,2013,ISBN: 978-1-118-43062-0
2. Daniel Kellmereit, "The Silent Intelligence: The Internet of Things". 2013, ISBN 0989973700
3. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017

ONLINE WEB RESOURCES:

https://www.coursera.org/specializations/iot

FUZZY COMPUTING	
CSM 413(B)	**Credits : 3**
Instruction : 3 Periods /Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

- Basic Knowledge of mathematical function and relation. Knowledge of set theory and logical Operations.

Course Objectives:

- To understand Fuzzy logic and inference system.
- To learn automated method of learning.
- To be able to apply decision making and classification techniques.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Differentiate between Fuzzy sets and crisp sets and their relational operations.
2.	Apply Fuzzification and de-Fuzzification with different member functions.
3.	Implement different automated methods of learning.
4.	Do decision making while solving problems for engineering applications.
5.	Classify and recognition patterns of discriminative classes.

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	2	-	1	-	-	-	-	-	-	1	-	-	1
2	3	2	-	1	-	-	-	-	1	-	1	-	1	2
3	2	3	-	1	-	-	-	-	2	-	1	-	2	3
4	3	3	-	2	-	-	-	-	3	-	3	-	1	3
5	3	3	-	3	-	-	-	-	3	-	3	-	1	2

SYLLABUS

UNIT-I: **10 periods**

Fuzzy systems:

Introduction, History, Utility, Limitations, Uncertainty, accuracy and information, Fuzzy set, Fuzzy membership, Sets in hypercube.

Fuzzy sets: Function and mapping in classical sets, Crisp versus Fuzzy set, Operations on Fuzzy sets, Properties.

UNIT-II: **10 periods**

Crisp and Fuzzy Relations:

Cardinality and properties of crisp relations, Operations on crisp relations, Cardinality and properties of Fuzzy relations, Operations on Fuzzy relations, Fuzzy Cartesian product and composition, Crisp tolerance and equivalence relations, Fuzzy tolerance and equivalence relations, Value assignments, Cosine amplitude, Max–Min method, Other similarity methods.

UNIT-III: **10 periods**

Logic and Fuzzy System:

Membership function and it's features, Fuzzification and its types, Defuzzification, λ-cuts for Fuzzy relations, Defuzzification to Scalars, Classical logic, Proof, Fuzzy logic, Approximate reasoning, Other forms of the implication operation, Rule-based systems, Graphical techniques of inferences, Membership value assignments through intuition, inference, and rank ordering.

UNIT-IV **10 periods**

Automated Methods:

Batch least squares algorithm, Recursive least squares algorithm, Gradient method, Clustering method, Learning from examples, Modified learning from examples.

UNIT-V: **10 periods**

Decision Making:

Synthetic evaluation, Ordering, Non-transitive ranking, Preference and consensus, Multi- objective decision making.

Classification: Classifying by equivalence relations, Crisp relations and Fuzzy relations, Cluster analysis, Cluster validity, Hard c-Means (HCM) and Fuzzy c-Means (FCM), Fuzzy c-Means Algorithm.

Text Books:

1. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, Wiley.

Reference Books :

1. S. Rajasekaran, G.A.V. Pai,"Neural Network, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications",PHI.

Web Resources:

- http://nptel.ac.in/courses/106105173/2

MACHINE LEARNING FOR CYBER SECURITY	
CMD 413	**Credits: 3**
Instruction: 3 Periods /Week	**Sessional Marks: 40**
End Exam: 3 Hours	**End Exam Marks: 60**

Prerequisites:

- Proficiency in the Python programming language and Basic knowledge of cybersecurity concepts such as network security, cryptography, and malware detection.

Course Objectives:

- Understand the basic concepts and principles of machine learning, and how they can be applied to cybersecurity problems.
- Learn how to preprocess and prepare data for machine learning tasks in cybersecurity.
- Gain knowledge of various machine learning algorithms, such as supervised and unsupervised learning, clustering, classification, and anomaly detection, and how they can be used for cybersecurity tasks.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Explain the fundamentals of machine learning, including its different types, and the various machine learning algorithms and architecture used in the field.
2.	Apply heuristics and machine learning algorithms such as logistic regression, and multiclass classification to detect and classify malicious urls, as well as explain the types of abnormalities commonly found in urls and their relevance to cybersecurity.
3.	Identify and compare different types of email spoofing techniques and implement machine learning algorithm logistic regression for various spam detection.
4.	Analyze and detect malware using static and dynamic analysis techniques. They will also be able to use machine learning algorithms to detect the file type and similarity between files and develop a static malware detector to identify and classify malicious files.
5.	Capture and analyze network traffic and detect potential security threats such as network behavior anomalies, botnet traffic, insider threats, and ddos attacks.

Mapping of Course Outcomes with Program Outcomes:

CO	**PO**												**PSO**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3	1	2	1	1	-	-	-	-	-	-	1	-
2	3	3	3	3	3	1	-	2	-	2	-	1	3	2
3	2	3	3	3	3	1	-	2	-	2	-	1	3	3
4	3	3	3	3	3	1	-	2	-	2	-	1	3	2
5	2	3	3	3	3	1	-	2	-	2	-	1	3	2

SYLLABUS

UNIT- I **10 Periods**

Introduction:
What is machine learning? Problems that machine learning solves, Why use machine learning in cybersecurity? Current cybersecurity solutions, Data in machine learning, Different types of machine learning algorithms, Algorithms in machine learning, and the machine learning architecture**.**

Learning Outcomes:

1. Explain the importance of data in machine learning, the problems it solves, and the benefits it provides overcurrent cybersecurity solutions.
2. explain different machine learning algorithms and their use in cybersecurity.

UNIT-II: **10 Periods**

Segregating Legitimate and Lousy URLs: Introduction to the types of abnormalities in URLs, using heuristics to detect malicious pages, using machine learning to detect malicious URLs, Logistic regression to detect malicious URLs, SVM to detect malicious URLs, Multiclass classification for URL classification.

Learning Outcomes:

1. identify different types of abnormalities in URLs and understand how to use heuristics to detect malicious URLs.
2. apply multiclass classification techniques for URL classification.

UNIT-III: **10 Periods**

Catch Email Fraud and Spam:
Email spoofing: Bogus offers, Requests for help, and Types of spam emails.
Spam detection: Types of mail servers, Data collection from mail servers, Using the Naive Bayes theorem to detect spam, Laplace smoothing, Featurization techniques that convert text-based emails into numeric values, Logistic regression spam filters.

Learning Outcomes:

1. describe different types of email spoofing techniques and various types of spam emails**.**
2. describe featurization techniques that convert text-based emails into numeric values, which can be used for logistic regression spam filters.

UNIT-IV: **10 Periods**

Malware Detection: Malware static analysis, Malware dynamic analysis, using machine learning to detect the file type, Measuring the similarity between two strings, Measuring the similarity between two files, and building a static malware detector.

Learning Outcomes:

1. Perform both static and dynamic analysis of malware, including the ability to examine the code and file structure

2. Use machine learning algorithms to detect the file type of malware and measure the similarity between two strings or files.

UNIT-V: **10 Periods**

Automatic Intrusion Detection:
Capturing network traffic, Network behavior anomaly detection, Botnet traffic detection, Insider threat detection, Detecting DDoS.

Learning Outcomes:
1. Able to capture and analyze network traffic using appropriate tools and techniques.
2. Use machine learning algorithms to detect and prevent network security threats**.**

Text Books:
1. Soma Halder, Sinan Ozdemir "Hands-On Machine Learning for Cybersecurity: Safeguard your system by making your machines intelligent using the Python ecosystem" 1st Edition,2018, Packt Publishing, Birmingham, UK.

2. Emmanuel Tsukerman, "Machine Learning for Cybersecurity Cookbook: Over 80 recipes on how to implement machine learning algorithms for building security systems using Python ", 1st Edition,2019 , Packt Publishing, Birmingham, UK

Reference Books :

1. Brij B. Gupta , Quan Z. Sheng "Machine Learning for Computer and Cyber Security: Principle, Algorithms, and Practices (Cyber Ecosystem and Security" 1st Edition, CRC Press

Prepared By
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CLOUD COMPUTING	
CSM 413(D)	**Credits: 3**
Instruction : 3 Periods /Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

- Student Must have good back ground in Operating Systems Concepts and Networking Concepts will be very helpful.

Course Objectives:

- This course provides an insight into cloud computing
- To make a students to understand the different cloud service models, service oriented architectures.
- Student learn cloud programming environments, Concept of Virtualization.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Describe the principles of cloud computing and cloud Characteristics.
2.	Able to understand various service delivery models of a cloud computing architecture.
3.	Illustrate various service delivery models of a cloud computing architecture.
4.	Analyzing the ways in which the cloud can be programmed and deployed.
5.	Able to Understand how cloud computing leverages the virtualization for its different service models

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	1	1	1	1	-	1		-	1	1		
2	2	1	3	1	1	1	-	1		-	1	1	1	2
3	2	2	2	2	1	1	-	1		-	1	1	2	2
4	2	2	2	2	1	1	-	1		-	1	1	2	2
5	1	2	2	2	1	1	-	1		-	-	1	2	2

SYLLABUS

UNIT-1: 10 Periods

Cloud Computing Fundamentals: Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models

Learning Outcomes:

1. Understand the basic ideas and motivation for cloud computing
2. Learn various Cloud Deployment Models.

UNIT-II: 10 Periods

Cloud Computing Architecture and Management: Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications, on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure Managing the Cloud application, Migrating Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.

Learning Outcomes:

- Provide an overview of the cloud architecture
- Learn Cloud Infrastructure and Various Migration approaches

UNIT-III: 10 Periods

Cloud Service Models(Part 1): Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers.

Learning Outcomes:

- Understand how the Infrastructure as a Service (IaaS) changes computing
- Understand how the Platform as a Service (PaaS) changes the application developer

UNIT-IV: 10 Periods

Cloud Service Models(Part II): Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers, Other Cloud Service Models.
Application Environment: Application Development Methodologies, Power of Cloud Computing in Application Development, Cloud Application Development Platforms, Cloud Computing APIs

Learning Outcomes:

- Understand how the Software as a Service (SaaS) changes the application delivery
- Implementation of service providers in application development.

UNIT-V: **10 Periods**

Virtualization: Introduction, Virtualization Opportunities, Approaches to Virtualization, Hypervisors, From Virtualization to Cloud Computing.

Learning Outcomes:

- Describe Importance of Virtualization approaches
- Understand the basics of hypervisor and its security issues

Text Books:

2. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014
3. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.

Reference Books :

1. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
2. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp 2011.

Prepared By

Mrs. G. Suryakala Eswari, Assistant Prof, Dept of CSE (AI&ML,DS)

INTRODUCTION TO INTELLIGENT SYSTEMS	
CSM 414	**Credits:3**
Instruction: 3 Periods /Week	**Sessional Marks: 40**
Final Exam: 3 Hours	**End Exam Marks: 60**

Pre requisites:

- Probability and Discrete Mathematics, Basic knowledge on algorithms and programming language

Course Objectives:

- To use digital tools for implementation of intelligent systems
- To explain the value of intelligent systems for sustainable processes, services, or systems
- To create relevant solution methods in a professional and scientific manner

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Describe different intelligent agents and their structure.
2.	Illustrate how different problems solved using searching
3.	Explore the methods to apply predicate logic for the agents
4.	Apply the different approaches in planning
5.	Describe utility functions for decision making

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	1	-	-	-	-	-	-	-	-	-	-	1	-
2	1	2	-	-	-	-	-	-	2	-	-	-	1	-
3	1	2	2	2	-	-	-	-	2	-	-	-	1	-
4	1	2	2	2	-	-	-	-	2	-	-	-	1	-
5	1	1	-	1	-	-	-	-	1	-	-	-	-	-

SYLLABUS

UNIT-I **10 Periods**

Introduction to agents: Introduction to agents and environments, Good behavior, the nature of environments, the structure of agents.

Learning Outcomes: At the end of this unit the students will be able to

1. Discuss the nature of agents of intelligent systems
2. Describe the different types of agents and its structure

UNIT- II **10 Periods**

Solving Problems by searching: Problem solving agents, Example Problems, Searching for solutions.

Learning Outcomes: At the end of this unit the students will be able to

1. Describe the agents for solving problems
2. Discuss how different agents are used for solving problems

UNIT-III **10 Periods**

Logical Agents: Knowledge based agents, Logic, Propositional Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents based on Propositional Logic.

Learning Outcomes: At the end of this unit the students will be able to

1. Discuss about the knowledge based agents
2. Describe the methods to apply predicate logic for the agents

UNIT-IV **10 Periods**

Classical Planning: Introduction, Algorithms for Planning as State-Space Search, Planning Graphs, Other approaches, Analysis of approaches.
Planning and Acting in the Real World: Time, Schedules and Resources, Hierarchical Planning, Planning and Acting in Non-deterministic Domain, Multiagent Planning.

Learning Outcomes: At the end of this unit the students will be able to

1. Describe different methods for planning
2. Apply the different methods for planning

UNIT-V **10 Periods**

Agents acting under uncertainty: Probability Notation, Bayes rule, Probabilistic Reasoning – Representation, Semantic, Effective and Approximate Inference in Bayesian Networks, **Making Simple Decisions:** Combining Beliefs, Utility Theory and functions.

Learning Outcomes: At the end of this unit the students will be able to

1. Discuss different notations on uncertainty
2. Describe utility functions for decision making

Text Books:

1. Russell, S. and Norvig, P., 2009. edition 3rd edn. Artificial intelligence: a modern approach. Upper Saddle River, NJ. Prentice Hall.

Reference Books:

1. Meystel, A. and Albus, J. (2002), Intelligent Systems: Architectures, Design, Control, John Wiley & Sons, Inc., New York, NY.

Prepared By:

1. Mrs.G.V.Gayathri, Assistant Professor, Dept. of CSD&CSM
2. Mrs.L.Keerthi, Assistant Professor, Dept. of CSD&CSM

ARTIFICIAL INTELLIGENCE IN ROBOTICS	
CSM 415	**Credits: 3**
Instruction: 2 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisite:

- Basic Engineering Mathematics, Kinematics of Machinery, Basic Electrical and electronics engineering

Course Objectives:

- The objective of this course is to impart knowledge about robots for their control and design in various industrial and general applications

Course Outcomes:

At the end of the course the student will be able to:	
CO-1	Explain the anatomy of robots, workspaces, robot types, end effector functions, and principles of actuation and drive systems.
CO-2	Apply kinematics, DH parameters, obstacle-aware trajectory planning, and control systems for accurate, adaptable, and safe robot motion.
CO-3	Describe various sensors, feedback systems and image processing techniques in robot.
CO-4	Apply programming languages to develop robotic systems and control their behavior.
CO-5	Comprehend the application of AI and ML concepts for operation of robots

Mapping of Course Outcomes with Program Outcomes:

CO	**PO**												**PSO**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2	1	-	-	2	-	-	-	2	2	-	2	1	2
2	3	3	2	-	2	-	-	-	2	2	-	2	1	2
3	2	-	-	-	2	-	-	-	2	2	-	2	1	2
4	3	2	2	-	2	-	-	-	2	2	-	2	1	2
5	2	2	-	-	2	-	-	-	2	2	-	2	1	2

SYLLABUS

UNIT - I **10 Periods**

Basics of Robotics

Definition and scope of robotics, Historical overview of robotics, Laws of robotics, overview of robotic systems and components, Robot workspaces and configurations, Types of robots and their applications, End effectors and grippers for different tasks and selection criteria. Actuation and drive systems in robot

UNIT - II **10 Periods**

Kinematics and Control of Robot

Kinematics: Scaling, Rotation and homogenous transformation matrix, Forward kinematics and inverse kinematics, Denavit Hartenberg (DH) parameters,

Trajectory planning: Trajectory planning and path generation for robot motion- steps in trajectory planning, Joint Space Techniques, Cartesian Space Techniques.

Robot Control: P,I,D, PD, PI, PID control, adaptive control.

UNIT - III **10 Periods**

Sensors and Computer Vision in Robot

Feedback System: Open and closed loop feedback systems.

Robot sensors: Sensor types and characteristics (Range, proximity, vision, force and torque), Sensor fusion and filtering techniques.

Computer Vision in Robotics: Image processing and feature extraction, Object detection, tracking, and recognition, Visual servoing and robot vision applications.

UNIT - IV **10 Periods**

Robotic Programming and simulation

Programming languages for robotics (C++, Python, ROS), Behavior-based programming and robot architectures, Robot simulation and visualization tools.

Applications: Robotics at Agriculture, Automotive, Supply Chain, Healthcare, Warehouses - material Transfer, Material handling, loading and unloading; Processing - spot and continuous welding

UNIT - V **10 Periods**

AI Powered Robotics

AI and Machine Learning for Robotics: Reinforcement learning for robot control, Deep learning in perception and decision-making,

Advanced Topics in Robotics: Human-robot interaction and collaboration, Mobile robots and navigation, Swarm robotics and multi-robot systems.

TEXT BOOKS:

1. Robert J. Schilling, “Fundamentals of Robotics Analysis and Control”, PHI Learning,
2. Francis X. Govers , “Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using AI techniques".
3. Groover M P, “Industrial Robotics”, Pearson Edu.
4. Mittal R K & Nagrath I J, “Robotics and Control”, TMH.

REFERENCE BOOKS:

1. Fu K S, Robotics, McGraw Hill.
2. Rich and Knight, Artificial Intelligence, 3rd Edition, Tata McGraw Hill, 2014.

WEB RESOURCES:

- http://ecoursesonline.iasri.res.in/course/view.php?id=82
- https://www.robotplatform.com/knowledge/sensors/types_of_robot_sensors.html
- https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm
- https://www.iiitdmj.ac.in/ict.iiitdmj.ac.in/summer-courses-2020/R-AI/
- https://ocw.snu.ac.kr/sites/default/files/NOTE/Chap12_Robot%20programming%20languages.pdf
- https://www.plyrotech.com/blog/artificial-intelligence-machine-learning-and-robotics/#:~:text=Robotic%20Process%20Automation%20is%20an,scale%20Internet%20companies%20are%20built.

OBJECT ORIENTED SOFTWARE ENGINEERING LAB	
CSM 416	**Credits : 1.5**
Instruction : 3 Periods /Week	**Sessional Marks : 50**
End Exam : 3 Hours	**End Exam Marks : 50**

Prerequisites:

- Basic Mathematical Knowledge
- Basic knowledge on procedural and object-oriented programming
- Basic knowledge on problem solving.

Course Objectives:

The course should enable the students:

- To provide working knowledge of UML.
- To provide working knowledge of the technologies essentially for incorporating in the project.
- To expertise for testing and document software.
- To present the project in a professional manner.

Course Outcomes:

By the end of the course, the student will be able to:	
1	Design DFD, UML Diagrams for the specified software project
2	Write the Software Requirements Document for a specified project
3	Design Test Suites
4	Discuss about the project implementation among the team members and improve their professional skills

Mapping of Course Outcomes with Program Outcomes & PSOs:

Mapping	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	--	3	3	2	3	2	--	1	1	1	2	2	3	3
CO2	--	2	1	1	--	2	1	1	1	2	1	--	2	--
CO3	--	2	3	2	--	2	--	2	1	--	1	--	1	--
CO4	--	--	--	1	--	--	--	--	3	2	--	1	--	--

List of Experiments

Experiment -1

Familiarize students with the software development process in the IT industry and guide them in selecting appropriate project titles for each batch.

Experiment-2

System Modelling –DFD Diagram

Experiment-3

Introduction to UML and Use Case Scenario, Use Case Diagram

Experiment-4

Object Oriented Analysis: Discovering Classes , Class Diagram

Experiment-5

Interaction Diagrams: Sequence and Collaboration Diagrams

Experiment-6

State Chart Diagram

Experiment-7

Flow of Events and Activity Diagrams

Experiment-8

Component and Deployment Diagrams

Experiment-9

Software Requirements Specification Document

Experiment-10

Design Test Cases

Experiment-11

Test Report & Error Report

Experiment-12

PPT Presentation of their mini project

Text Books:

1. Roger S Pressman,Software Engineering: A Practitioner's approach,Tata McGraw Hill Education,8th edition,2015
2. Pankaj Jalote, An integrated Approach to Software Engineering, Springer, 3rd edition,2005
3. Timothy C. Lethbridge, "Object Oriented Software Engineering" (Practical Software Development using UML and Java" Tata McGraw-Hill,2nd Edition,2019

Reference :

1 Ali Bahrami,Object Oriented Systems Development,Tata Mcgraw-Hill Education ,1st Edition,2008.

ARTIFICIAL INTELLIGENCEIN ROBOTICS- LAB	
CSM 417	**Credits: 3**
Instruction:3 Periods /Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Cycle – I

1. Introduction to Robot Analyzer Software
2. Perform the Forward kinematics of a 2-DOF planar robot, 3-DOF anthropomorphic arm & a 3-DOF wrist and KUKA KR5 Arc Robot.
3. Perform the Inverse kinematics of a 2-DOF planar robot, 3-DOF anthropomorphic arm & a 3-DOF wrist and KUKA KR5 Arc Robot.
4. Workspace Analysis of a 6 axis Robot
5. Inverse and Forward Dynamics of Robots
6. Creating Robot Joint Trajectories

Cycle – II

1. Introduction to Firebird V wheeled Robot- sensors actuator
2. IO Buzzer Programming using embedded C
3. Motion Control of Firebird V
4. Velocity Control of Firebird V using PWM
5. LCD Interfacing for Firebird V
6. Programming Firebird V to Follow the White Line

TEXT BOOKS:

5. Robert J. Schilling, “Fundamentals of Robotics Analysis and Control”, PHI Learning,
6. Francis X. Govers , “Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using AI techniques".
7. Groover M P, “Industrial Robotics”, Pearson Edu.
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REFERENCE BOOKS:

3. Fu K S, Robotics, McGraw Hill.
4. Rich and Knight, Artificial Intelligence, 3rd Edition, Tata McGraw Hill, 2014.

WEB RESOURCES:

- http://ecoursesonline.iasri.res.in/course/view.php?id=82
- https://www.robotplatform.com/knowledge/sensors/types_of_robot_sensors.html

- https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm
- https://www.iiitdmj.ac.in/ict.iiitdmj.ac.in/summer-courses-2020/R-AI/
- https://ocw.snu.ac.kr/sites/default/files/NOTE/Chap12_Robot%20programming%20languages.pdf
- https://www.plyrotech.com/blog/artificial-intelligence-machine-learning-and-robotics/#:~:text=Robotic%20Process%20Automation%20is%20an,scale%20Internet%20companies%20are%20built.