MARUDHAR KESARI JAIN COLLEGE FOR WOMEN (AUTONOMOUS)

Vaniyambadi – 635 751

Department of Artificial Intelligence

for

Undergraduate Programme

Bachelor of Science in Artificial Intelligence

From the Academic Year 2024-25

CONTENT

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK FOR UNDERGRADUATE AND POSTGRADUATE EDUCATION

1. Preamble

Bachelor of Computer Science with Artificial Intelligence is a 3 – Year Undergraduate Programme spread over six semesters. The course is designed to achieve a high degree of technical skills in Problem solving and Modern application development. The course develops requisite professional skills and problem solving along with developing the analytical abilities for pursuing a successful career in software industry and forms the required basics for further higher studies in Computer Science specifically in the are a of Artificial Intelligence.

PROGRAMME OUTCOMES (PO)

Programme	**B.Sc. Artificial Intelligence**
Programme Code	**US02**
Duration	**3 years[UG]**
Programme Outcomes	**PO1:** Acquire knowledge in Artificial Intelligence to apply the knowledge in their day-to-day life for betterment of self and society. **PO2:** Acquire knowledge in Artificial Intelligence to apply the knowledge in their day-to-day life for betterment of self and society. **PO3:** Develop research related skills in defining the problem, formulate and test the hypothesis, analysis, interpret, and draw conclusion from data. **PO4:** Address and develop solutions for societal and environmental needs of local, regional and national development. **PO5:** Work independently and engage lifelong learning and enduring proficient progress. **PO6:** Provoke employability and entrepreneurship among students along with ethics and common skills. **PO7:** Understand the importance of ethical behavior in business contexts and be able to recognize and address ethical dilemmas they may encounter in their professional **PO8:** Prepared for lifelong learning and professional development, including the ability to adapt to changes in technology, business practices, and economic conditions throughout their careers.
Programme Specific Outcomes:	**PSO1** Artificial Intelligence for Real-World Solutions Demonstrate the ability to apply Artificial Intelligence and computational techniques to analyze and solve complex real-world problems effectively. **PSO2** Ethical and Professional Practices Exhibit ethical responsibility in professional practices, ensuring compliance with cyber regulations, laws, and industry standards while designing and developing computing solutions**.** **PSO3** Innovation and Entrepreneurship Apply innovative thinking and entrepreneurial strategies to develop and implement technology-driven solutions for societal and business challenges.

Eligibility for Admission:

Candidate seeking admission to the first year of the UG Degree Course should have passed the Higher Secondary Course Examination (Academic or Vocational) conducted by the Govt. of Tamilnadu with Mathematics/Business Mathematics /Statistics/Computer Science as a subject or an Examination of any other University accepted as equivalent there to by the Syndicate subject to such other conditions as may be prescribed. Such candidates shall be permitted to take the B.Sc. Degree Examination of this University after the completion of the Course of three Academic Years in this University / Colleges affiliated to this University and shall qualify for the B.Sc. Degree.

Methods of Evaluation and Assessment

Methods of Evaluation		
Internal Evaluation		25 Marks
External Evaluation	End Semester Examination	75 Marks
	Total	**100 Marks**
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand / Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, short summary or overview	
Application (K3)	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain	
Analyze (K4)	Problem-solving questions, finish a procedure in many steps, Differentiate Between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations	

Semester - III						
Code	Course Title	Hours Distribution				C
		L	T	P	S	
24UFTA31	Tamil-3	4	1	0	0	3
24UFEN31	English-3	4	1	0	0	3
24UAIC31	CC–5Artificial Intelligence	3	1	2	0	5
24UAIC32P	CC-6 Practical-III Artificial Intelligence Lab	0	0	4	0	2
24UAIA31 24UAIA32	EC-4 1. Relational Database Management Systems 2. Mobile Application Development	3	1	0	0	4
24UAIA33P 24UAIA34P	EC-5 1.RDBMSLab 2. Mobile Application Development Lab	1	0	1	0	2
24UAIS31	SEC-4 Data Communication and Network	2	0	0	0	2
24UAEC31	AEC–2 Human Values and Professional Ethics	1	1	0	0	2
TOTAL					**30**	**23**

Semester - IV						
Code	Course Title	Hours Distribution				C
		L	T	P	S	
24UFTA41	Tamil-4	4	1	0	0	3
24UFEN41	English-4	4	1	0	0	3
24UAIC41	CC – 7 R Programming	3	1	2	0	5
24UAIC42P	CC - 8 (Practical) - R Programming Lab	0	0	4	0	2
24UAIA41 24UAIA42	EC-6 1. Introduction to fuzzy Logic 2.Robotics and it Applications	3	1	0	0	4
24UAIA41P 24UAIA42P	EC - 7 1.IOT and its Applications Lab 2. Robotics and its Applications Lab	0	0	2	0	2
24UAIS41	SEC – 5 Fundamentals of Fuzzy Logic	2	0	0	0	2
24UAEC41	AEC – 3 Environmental Studies & Disaster Management	2	0	0	0	2
TOTAL					**30**	**23**

L-Lecture **T-Tutorial** **P-Practical** **S-Seminar** **C-Credit**

Students must complete at least one online course (MOOC) from platforms like SWAYAM, NPTEL, or Nanmudalvan within the fifth semester. Additionally, engaging in a specified Self-learning Course is mandatory to qualify for the degree, and successful participation will be acknowledged with an extra credit of 2*.

Part – 1 & 2	Tamil & English	8	SEC	Skill Elective Course	5
CC	Core Course	1	FC	Foundation Course	1
EC-AL	Elective Course – Applied	7	AEC	Ability Enhancement Course	4
EC	Elective Course - Major	4	SLC	Self-Learning Course	1

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIC31	Artificial Intelligence	CC-5	3	1	2	0	5	6	25	75	100

Learning Objectives	
LO1	To describe the concepts of Artificial Intelligence
LO2	To Understand the method of solving problems using Artificial Intelligence
LO3	To study the Knowledge Representation
LO4	To comprehend the concept of Software Agents
LO5	To study various AI applications

Unit	Content	Hours
1	**INTRODUCTION:** Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.	18
2	**PROBLEM SOLVING METHODS** Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games	18
3	**KNOWLEDGE REPRESENTATION** First Order Predicate Logic – Pro log Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories–Reasoning with Default Information	18
4	**SOFTWARE AGENTS SOFTWARE AGENTS** Architecture for Intelligent Agents – Agent communication– Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.	18
5	**APPLICATIONS** AI applications – Language Models – Information Retrieval Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition–Robot–Hardware–Perception–Planning–Moving	18

CO	Course Outcomes
CO1	Explain the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents.
CO2	To describe search techniques and gaming theory
CO3	The student will learn to apply knowledge representation techniques and problem solving strategies to common AI applications.
CO4	Examine the architecture and argumentation among software agents
CO5	Illustrate the basics of pattern recognition and steps required for it.
Textbooks:	
1	Elaine Rich, Kevin Knight (2008), Shiv sankar B Nair, Artificial Intelligence, Third Edition ,Tata Mc Graw Hill Publication
2	P. Rizwan Ahmed, Artificial Intelligence, Margham Publications,Chennai,2012
Reference Books:	
1	Russel S, Norvig P (2010), Artificial Intelligence : A Modern approach, Third Edition, Pearson Education
2	Dan W Patterson (2007), Introduction to Artificial Intelligence and Expert System, Second Edition, Pearson Education Inc.
3	Jones M(2006), Artificial Intelligence application Programming, Second Edition, Dream tech Press
4	Nilsson(2000),Artificial Intelligence :A new synthesis, Nils J Harcourt Asia Pvt Ltd.
Web resources:	
1	WWW.GeeksforGeeks
2	https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SECA3011.pdf

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	2	3	3	3	3	3	2	3	3	3
CO3	3	3	2	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	15	14	14	15	15	15	15	14	14	15	15
Average	3	2.8	2.8	3	3	3	3	2.8	2.8	3	3

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIC32P	Artificial Intelligence Lab	CC-6	0	0	4	0	2	4	25	75	100

Learning Objectives	
LO1	To understand the potential benefits of using AI in knowledge-sharing and management
LO2	To Learn automation of knowledge management tasks using AI Tools
LO3	To study how AI is role in data analysis and decision-making
LO4	To explore ways to integrate AI applications into existing knowledge management systems
LO5	To Integrate AI with existing knowledge management systems

Unit	Content	Hours
	1.Write a python program to implement Breadth First Search Traversal? 2.Write a python program to implement Water Jug Problem? 3.Write a python program to remove punctuations from the given string? 4.Write a python program to sort the sentence in alphabetical order? 5.Write a program to implement Hang man game using python. 6.Write a program to implement Tic-Tac-Toe game using python. 7.Write a python program to remove stop words for a given passage from a text file using NLTK? 8.Write a python program to implement stemming for a given sentence using NLTK? 9.Write a python program to POS(Parts of Speech)tagging for the give sentence using NLTK? 10.Write a python program to implement Lemmatization using NLTK? 11.Write a python program to for Text Classification for the give sentence using NLTK	60

CO	Course Outcomes
CO1	Implement python code to understand the concept of AI
CO2	Implement different AI Techniques
CO3	Application of AI techniques in practical Life
CO4	Use of Natural Language Tool Kit in Python
CO5	Demonstrate integration of NLTK with Python code
Textbooks:	
1	Elaine Rich, Kevin Knight (2008), Shiv sankar B Nair, Artificial Intelligence, Third Edition ,Tata Mc Graw Hill Publication
2	P.Rizwan Ahmed, Artificial Intelligence, Margham Publications,Chennai,2012
Reference Books:	
1	Russel S, Norvig P (2010), Artificial Intelligence : A Modern approach, Third Edition, Pearson Education
2	Dan W Patterson (2007), Introduction to Artificial Intelligence and Expert System, Second Edition, Pearson Education Inc.
3	Jones M(2006), Artificial Intelligence application Programming, Second Edition, Dream tech Press
4	Nilsson(2000),Artificial Intelligence: A new synthesis, Nils J Harcourt Asia Pvt Ltd.
Web resources:	
1	WWW.GeeksforGeeks
2	www.w3cschools.com

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	2	2	3	3	3	3	2	2
CO3	2	2	1	3	3	3	2	2	1	3	3
CO4	3	3	3	3	3	2	3	3	3	3	3
CO5	3	3	3	3	3	2	3	3	3	3	3
Total	14	14	13	14	14	12	14	14	13	14	14
Average	2.8	2.8	2.6	2.8	2.8	2.4	2.8	2.8	2.6	2.8	2.8

3– Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIA31	**Relational Database Management Systems**	**EC-4**	**3**	**1**	**0**	**0**	**4**	**4**	**25**	**75**	**100**

Learning Objectives

LO1	To understand the basic concepts in the design and implementation of a database system.
LO2	To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
LO3	To understand and use data manipulation language to query, update, and manage a database
LO4	To develop an understanding of essential DBMS concepts such as: PL/SQL
LO5	To understand exception handling while building a simple database system

Unit	Content	Hours
1	**Introduction:** Database System-Characteristics of Database Management Systems-Architecture of Database Management Systems-Database Models System Development Life Cycle- Entity Relationship Model	12
2	**Relational Database Model:** Structure of Relational Model-Types of keys. Relational Algebra: Unary operations-Set operations-Join operations. Normalization: Functional Dependency-First Normal form-Second Normal Form-Third Normal form-Boyce-Codd Normal Form-Fourth Normal Form.	12
3	**SQL:** Introduction. Data Definition Language: Create, alter, drop, rename and truncate statements. Data Manipulation Language: Insert, Update and Delete Statements. Data Retrieval Language: Select statement. Transaction Control Language: Commit, Rollback and Save point statements. Single row functions using dual: Date, Numeric and Character functions. Group/Aggregate functions: count, max, min, avg and sum functions. Set Functions: Union, union all, intersect and minus. Sub query: Scalar, Multiple and Correlated subquery. Joins: Inner and Outer joins. Defining	12
4	**PL/SQL:** Introduction-PL/SQL Basic-Character Set-PL/SQL Structure-SQL Cursor-Subprograms-Functions-Procedures.	12
5	**Exception Handling:** Introduction-Predefined Exception-User Defined Exception-Triggers-Implicit and Explicit Cursors-Loops in Explicit Cursor.	12

CO	Course Outcomes
CO1	Demonstrate the characteristics of Database Management Systems and the basic concepts and models of database.
CO2	Classify the keys and the concepts of Relational Algebra and explain the applications of various Normal Forms Classification of Dependency.
CO3	Elaborate the different types of Functions and Joins and their applications. Introduction of Views, Sequence, Index and Procedure.
CO4	Demonstrate the Representation of PL-SQL Structure and implement Sub Programs, Functions and Procedures.
CO5	Demonstrate the handling of Exception and Pre-Defined Exception. And appreciate importance of Triggers ,Implicitand Explicit Cursors..
Textbooks:	
1	Pranab Kumar Das Gupta and P. Radha Krishnan, "Database Management System Oracle SQL and PL/SQL",SecondEdition,2013,PHI Learning Private Limited.
2	P.Rizwan Ahmed, RDBMS and Oracle, Margham Publications, Chennai.2018
3	A Silber schatz, H Korth, S Sudarshan, "Database System and Concepts", fifth Edition McGraw Hill, Rob, Coronel, "Database Systems", Seventh Edition, Cengage Learning.
Reference Books:	
1	RamezElmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Publications.
2	Abraham Silberschatz, Henry Korth, S.Sudarshan, "Database System Concepts",Seventh Edition, TMH.
Web resources:	
1	https://www.geeksforgeeks.org/dbms/dbms/

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	2	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	2	3	3	3	3	3	2	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	14	15	15	14	15	14	14	15	15	14	15
Average	2.8	3	3	2.8	3	2.8	2.8	3	3	2.8	3

3– Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIA32	Mobile Application Development	EC-4	3	1	0	0	4	4	25	75	100

Learning Objectives	
LO1	To understand the basics of smart phones and android platforms
LO2	To Study the basic concepts of user interface related to app development.
LO3	To learn the importance of data persistence in mobile environment.
LO4	To understand the various services and network facilities provided by android platform.
LO5	To Comprehend the various apps deployed and developed on by mobile platform.

Unit	Content	Hours
1	**INTRODUCTION TO ANDROID PLATFORM-**Introduction to Mobile Application Development–Various platforms–Smart phones–Android platform: features–Architecture–Versions–ART(Android Runtime)–ADB (Android Debug Bridge)–Development environment/IDE: Android studio and its working environment–Emulator setup–Application framework basics XML representation and Android manifest file–Creating a simple application.	12
2	**ANDROID UI DESIGN-GUI for Android:** activities lifecycle–Androidv7 support library–Intent: Intent object–Intent filters–Adding categories–Linking activities–User Interface design components–Basic Views–Picker Views–List View–Specialized Fragment–Gallery and Image View–Image Switcher–Grid View, Options Menu–Context Menu–Clock View–Web view–Recycler View	12
3	**DATA PERSISTENCE-**Different Data Persistence schemes: Shared preferences–File Handling–Managing data using SQLite database–Content providers: user content provider–Android in build content providers.	12
4	**ANDROID SERVICES & NETWORK ENVIRONMENT-Services:** Introduction to services–Local service–Remote service–Binding the service Communication between service and activity–Intent Service–Multi–Threading: Handlers–Async Task–Android network programming: Http Url Connection Connecting to REST–based–SOAP based Web services–Broadcast receivers: Local Broadcast Manager–Dynamic broadcast receiver–System Broadcast Telephony Manager: Sending SMS and making calls.	12

5	**ADVANCED APPLICATIONS-Location based services:** Google maps V2 services using Google API–Animations and Graphics: Property Animation View Animations–Drawable Animations–Media and Camera API: Working with video and audio inputs–camera API–Sensor programming: Motion sensors–Position sensors–Environmental sensors–Publishing Android Apps: Guidelines–policies and process of uploading Apps to Googleplay	12

CO	**Course Outcomes**
CO1	Explain the basics of android applications
CO2	Describe the role of GUI for android.
CO3	To examine the importance of data persistence in mobile environment
CO4	Explain the various series of android services
CO5	Develop simple mobile application using android
Textbooks:	
1	"Head First: Android Development", Dawn Griffiths, David Griffiths, OReilly, 1st Edition,2015.
2	Barry Burd, "Android Application Development–All–in–one fo rDummies",2nd Edition, Wiley India,2016.
Reference Books:	
1	"Professional Android™ Sensor Programming", Greg Milette, Adam Stroud, John Wiley and Sons, Inc 2012.
2	"Android 6 for Programmers, App Driven approach", Paul Deital, Harvey Deital, Alexander Wald, Prentice Hall, 2015.
Web resources:	
1	https://www.w3schools.com
2	https://www.javatpoint.com/r-tutorial
3	https://www.tutorialspoint.com/r/index.htm

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	2	2	2	2	3
CO2	3	3	2	3	2	3	2	3	3	3	2
CO3	3	3	2	3	3	2	2	3	3	3	2
CO4	3	3	2	3	3	3	3	3	3	3	3
CO5	3	3	2	3	3	3	2	3	3	3	2
Total	15	15	10	15	13	14	11	14	14	14	12
Average	3	3	2	3	3	3	2.2	3	3	3	2

3– Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIA33P	**RDBMS LAB**	**EC-5**	**1**	**0**	**1**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the concepts of DDL/DML/DCL/TCL commands.
LO2	To understand the concepts of Join queries.
LO3	To understand the concepts of exception handling.
LO4	To understand the concepts of cursors.
LO5	To understand the concepts of packages.

Unit	Content	Hours
	1.Execute a single line query and group functions. **2.**Execute DDL Commands. **3.**Execute DML Commands **4.**Execute DCL and TCL Commands. **5.**Implement the Nested Queries. **6.**Implement Join operations in SQL **7.**Create views for a particular table **8.**Implement Locks for a particular table. **9.**Develop a PL/SQL procedure for an application using exception handling. **10.**Develop a PL/SQL procedure for an application using cursors. **11.**Develop a PL/SQL procedure for an application using functions **12.**Develop a PL/SQL procedure for an application using package	**30**

CO	Course Outcomes
CO1	Design and Implement a database schema for a given problem domain.
CO2	Populate and Query a database using SQL DDL/DML Commands
CO3	Build well formed in String Date/Aggregate Functions
CO4	Design and Implement a database query using Joins, Sub-Queries and Set Operations.
CO5	Program in SQL including Objects(Functions, Procedures, Triggers)
Textbooks:	
1	Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition
2	Nilesh Shah, "Database Systems Using Oracle",2nd edition, Pearson Education India, 2016
Reference Books:	
1	Abraham Silberschatz, Henry F.Korth and S.Sudarshan, “Database System Concepts”, Mc Graw Hill International Publication, VI Edition
2	Shio Kumar Singh, “Database Systems“, Pearson publications, II Edition
Web resources:	
1	https://www.w3schools.com/mysql/mysql_rdbms.asp

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	2	2	2	2	3
CO2	3	3	2	3	2	3	2	3	3	3	2
CO3	3	3	2	3	3	2	2	3	3	3	2
CO4	3	3	2	3	3	3	3	3	3	3	3
CO5	3	3	2	3	3	3	2	3	3	3	2
Total	15	15	10	15	13	14	11	14	14	14	12
Average	3	3	2	3	3	3	2.2	3	3	3	2

3– Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIA34P	**Mobile Applications Development Lab**	**EC-5**	**1**	**0**	**1**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand how to change fonts.
LO2	To understand how to change colors.
LO3	To know about layout managers.
LO4	To understand drawing methods.
LO5	To understand database connectivity.

Unit	Content	Hours
	1.Develop an application that uses GUI components, Font and Colors. 2.Develop an application that uses Intent and Activity. 3.Develop an application that uses Layout Managers and event listeners. 4.Write an application that draws basic graphical primitives on the screen. 5.Develop an application that makes use of RSS Feed. 6.Implement an application that implements Multi-threading. 7.Develop an application that create alarm clock. 8.Develop an application Using Widgets. 9.Implement an application that writes data to the SD card. 10.Implement an application that creates an alert upon receiving a message. 11.Develop an application that makes use of database.	30

CO	Course Outcomes
CO1	To understand android basics
CO2	To gain knowledge of GUI for android.
CO3	To understand SQLite database
CO4	To understand android services
CO5	To develop simple mobile application using android
Textbooks:	
1	"Head First: Android Development", Dawn Griffiths, David Griffiths, O Reilly,1st Edition, 2015.
2	Barry Burd, "Android Application Development–All–in–one for Dummies", 2nd Edition, Wiley India, 2016.
Reference Books:	
1	"Professional Android™ Sensor Programming", Greg Milette, Adam Stroud, John Wiley and Sons, Inc 2012.
2	"Android 6 for Programmers, App Driven approach", Paul Deital, Harvey Deital, Alexander Wald, Prentice Hall,2015.
Web resources:	
1	https://www.w3schools.com/
2	https://www.javatpoint.com/r-tutorial
3	https://www.tutorialspoint.com/r/index.htm

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	2	2	2	2	3
CO2	3	3	2	3	2	3	2	3	3	3	2
CO3	3	3	2	3	3	2	2	3	3	3	2
CO4	3	3	2	3	3	3	3	3	3	3	3
CO5	3	3	2	3	3	3	2	3	3	3	2
Total	15	15	10	15	13	14	11	14	14	14	12
Average	3	3	2	3	3	3	2.2	3	3	3	2

3– Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIS31	**Data Communication And Network**	**SEC-4**	**2**	**0**	**0**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	To introduce the fundamental network architecture concepts and their core principle issues in the emerging communication/data networks.
LO2	To have a complete picture of the data and computer networks systematically
LO3	To provide a strong foundation in networking concepts and technology
LO4	To know the significance of various Flow control and Congestion control Mechanisms
LO5	To know the Functioning of various Application layer Protocols.

Unit	Content	Hours
1	**Data Communications:** Introduction–Networks–The Internet–Protocols and Standards-Network Models: OSI model–TCP/IP protocol suite–Transmission Media: Guided media–Unguided Media.	6
2	**Data Link Layer:** Error Detection and Correction: Introduction-Block coding Linear block codes–Cyclic Codes–Checksum. Framing–Flow and Error Control: Protocols–Noiseless Channels: Stop-and–Wait–Noisy Channel: Stop and Wait Automatic Repeat Request-Go-Back–N	6
3	**Medium Access and Network Layer: Multiple Access:** Random Access Controlled access-Channelization. Network Layer Logical addressing: IPv4 addresses–IPv6 addresses. Transport Layer: Process to Process delivery: UDP TCP. Congestion Control–Quality of Service	6
4	**Application Layer: Domain Naming System:** Name Space-Domain Name Space-Distribution of Name Space-DNS in the INTERNET-Resolution Remote logging–E-mail–FTP	6
5	**Wireless Networks:** Wireless Communications–Principles and Fundamentals. WLANs–WPAN-Satellite Networks-Ad-hoc Networks	6

CO	Course Outcomes
CO1	Understand the basics of data communication, networking, internet and their importance.
CO2	Analyze the services and features of various protocol layers in data networks.
CO3	Differentiate wired and wireless computer networks
CO4	Analyze TCP/IP and their protocols.
CO5	Recognize the different internet devices and their functions.
Textbooks:	
1	Forouzan, A.Behrouz.(2006),Data Communications & Networking, Fourth Edition, Tata Mc Graw Hill Education
2	Nicopolitidis, Petros, Mohammad SalamehObaidat, G.L. Papadimitriou(2018),Wireless Networks, John Wiley & Sons.
Reference Books:	
1	Fred Halsall(1996),Data Communications Computer Networks and Open Systems, Fourth Edition, Addison Wesley.
Web resources:	
1	https://www.tutorialspoint.com/data_communication_computer_network/index.htm
2	https://www.geeksforgeeks.org/data-communication-definition-components-types channels/

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	2	3	3	3	2	3	2	3	3	3	2
CO3	3	3	3	3	2	2	3	3	3	3	2
CO4	3	3	3	3	2	3	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	14	15	15	15	13	14	14	15	15	15	13
Average	2.8	3	3	3	2.6	2.8	2.8	3	3	3	2.6

3– Strong, 2- Medium, 1- Low

2nd YEAR: FOURTH SEMESTER

Course Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
24UAIC41	R Programming	CC- 7	3	1	2	0	5	25	75	100

Learning Objectives	
LO1	To Understand the basic R Programming concepts
LO2	To Explore about Control Structures and Vector Concepts
LO3	To learn about List Operations
LO4	To Know about how to Work with Factors and Tables
LO5	To Understanding the concept of Object Oriented programming.

UNIT	Contents	No. Of. Hours
I	**Introduction**: Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Packages and Libraries in R, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations	**18**
II	**Control structures**, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations	**18**
III	**Lists**: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, DATA FRAMES, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations	**18**
IV	**FACTORS AND TABLES**, Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables, extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions	**18**
V	**OBJECT-ORIENTED PROGRAMMING**: S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation.	**18**

CO	Course Outcomes
CO1	Demonstration and implement of basic R programming framework and data structures
CO2	Explain critical R programming language concepts such as control structures and Vectors
CO3	Create Data Frames and Matrix Operations
CO4	Applying mathematical and statistical operations data in R
CO5	Make use of appropriate statistical tests using R and Create and edit visualizations with regression models
Textbooks:	
1	R Programming for Data Science by Roger D.Peng
2	The Art of R Programming by Prashanth singh, Vivek Mourya, Cengage Learning India.
Reference Books:	
1	Tilman M. Davies, The Book of R: A First Course in Programming and Statistics, 1st edition, 2019.
2	Andy Field, Discovering Statistics Using R,1st edition, SAGE Publications Ltd
Web resources:	
1	https://www.w3schools.com/r/
2	https://www.javatpoint.com/r-tutorial
3	https://www.tutorialspoint.com/r/index.htm

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	2	3	3	3	3	3	2	3	3	3
CO3	3	3	2	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	15	14	14	15	15	15	15	14	14	15	15
Average	3	2.8	2.8	3	3	3	3	2.8	2.8	3	3

3 – Strong, 2- Medium, 1- Low

2nd YEAR: FOURTH SEMESTER

Course Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
24UAIC42P	R Programming Lab	CC-8 Practical	0	0	4	0	2	25	75	100

Learning Objectives:

LO1	Gain knowledge in developing basic R programs using operators, control structures, and functions.
LO2	Develop how to work with Factorial Numbers
LO3	Develop the ability to implement common programming logic such as condition checking, recursion, loops, and number operations in R.
LO4	Gain knowledge in developing basic R programs using operators, control structures and functions.
LO5	Understand how to create and work with different types of R objects, including vectors, S3, S4, and Reference Classes.

LAB EXERCISES	Hours
1. Develop an R program to demonstrate the working of Arithmetic, Relational, Logical, and Assignment operators. 2. (a) Develop an R program to check if a number is Odd or Even. (b) Develop an R program to check if the given number is a Prime Number. 3. (a) Develop an R program to find the Factorial of a number. (b) Develop an R program to find the Factors of a number. 4. Write an R Program to Find the Fibonacci sequence Using Recursive Function. 5. (a) Develop an R program to perform basic arithmetic operations using a Simple Calculator. (b) Extend the program to find the L.C.M of two numbers. 6. Write an R Program to create Vector and to access elements in a Vector. 7. Create an R program to implement an S3 class with objects and a user-defined generic function. 8. Develop an R program to create an S4 class and its objects. 9. Create an R program to define a user-defined generic function in an S4 class. 10. Design an R script to create a Reference Class and update its methods.	**60**

CO	Course Outcomes The student will be able to
CO1	Understand the fundamental concepts in R
CO2	Acquire programming skills in R
CO3	Solve statistical problems using R
CO4	Implement and describe Vector in R Programming
CO5	Minimize and maximize functions were performed using R
Textbooks:	
1	R Programming for Data Science by Roger D.Peng
2	The Art of R Programming by Prashanthsingh, Vivek Mourya, Cengage Learning India.
Reference Books:	
1	Tilman M. Davies, The Book of R: A First Course in Programming and Statistics, 1st edition, 2019.
2	Andy Field, Discovering Statistics Using R,1stedition,SAGE Publications Ltd
Web resources:	
1	WWW.GeeksforGeeks
2	https://www.javatpoint.com/r-tutorial

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	2	2	3	3	3	3	2	2
CO3	2	2	1	3	3	3	2	2	1	3	3
CO4	3	3	3	3	3	2	3	3	3	3	3
CO5	3	3	3	3	3	2	3	3	3	3	3
Total	14	14	13	14	14	12	14	14	13	14	14
Average	2.8	2.8	2.6	2.8	2.8	2.4	2.8	2.8	2.6	2.8	2.8

3 – Strong, 2- Medium, 1- Low

2nd YEAR: FOURTH SEMESTER

Course Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
24UAIA41	IOT and Its Applications	EC-6	3	1	0	0	4	25	75	100

Learning Objectives	
LO1	Understand the fundamental concepts of IoT, its architecture, convergence with web technologies, and strategic research directions.
LO2	Analyse the evolution from M2M to IoT, including value chains, industrial structures, and architectural design principles.
LO3	Explain IoT reference models, functional views, and architectural perspectives for deployment and operations.
LO4	Apply IoT concepts to real-world applications such as smart industry, retail, oil & gas, eHealth, and smart homes to create business value.
LO5	Evaluate security, privacy, governance, and data management challenges in IoT ecosystems and propose solutions for trusted platforms.

UNIT	Contents	Hours
I	**IoT and its Technology :** The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization.	12
II	**M2M to IoT :** A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT- An Architectural Overview– Building an architecture, Main design principles and needed capabilities.	12
III	**IoT Architecture:** State of the Art – Introduction, State of the art, Architecture. Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views	12
IV	**IoT Applications for Value Creations:** Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth	12
V	**Internet of Things Privacy, Security and Governance:** Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.	12

	Course Outcomes The student will be able to
CO1	Use of Devices, Gateways and Data Management in IoT.
CO2	Design IoT applications in different domain and be able to analyze their performance
CO3	Implement basic IoT applications on embedded platform
CO4	To gain knowledge on Industry Internet of Things
CO5	To Learn about the privacy and Security issues in IoT
Textbooks:	
1	Vijay Madisetti and Arshdeep Bahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited 2014, 1st Edition.
2	Ovidiu Vermesan and Peter Friess, "Internet of Things – From Research and Innovation to Market Deployment"River Publishers,978-87-93102-94-1,2014
3	"From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence",Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
4	IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017
Reference Books:	
1	Michael Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World".
2	Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications 2013, 1st Edition.
Web resources:	
1	https://onlinecourses.nptel.ac.in/noc20_cs66/preview
2	https://www.tutorialspoint.com/internet_of_things/index.htm

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	2	2	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	2	3	3	3	3	3	2	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	14	15	15	14	15	14	12	15	15	14	15
Average	2.8	3	3	2.8	3	2.8	2.4	3	3	2.8	3

3 – Strong, 2- Medium, 1- Low

2nd YEAR: FOURTH SEMESTER

Course Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
24UAIA42	**Robotics and Its Applications**	**EC-6**	**3**	**1**	**0**	**0**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the robotics fundamentals
LO2	Understand the sensors and matrix methods
LO3	Understand the Localization: Self-localizations and mapping
LO4	To study about the concept of Path Planning, Vision system
LO5	To learn about the concept of robot artificial intelligence

UNIT	Contents	Hours
I	**Introduction:** Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics.	12
II	**Actuators and sensors :** Types of actuators, stepper-DC-servo- and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor- common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors	12
III	**Localization:** Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.	12
IV	**Path Planning:** Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies Vision system: Robotic vision systems-image representation- object recognition-and categorization-depth measurement- image data compression	12
V	**Application:** Ariel robots-collision avoidance robots for agriculture-mining-exploration-underwater-civilian- and military applications-nuclear applications-space Applications-Industrial robots-artificial intelligence in robots-application of robots in material handling.	12

CO	Course Outcome The student will be able to
CO1	Describe the different physical forms of robot architectures.
CO2	Kinematically model simple manipulator and mobile robots.
CO3	Mathematically describe a kinematic robot system
CO4	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control and uncertainty.
CO5	Program robotics algorithms related to kinematics,control, optimization and uncertainty.
Textbooks:	
1	Richared D.Klafter. Thomas Achmielewski and Mickael Negin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001
2	Saeed B.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2 nd edition 2011
Reference Books:	
1	Industrial robotic technology-programming and application by M.P.Grooveret.al, McGrawhill 2008
2	Robotics technology and flexible automation by S.R.Deb, THH-2009
Web resources:	
1	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm
2	https://www.geeksforgeeks.org/robotics-introduction/

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	2	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	2	3	3	3	3	3	2	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	14	15	15	14	15	14	14	15	15	14	15
Average	2.8	3	3	2.8	3	2.8	2.8	3	3	2.8	3

Strong-3 Medium-2 Low-1

2nd YEAR: FOURTH SEMESTER

Course Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
24UAIA41P	IOT and its Applications Lab	EC-7	0	0	2	0	2	25	75	100

Learning Objectives:

LO1	Demonstrate the ability to interface various electronic components and sensors with Arduino.
LO2	Apply programming logic to control actuators such as LEDs, motors, and buzzers using Arduino.
LO3	Develop skills in reading and processing input data from sensors like LDR, LM35 and ultrasonic sensors.
LO4	Design and implement simple embedded systems for automation and control applications
LO5	Integrate multiple input/output devices to create functional prototypes for real-world problem solving.

LAB EXERCISES	Hours
1. Controlling the Light Emitting Diode (LED) with a push button 2. Interfacing the RGB LED with the Arduino 3. Controlling the LED blink rate with the potentiometer interfacing with Arduino 4. Detection of the light using photo resistor 5. Interfacing of temperature sensor LM35 with Arduino 6. Interfacing Servo Motor with the Arduino. 7. Interfacing of the Active Buzzer with Arduino 8. Interfacing of the Relay with Arduino 9. Building Intrusion Detection System with Arduino and Ultrasonic Sensor 10. Directional Control of the DC motor using Arduino	**30**

CO	Course Outcomes The student will be able to
CO1	Interface and operate various sensors (photoresistor, LM35, ultrasonic) with Arduino to acquire environmental data.
CO2	Control actuators such as LEDs, motors, buzzers, and relays using Arduino programming.
CO3	Implement real-time control systems using inputs from sensors and outputs to actuators.
CO4	Design and test embedded applications such as intrusion detection, motor control and automated lighting.
CO5	Integrate hardware components and software logic to develop functional Arduino-based prototypes
Textbooks:	
1	Arshdeep Bahga, Vijay Madisetti, "Internet of Things : A Hands-On Approach", 2014. ISBN: 978-0996025515
2	Boris Adryan, Dominik Obermaier, Paul Fremantle, "The Technical Foundations of IoT", Artech Houser Publishers, 2017.
Reference Books:	
1	Michael Margolis, "Arduino Cookbook", O"Reilly, 2011
2	Marco Schwartz, "Internet of Things with ESP8266", Packt Publishing, 2016.
3	Dhivya Bala, "ESP8266 : Step by Step Tutorial for ESP8266 IoT, Arduino NODEMCU Dev. Kit", 2018.
Web resources:	
1	https://onlinecourses.nptel.ac.in/noc20_cs66/preview
2	https://www.tutorialspoint.com/internet_of_things/index.htm

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	2	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	2	3	3	3	3	3	2	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	14	15	15	14	15	14	14	15	15	14	15
Average	2.8	3	3	2.8	3	2.8	2.8	3	3	2.8	3

Strong-3 Medium-2 Low-1

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIA42P	**Robotics and Its Applications Lab**	**EC-7**	**0**	**0**	**2**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	To determine the Maximum/Minimum position of link
LO2	To understand basics of accuracy, repeatability and resolution .
LO3	To learn how to write a program for shape identification.
LO4	To learn about simulation of cutting and welding operations
LO5	To learn how to write a program for industrial process.

Unit	**Content**	**Hours**
	1. Determine Maximum/Minimum positions of link 2. Verify transforms (gripper ↔ world coordinate) 3. Measure accuracy, repeatability, resolution 4. Robot Programming and Simulation for Pick and Place 5. Robot Programming and Simulation for Colour identification 6. Robot Programming and Simulation Shape detection tasks 7. Simulate machining (cutting/welding operations) 8. Robot Programming and Simulation for writing practice 9. Create simulations for industrial processes (packaging, assembly) 10. Multi-process robotic programming and scenarios	30

CO	Course Outcomes The student will be able to
CO1	Model and analyze the kinematics of robotic manipulators to determine workspace, positional limits, and coordinate transformations.
CO2	Understand the concept of accuracy and resolution.
CO3	Develop and implement the concept of shape identifications
CO4	Apply image processing methods for color detection, shape recognition, and visual feedback in robotic applications.
CO5	Design and simulate multi-process industrial robotic systems integrating machining, writing, packaging, and assembly operations.
Textbooks:	
1	" R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi, 4th Reprint, 2005.
2	John J.Criag, Introduction to Robotics Mechanics and Control, Third Edition, Pearson Education, 2009.
Reference Books:	
1	Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis, Oxford UniversityPress, Sixth Impression, 2010.
2	K.K.Appu Kuttan, Robotics, I K Intenational, 2007.
3	Fundamentals of Robotics by D.K. Pratihar, Narosa Publishing House, New-Delhi, 2017
Web resources:	
1	https://onlinecourses.nptel.ac.in/noc21_me76/preview
2	https://www.youtube.com/watch?v=xrwz9IxpMJg

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	2	2	2	2	3
CO2	3	3	2	3	2	3	2	3	3	3	2
CO3	3	3	2	3	3	2	2	3	3	3	2
CO4	3	3	2	3	3	3	3	3	3	3	3
CO5	3	3	2	3	3	3	2	3	3	3	2
Total	15	15	10	15	13	14	11	14	14	14	12
Average	3	3	2	3	3	3	2.2	3	3	3	2

Strong-3 Medium-2 Low-1

2nd YEAR: FOURTH SEMESTER

Course Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
24UAIS41	Fundamentals of Fuzzy Logic	SEC-5	2	0	0	0	2	25	75	100

Learning Objectives	
LO1	To understand the basic concept of Fuzzy logic
LO2	To learn the various operations on relation properties
LO3	To study about the membership functions
LO4	To learn about the Defuzzification and Fuzzy Rule-Based System
LO5	To learn the concepts of Applications of Fuzzy Logic

UNIT	Contents	Hours
I	**Introduction to Fuzzy Logic :** Fuzzy Sets , Fuzzy Set Operations, Properties of Fuzzy Sets – Classical Relations: Cartesian Product of Relation, Cardinality of Crisp Relation, Operations on Crisp Relation**,** Properties of Crisp Relations, Composition.	6
II	**Fuzzy Relations:** Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Product and Composition – Tolerance and Equivalence Relations: Crisp Relation, Fuzzy Relation.	6
III	**Membership Functions:** Features of Membership Function, Classification of Fuzzy Sets, Fuzzification – Membership Value Assignments: Intuition, Inference, Rank Ordering, Neural Network, Genetic Algorithm.	6
IV	**Defuzzification:** Lambda Cuts for Fuzzy Sets, Lambda Cuts for Fuzzy Relations, Defuzzification Methods – Fuzzy Rule-Based System: Formation of Rules, Decomposition of Rules, Aggregation of Fuzzy Rules, Properties of Set of Rules, Fuzzy Inference System.	6
V	**Fuzzy Decision Making:** Fuzzy Ordering, Individual Decision Making, Multi-Person Decision Making, Multi-Objective Decision Making, Fuzzy Bayesian Decision Method – Applications of Fuzzy Logic: Fuzzy Logic in Automotive Applications, Fuzzy Logic in Image Processing.	6

CO	Course Outcomes
CO1	Understand the basics of Fuzzy sets, operation and properties.
CO2	Apply Cartesian product and composition on Fuzzy relations and use the tolerance and Equivalence relations.
CO3	Analyze various fuzzification methods and features of membership Functions.
CO4	Evaluate defuzzification methods for real time applications.
CO5	Design an application using Fuzzy logic and its Relations.
Textbooks:	
1	S. N. Sivanandam, S. Sumathi and S. N. Deepa-Introduction to Fuzzy Logic using MATLAB, Springer-Verlag Berlin Heidelberg 2007.
Reference Books:	
1	Guanrong Chen and Trung Tat Pham- Introduction to Fuzzy Sets, Fuzzy Logic and Fuzzy Control Systems
2	Timothy J Ross , Fuzzy Logic with Engineering Applications
Web resources:	
1	https://www.javatpoint.com/fuzzy-logic
2	https://www.guru99.com/what-is-fuzzy-logic.html

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	2	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	2	3	3	3	3	3	2	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	14	15	15	14	15	14	14	15	15	14	15
Average	2.8	3	3	2.8	3	2.8	2.8	3	3	2.8	3

Strong-3 Medium-2 Low-1

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAEC41	**Environmental Studies & Disaster Management**	**AEC- 3**	**2**	**0**	**0**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	To provide basic knowledge of Environmental Science and Sustainability
LO2	To understand the Fundamentals of Disaster Management
LO3	To create awareness about Natural Disaster and Management
LO4	To familiarize students with Manmade Disaster and Management
LO5	To promote community participation and technological applications in disaster risk reduction

Unit	Content	Hours
1	**Environmental Science and Sustainability** Ecosystem: structure, types, and functions - Biodiversity: importance and conservation strategies - Environmental pollution: types (Air & Water), causes, effects, and control measures - Climate change and global warming	5
2	**Fundamentals of Disaster Management** Concepts: disaster, hazard, vulnerability, risk, resilience - Types of disasters: natural and man-made - Disaster management cycle: prevention, mitigation, preparedness, response, recovery.	5
3	**Natural Disasters and Management** Earthquakes, floods, Oil spill disaster, cyclones, Tsunami, droughts, landslides, Heat wave - Causes, consequences, and case studies - Community and government measures for preparedness and mitigation. Role of Government in Disaster Management – NDMA, SDMA & DDMA. Community Based Disaster Management	8
4	**Man-Made Disasters and Management** Industrial accidents, fires, chemical and nuclear hazards, Biological hazards, transport accidents - Impacts on society, economy, and environment - Disaster preparedness and management strategies - Case studies: Bhopal Gas Tragedy, Vizag Gas Leak, urban disasters.	7
5	**Sustainable Development and Disaster Risk Reduction** Principles of sustainable development and Sustainable Development Goals (SDGs) - Climate change and disaster interlinkages - Disaster risk reduction strategies: early warning systems, resilient infrastructure, policy framework. Role of technology, education, and media in environmental sustainability and disaster management	5

CO	Course Outcomes The Students will be able to
CO1	Describe the importance of ecosystems, biodiversity, and methods of controlling pollution.
CO2	Understand the basic concepts of disaster management, hazards, risks, and resilience.
CO3	Explain the causes, effects, and control measures of major natural disasters.
CO4	Identify different types of man-made disasters and suggest safety and preparedness
CO5	Recognize the role of sustainable development and disaster risk reduction strategies in
Textbooks:	
1	Government of India – Disaster Management Act, 2005
2	P.C. Mishra – Disaster Management and Mitigation
Reference Books:	
1	Erach Bharucha – Textbook of Environmental Studies
2	IGNOU Study Material – Disaster Management
Web resources:	
1	https://ndma.gov.in/

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	2	2	3	3	3	3
CO2	3	3	3	3	3	2	3	3	3	3	2
CO3	3	3	3	3	3	2	3	3	3	3	2
CO4	3	2	3	3	3	2	3	3	3	3	2
CO5	3	2	3	3	3	2	3	3	3	3	2
Total	15	13	15	14	15	10	14	15	15	15	11
Average	3	2.6	3	2.8	3	2	2.8	3	3	3	2.2

3 – Strong, 2- Medium, 1- Low