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 EDUCATION

Preamble

Bachelor of 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 area 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 life long 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.
Program 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 – I						
Code	Course Title	Hours Distribution				C
		L	T	P	S	
24UFTA11/ 24UFUR11	Tamil – 1 / Urdu- 1	4	1	0	0	3
24UFEN11	English – 1	4	1	0	0	3
24UAIC11	CC – 1 Programming for Problem Solving	3	1	2	0	5
24UAIC12P	CC - 2 (Practical) Problem Solving using C	0	0	4	0	3
24UMAA12	EC - 1 AL I) Statistical Methods and their Applications - I	3	1	0	0	3
24UAIS11	SEC – 1 NM Office Automation	1	0	1	0	2
24UAIS12	SEC – 2 Internet & Web Development	1	0	1	0	2
24UAIF11	FC Digital Computer Fundamentals	1	1	0	0	2
					30	**23**

Semester – II						
Code	Course Title	Hours Distribution				C
		L	T	P	S	
24UFTA21/ 24UFUR21	Tamil – 2 / Urdu- 2	4	1	0	0	3
24UFEN21	English - 2	4	1	0	0	3
24UAIC21	CC - 3 Python Programming	3	1	2	0	5
24UAIC22P	CC - 4 (Practical) Python Programming Lab	0	0	4	0	2
24UMAA23	EC - 2 AL Statistical Methods and it's Applications-II	3	1	0	0	4
24UMAA23P	EC - 3 AL Statistical Methods and it's Applications –I & II Practical's	0	0	2	0	2
24UAIS21	SEC - 3 PHP Programming	1	0	1	0	2
24UAEC21	AEC – 1 Life Skill For Yoga	1	1	0	0	2
					30	**23**

Semester – III						
24UFTA31	Tamil - 3	4	1	0	0	3
24UFEN31	English - 3	4	1	0	0	3
24UAIC31	CC – 5 Artificial Intelligence	3	1	2	0	5
24UAIC32P	CC - 6 Practical -III Artificial Intelligence Lab	0	0	4	0	2
24UAIA31 24UAIA32	EC - 4 AL 1. Relational Database Management Systems 2. Mobile Application Development	3	1	0	0	4
24UAIA33P 24UAIA34P	EC - 5 AL 1. RDBMS Lab 2. Mobile Application Development Lab	0	0	2	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
					30	**23**

Semester – IV						
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 AL 1. IOT and its Applications 2. Robotics and its Applications	3	1	0	0	4
24UAIA41P 24UAIA42P	EC - 7 AL 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
					30	**23**

Semester – V						
24UAIC51	CC -9 Artificial Neural Networks	4	1	0	0	5
24UAIC52P	CC- 10 Artificial Neural Networks Lab	0	0	4	0	3
24UAIC53	CC – 11Tensor Flow	2	1	1	0	4
24UAIC54P	CC– 12 Tensor Flow Lab	0	0	3	0	2
24UAIE51 24UAIE52	EC – 8 i) Cryptography ii) Big Data	4	1	0	0	4
24UAIE53 24UAIE54	EC – 9 i) Full Stack Development ii)Simulation and Modeling	4	1	0	0	4
24UAEC51	AEC – 4 Gender Equality and Social Inclusion	1	1	0	0	2
24UAIIN51	Internship					2
24UCSIK51	*IKS* Exploring Game Design for Cultural Heritage				2	
					30	**26**

Semester – VI						
24UAIC61	CC – 13 – Machine Learning	4	1	0	0	4
24UAIC62P	CC - 14 Practical – Machine Learning Lab	0	0	5	0	3
24UAIC63P	CC - 15 - Project	0	0	5	0	4
24UAIE61 24UAIE62	EC – 10 i) Data Visualization (TABLEAU) ii) Virtual Reality	4	1	0	0	4
24UAIE63 24UAIE64	EC – 11 i) Cloud Computing ii) Natural Language Processing	4	1	0	0	4
24UAIP61	PEC – 1 Ethical Hacking	1	1	0	0	2
24UAIL61	SLC – 1 MongoDB	0	0	0	3	2
					30	**23**
					141+2*	

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	15	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

FIRST YEAR: FIRST SEMESTER

Course Code	Course Name Core Course 1	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIC11	CC-1 Programming for Problem Solving	Core	3	1	2	0	5	6	25	75	100

Learning Objectives

LO1	Understand and develop algorithms to solve problems.
LO2	Learn the basics of a programming language such as syntax, data types, variables, control structures (loops, conditionals), functions, and basic I/O operations.
LO3	Use data structures like arrays, linked lists, and stacks to solve various problems
LO4	Cultivate problem-solving skills by practicing solving various types of problems, including mathematical, logical, and real-world problems.
LO5	Foster critical thinking skills by exploring different approaches to solving problems and evaluating their effectiveness.

Unit	Content	Hours
1	Introduction to Programming: Introduction to computers, Computer characteristics, Hardware vs software, Steps to develop a program, Software development life cycle, Structured programming, Types of programming languages, Introduction to c, Developing a c program, Console input and output functions, Error diagnostics, Debugging Techniques	18
2	Operators and Expressions: Identifiers and keywords, Data types, Constants, Variables, Declarations, Expressions, Statements, Arithmetic operators, Unary operators, Relational and logical operators, Assignment operators, Conditional operator Branching, if- else statement, switch statement, go to statement, Looping, while statement, do- while statement, for statement, Nested control structures, break statement, continue statement.	18
3	Arrays and Strings: Defining an array, Processing an array, Multidimensional arrays, Searching algorithm, Linear search, Sorting algorithm, Bubble sort algorithm, Strings, Defining a string, Initialization of strings, Reading and writing a string, Processing the strings.	18
4	Functions: Functions, Overview, Defining a function, Accessing a function, Function prototypes, Passing arguments to a function, Passing arrays to functions, Recursion. Pointers and Structures: Fundamentals, Pointer declarations, Passing pointers to functions	18

5	Pointers and one dimensional arrays, Dynamic memory allocation, Operations on pointers, Defining a structure, Processing a structure, Array of structures, Structures and pointers, Self-referential structures. File system, Types of file, working with files, File Handling, file operation.	18

CO	Course Outcomes
CO1	The student can understand the fundamentals of computer and program development process.
CO2	They can prepare innovative solution for the problem using branching and looping statements.
CO3	The student can decompose a problem into functions and synthesize a complete program using divide and conquer approach.
CO4	The Student will be able to formulate algorithms and programs using arrays, pointers and structures
CO5	The Student will be able to create a new application software to solve real world problems.
Textbooks:	
1	Problem Solving & Program Design in C Pearson Education India 7th edition Jeri R. Henly
2	Problem Solving with C Paperback – 30 April 2018 by M.T. Somashekara (Author), D. S. Guru (Author), K. S. Manjunatha (Author)
Reference Books:	
1	Yashavant Kanetkar, "Let Us C", 15thedition, 2016, Bpb Publications, ISBN:9788183331630
2	Herbert Schildit, "The Complete Reference C", 4th edition, 2017, McGraw Hill Education(India), 2017, ISBN:978007041183
3	Beulah Christalin Latha, Anuja Beatrice, Carolin Jeeva & Anita Sofia, Fundamentals of Computing and Programming, 1st edition, Pearson, 2018
4	Sumitabha Das, "Computer Fundamentals and C Programming",18thedition,2018, McGraw Hill Education(India),ISBN:9789387886070
5	Stephen G.Kochan, "Programming in C",4th edition,2015,ISBN:9789332554665,
Web resources:	
1	https://www.technologywithvivek.com/2023/09/Problem%20solving%20techniques%20kya%20hoti%20hai.html
2	http://aagasc.edu.in/cs/C-Notes.pdf

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	2.6	2.8	2.2	2.8	2.8	2.8	2.4

3 – Strong, 2- Medium, 1- Low

FIRST YEAR: FIRST SEMESTER

Course Code	Course Name Core Course 2	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIC12P	**CC-2 Practical Problem Solving using C**	**Core**	**0**	**0**	**4**	**0**	**3**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	Understand the need for programming to solve computational problems
LO2	Encourage learners to collect relevant data and information related to the problem. This could involve research, interviews, observations, or data analysis.
LO3	Discover the basic programming constructs to prepare the program
LO4	Analyze and interpret data using array, functions and pointers
LO5	Recognize the bugs in the C Program

	List of Programs	**Hours**
I	1. Implementation of Basic C programs 2. Write a c program Add two complex number. 3. Simple computational problems using arithmetic expressions and operators 4. Program to print path from root node to destination node 5. Problem solving using branching and logical expressions 6. Iterative problems using Loops, while and for loops 7. Implementation of linear searching, bubble sort, and Matrix Manipulation using Arrays 8. Implementation of Text Processing using Strings 9. Find Square Root, numerical differentiation, numerical integration using functions and Recursion. 10. Implementation of basic file operations	60

CO	Course Outcomes
CO1	Translate given algorithms to a working and correct program
CO2	Identify and correct logical errors encountered at run time
CO3	Create iterative as well as recursive programs.
CO4	Represent data in arrays, strings and structures and manipulate them through a program.
CO5	Declare pointers of different types and use them in defining self-referential structures.
Textbooks:	
1	Verbal and nonverbal Reasoning by RS Agarwal from S Chand publications
2	Quantitative aptitude by R S Agarwal, S Chand Publications
3	Floyd, Thomas L, "Digital Computer Fundamentals", 10th Edition, University Book Stall, 1997
4	Peter Norton, "Introduction to Computers",4th Edition, TMH Ltd, New Delhi, 2001.
5	R.G. Dromey,"How to solve it by Computers", Pearson Publishers, New Delhi, 2007
Reference Books:	
1	Practical Electronics for Inventors, 4th Edition Paul Scherz , Dr. Simon Monk
2	Quantitative Aptitude by Competitive Examinations by Abhijit Guha 4 th edition 67.
3	Analytical and Logical reasoning By Sijwali B S
4	A Modern Approach To Verbal & Non Verbal Reasoning By R S Agarwal& Analytical and Logical reasoning for CAT and other management entrance test By Sijwali B S
5	Malvino, Paul Albert and Leach, Donald P, "Digital Principles and Applications", 4 th Edition, TMH, 2000.
6	Malvino, Paul Albert and Leach, Donald P, "Digital Computer Fundamentals", 3 rd Edition, TMH, 1995.
7	Bartee, Thomas C, "Digital Computer Fundamentals", 6th Edition, TMH, 1995.
Web resources:	
1	https://www.coursesidekick.com/mathematics/2831716/
2	https://byjus.com/maths/number-system/
3	https://www.sctevtservices.nic.in/docs/website/pdf/140294.pdf/
4	https://www.jsscacs.edu.in/sites/default/files/Department%20Files/Number%20System%20.pdf/
5	https://www.vedantu.com/maths/factorisation

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	2.8	2.2	2.8	2.8	2.8	2.4

3 – Strong, 2- Medium, 1- Low

FIRST YEAR: FIRST SEMESTER

Course Code	Course Name Skill Enhancement Course-1	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIS11	SEC-1 Office Automation	SEC	1	0	1	0	2	2	25	75	100

Learning Objectives	
LO1	Understand basic computer hardware components and their functions, Differentiate between operating systems like DOS, UNIX, and Windows.
LO2	Learn to open, save, and close documents, Master text editing, formatting, and document layout, and Use spell checker and printing features effectively.
LO3	Navigate Excel for data entry, formatting, and basic analysis. Understand formulas, charts, and financial statement preparation.
LO4	Learn about databases, sorting, indexing, and record retrieval Design and execute queries and reports using DBMS tools like MS Access.
LO5	Create and deliver engaging presentations using PowerPoint. Understand slide types, adding objects, transitions, and animations

Unit	Content	Hours
1	Introductory concepts: Memory unit– CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating Systems and it's features: DOS–UNIX–Windows. Introduction to Programming Languages.	6
2	Word Processing: Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, header and footers, numbering; printing Preview, options, merge.	6
3	Spreadsheets: Excel– opening, entering text and data, formatting, navigating; Formulas–entering, handling and copying; Charts–creating, formatting and printing, analysis tables, preparation of financial statements, introduction to data analytics.	6
4	Database Concepts: The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of data files; Understanding Programming environment in DBMS; Developing menu drive applications in query language(MS–Access).	6
5	Power point: Introduction to Power point - Features – Understanding slide typecasting & amp; viewing slides – creating slide shows. Applying special object – including objects & amp; pictures– Slide transition– Animation effects, audio inclusion, timers.	6

CO	Course Outcomes
CO1	Possess the knowledge on the basics of computers and its components
CO2	Gain knowledge in Creating Documents, spreadsheets and presentations.
CO3	Demonstrate an understanding of different automation tools.
CO4	Learn the concepts of Database and implement the Query in Database.
CO5	Utilize the automation tools for documentation, calculation and presentation purpose.
Textbooks:	
1	Peter Norton, "Introduction to Computers"–Tata McGraw - Hill.
2	Archana Kumar "Computer Basics with Office Automation'' January 2019 Edition, Dream Tech Publication
3	"Computer Fundamentals and Office Automation " Vishal Sharma, Vision Publications
4	Computer Fundamentals and Office Automation (English, Paperback, Dr. R. Deepalakshmi) Charulatha Publications Private Limited ,Edition 2019
Reference Books:	
1	Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, "Microsoft 2003", Tata McGrawHill.
2	"Office Automation: Concepts and Tools" Springer-Verlag Berlin and Heidelberg Co. 1985 edition
Web resources:	
1	https://www.udemy.com/course/office-automation-certificate-course/
2	https://www.javatpoint.com/automation-tools/

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	3	2	3	3	2
CO2	3	2	2	3	3	3	2	2	3	3	3
CO3	3	2	2	3	3	3	2	2	3	3	3
CO4	3	2	2	3	3	3	3	2	2	2	3
CO5	3	2	2	3	3	3	2	2	3	3	2
Total	15	11	10	14	14	14	12	10	14	14	13
Average	3	2.2	2	2.8	2.8	2.8	2.4	2	2.8	2.8	2.6

3 – Strong, 2- Medium, 1- Low

FIRST YEAR: FIRST SEMESTER

Course Code	Course Name Skill Enhancement Course-2	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIS12	SEC-2 Internet And Web Development	Core	1	0	1	0	2	2	25	75	100

Learning Objectives	
LO1	To introduce the fundamentals of Internet and internet connections, networking.
LO2	Learning about internet technology and threats.
LO3	To introduce the fundamentals of HTML, and the principles of web design.
LO4	To Learn how to apply CSS rules to HTML elements to control their appearance, such as color, size, font, spacing, and positioning.
LO5	To construct basic websites using HTML and Cascading Style Sheets**.**

Unit	Content	Hours
1	Introduction to Internet-How does internet works. -History of Internet- Concept of WWW, Internet and WWW.Types of Internet Connection (Dial Up connection, Direct Connection & Broad Band Connection, VPN)- Internet vs Web, Web Servers, Webpage Addresses (URL's)-Use of the Internet and Benefits of Internet-Introduction to Web technologies. Types of search engines-Difference between search engine and web browser.	6
2	Internet Technology And Threats: TCP/IP–Internet Technology and Protocol. Packet switching technology, Internet Protocols: TCP/IP, Router, Internet Addressing. HTTP Protocol: Request and Response. Features of latest version of Web. Introduction of Internet threats: History Of worms And Virus - Types of Threats on Internet. Issues of Threats on Internet. Protecting Computer from virus • Firewall.	6
3	Introduction of HTML-HTML Basic Formatting Tags-Working with Text, organizing text in HTML Working with Links and URL. Creating Tables Working with Images. Working with Lists, Hyperlinks and Frames. Working with Forms, Interactive Elements.	6
4	Introduction to CSS: Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, Overview and features of latest version of CSS. CSS lists, CSS tables.	6
5	HTML &CSS Exercises: Practical sessions-To create login page-To create a hyperlink for webpage navigation -Student table creation- student registration form-create a order and un order list Create a dynamic navigation bar.	6

CO	Course Outcomes
CO1	The Students will able to understand the concepts basic of internet.
CO2	The Students will develop an understanding of internet technology and online threats.
CO3	To introduce the fundamentals of HTML, and the principles of web design.
CO4	The students will able to apply CSS rules to HTML elements such as color, size, font, spacing, and positioning.
CO5	The students will be able to construct basic web page design using HTML & CSS.
Textbooks:	
1	HTML and CSS QuickStart Guide: The Simplified Beginners Guide to Developing a Strong Coding Foundation, Building Responsive Websites, and Mastering ... of Modern Web Design (QuickStart Guides) 2021 by David Durocher (Author).
2	Textbook Of Web Design With HTML & CSS (Paperback, Nishant Katiyar, Dr. Kapil Saxena, Dr. Rakesh Kumar Bhujade, Dr. Sachin Kamley),2020.
3	Web Design With HTML &CSS : HTML & CSS Complete Beginner's Guide Paperback– 31 October 2021by Prem Kumar (Author).
Reference Books:	
1	HTML & CSS: THE COMPLETE REFERENCE fifth edition by Thomas Powell (Author).2017
2	Head First HTML and CSS by Elizabeth Robson and Eric Freeman published in 2012
Web resources:	
1	https://www.tutorialspoint.com/internet_technologies/internet/
2	https://www.w3schools.com/html/html_css/
3	https://www.codecademy.com/
4	https://www.geeksforgeeks.org/

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	2	2
CO2	3	3	3	3	2	3	3	2	2	2	2
CO3	3	3	3	3	3	2	2	2	3	3	3
CO4	3	3	3	3	3	2	2	2	3	3	3
CO5	3	3	3	3	3	2	2	3	3	3	2
Total	15	15	15	15	14	12	12	12	14	13	12
Average	3	3	3	3	3	2	2	2	3	3	2

3 – Strong, 2- Medium, 1- Low

FIRST YEAR: FIRST SEMESTER

Course Code	Course Name Foundation Course	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIF11	**FC- Digital Computer Fundamentals**	**Foundation**	**1**	**1**	**0**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	Identify the logic gates and their functionality
LO2	Perform number conversions from one system to another system
LO3	Design basic electronic circuits (combinational circuits)
LO4	Perform a comparative analysis of the components of different memory units
LO5	Perform number conversions

Unit	Content	Hours
1	Divisibility, LCM, HCF- Numbers, Decimals, Fractions, Powers -Profit, Loss - Simple interest and Compound interest -Speed, Distance, Time.	6
2	Coding, Decoding, Series-missing number, odd one out, Cause and Effect, Blood relations	6
3	Number System And Codes: Decimal Numbers, Binary Numbers, Decimal to Binary Conversions, Binary Arithmetic, 1's and 2's complements of Binary Numbers, Signed Numbers, Arithmetic Operations with Signed numbers, Hexadecimal Numbers, Octal Numbers, Digital Codes, Error Detection Codes	6
4	Logic Gates: The Inverter, The AND gate, The OR gate, The NAND gate, NOR gate, The Exclusive–OR gate and Exclusive-NOR gate; Boolean Algebra and Logic Simplification – Boolean Operations and Expressions, De Morgan's Theorems, The Karnaugh Map, SOP Minimizations.	6
5	Factoring Methods: Finding the square root of a number, the smallest Divisor of an integer, the greatest common divisor of two integers, computing the prime factors of an integer, raising a number to a large power.	6

CO	Course Outcomes
CO1	Identify the logic gates and their functionality
CO2	Perform number conversions from one system to another system
CO3	Design basic electronic circuits (combinational circuits)
CO4	Perform a comparative analysis of the components of different memory units
CO5	Perform number conversions
Textbooks:	
1	R.G.Dromey, "How to Solve it by Computer", Pearson Education India, 2008.
2	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms",3rd Edition, The MIT Press Cambridge, Massachusetts London, England, 2008
3	Brain M. Kernighan, and Dennis M. Ritchie, "The C Programming Language", 2 nd edition, Princeton HallSoftware Series, 2012
Reference Books:	
1	Steven S. Skiena, "The Algorithm Design Module", 2nd Edition, Springer-Verlag London Limited, 2008
2	Donald E. Knuth, The Art of Computer Programming", Volume 1: Fundamental Algorithms, 3rd Edition, Addison Wesley Longman, 1997
3	Donald E. Knuth, The Art of Computer Programming", Volume 2: Semi numerical Algorithms, 3 rd Edition, Addison Wesley Longman, 1998
4	Greg Perry and Dean Miller, "C programming Absolute Beginner's Guide", 3rd edition, Pearson Education, Inc, 2014
Web resources:	
1	https://www.geeksforgeeks.org/number-series-in-quantitative-aptitude/

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	2	2
CO2	3	3	3	3	2	3	3	2	2	2	2
CO3	3	3	3	3	3	2	2	2	3	3	3
CO4	3	3	3	3	3	2	2	2	3	3	2
CO5	3	3	3	3	3	2	2	3	3	3	3
Total	15	15	15	15	14	12	12	12	14	13	12
Average	3	3	3	3	2.8	2.2	2.2	2	2.8	2.6	2

3 – Strong, 2- Medium, 1- Low

FIRST YEAR: SECOND SEMESTER

Course Code	Course Name Core Course	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIC21	**CC-3 Python Programming**	**Core**	**3**	**1**	**2**	**0**	**5**	**6**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the concepts of Python programming.
LO2	Understanding Decision and Looping statements.
LO3	To impart knowledge on functions, strings and modules.
LO4	To impart knowledge on list, set, tuples and dictionaries.
LO5	To know the file handling concepts.

Unit	Content	Hours
1	Basics of Python Programming: History of Python-Features of Python-Literal-Constants-Variables - Identifiers - Keywords-Built - in Data Types-Output Statements - Input Statements- Comments - Indentation-Operators- Expressions-Type conversions. Python Arrays: Defining and Processing Arrays - Array methods.	18
2	Control Statements: Selection/Conditional Branching statements: if, if-else, nested if and if-elif-else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops. Jump Statements: break, continue and pass statements	18
3	Functions: Function Definition Function Call Variable Scope and its Life time Return Statement. Function Arguments: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments. Python Strings: String operations mutable Strings-Built in String Methods and Functions-String Comparison. Modules: import statement - The Python module - dir() function - Modules and Namespace - Defining our own modules.	18
4	Python Sets & Lists: Creating a Sets & types - Creating a list-Access values in List-Updating values in Lists-Nested lists -Basic list operations-List Methods. Tuples: Creating, Accessing, Updating and Deleting Elements in a tuple - Nested tuples - Difference between lists and tuples. Dictionaries: Creating, Accessing, Updating and Deleting Elements in a Dictionary - Dictionary Functions and Methods - Difference between Lists and Dictionaries.	18
5	Python File Handling: Types of files in Python - Opening and Closing files-Reading and Writing files: write () and write lines () methods-append() method - read() and readlines()methods - with keyword-Splitting words - File methods -File Positions-Renaming and deleting files.	18

CO	Course Outcomes
CO1	Learn the basics of python, Do simple programs on python, Learn how to use an array.
CO2	Develop program using selection statement, Work with Looping and jump statements, Do programs on Loops and jump statements.
CO3	Illustrate Concept of, function arguments
CO4	Illustrate and implement the concept of Sets, Tuples, List and Dictionaries
CO5	Understand usage of File handlings in python.
Textbooks:	
1	Ashok Kamthaneet.al,Programming and Problem Sovling with Python, 2nd Edition,TMH
2	ReemaThareja, "Python Programming using problem solving approach", First Edition, 2017,Oxford University Press
Reference Books:	
1	VamsiKurama,"Python Programming:A Modern Approach",Pearson Education.
2	Mark Lutz,"Learning Python", Orielly.
3	Adam Stew arts,"Python Programming",Online
4	Fabio Nelli,"Python Data Analytics",A Press
5	Kenneth A. Lambert,"Fundamentals of Python
Web resources:	
1	https://www.programiz.com/python-programming
2	https://www.guru99.com/python-tutorials.html
3	https://www.w3schools.com/python/python_intro.asp
4	https://www.geeksforgeeks.org/python-programming-language/
5	https://en.wikipedia.org/wiki/Python_(programming_language)
6	https://infytq.infosys.com/

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	2	3	2	3	3	2	2	3	3	3	2
CO4	3	2	2	3	3	3	3	3	3	3	3
CO5	3	3	2	3	3	3	2	3	3	3	2
Total	14	14	10	15	13	14	11	14	14	14	12
Average	2.8	2.8	2	3	2.6	2.8	2.2	2.8	2.8	2.8	2.4

3 – Strong, 2- Medium, 1- Low

FIRST YEAR: SECOND SEMESTER

Course Code	Course Name Core Course	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIC22P	**CC-4 Python Programming Lab**	**Core Practical**	**0**	**0**	**4**	**0**	**2**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the concepts of Python programming.
LO2	Understanding Decision and Looping statements.
LO3	To impart knowledge on functions, strings and modules.
LO4	To impart knowledge on list,set, tuples,and dictionaries.
LO5	To know the file handling concepts.

	List of Programs	**Hours**
I	3. Write a program to check if a number belongs to the Fibonacci Sequence. 4. Write a program to solve Quadratic Equations. 5. Write a program to find the sum of n Natural Numbers. 6. Write a program to display Multiplication Tables. 7. Write a program to check if a given number is a Prime Number or Not 8. Write a program to implement a Sequential Search. 9. Write a program to create a Calculator. 10. Write a program to explore String Functions. 11. Write a program to implement Selection Sort. 12. Write a program to implement Stack. 13. Write a program to demonstrate usage of Basic Regular Expression. 14. Write a Python Program to find the area of a triangle given all three sides. 15. Write a program to demonstrate use of Advanced Regular Expressions for Data Validation. 16. Write a program to demonstrate the use of LIST. 17. Write a program to demonstrate use of Dictionaries. 18. Write a program to Create SQLite database and Perform Operations on Tables. 19. Write a program to demonstrate Exceptions in Python. 20. Write a program to drawing Line Chart and Bar Chart using Mat plot lib. 21. Write a program to draw Histogram and Pie Chart using Mat plot lib.	60

CO	Course Outcomes
CO1	Learn the basics of python,Do simple programs on python, Learn how to use an array.
CO2	Develop program using selection statement, Work with Looping and jump statements, Do programs on Loops and jump statements.
CO3	Illustrate Concept of, function arguments
CO4	Illustrate and implement the concept of Sets, Tuples, List and Dictionaries
CO5	Understand usage of File handlings in python.
Textbooks:	
1	Ashok Kamthaneet.al,Programming and Problem Sovling with Python, 2nd Edition,TMH
2	ReemaThareja, "Python Programming using problem solving approach", First Edition, 2017,Oxford University Press
Reference Books:	
1	VamsiKurama,"Python Programming:A Modern Approach",Pearson Education
2	Mark Lutz,"Learning Python", Orielly.
3	Adam Stew arts,"Python Programming",Online
4	Fabio Nelli,"Python Data Analytics",A Press
5	Kenneth A. Lambert,"Fundamentals of Python
Web resources:	
1	https://www.programiz.com/python-programming
2	https://www.guru99.com/python-tutorials.html
3	https://www.w3schools.com/python/python_intro.asp
4	https://www.geeksforgeeks.org/python-programming-language/
5	https://en.wikipedia.org/wiki/Python_(programming_language)
6	https://infytq.infosys.com/

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	2	3	2	3	3	2	2	3	3	3	2
CO4	3	2	2	3	3	3	3	3	3	3	3
CO5	3	3	2	3	3	3	2	3	3	3	2
Total	14	14	10	15	13	14	11	14	14	14	12
Average	2.8	2.8	2	3	2.6	2.8	2.2	2.8	2.8	2.8	2.4

3 – Strong, 2- Medium, 1- Low

FIRST YEAR: SECOND SEMESTER

Course Code	Course Name Core Course	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIS21	**PHP Programming**	**SEC**	**1**	**0**	**1**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	Learn how to take a static website and turn it into a dynamic website run from a database using PHP and MySQL.
LO2	Analyze the basic structure of a PHP web application and be able to install and maintain the web server, compile, and run a simple web application
LO3	PHP can generate dynamic page content and can create, open, read, write, delete, and close files on the server.
LO4	Understand the concepts of forms and files.
LO5	Create dynamic Web sites using PHP and MySQL.

Unit	Content	Hours
1	PHP : Introduction – installing & configuring PHP – Lexical structure – Basic syntax of PHP – programming in web environment – Common PHP Script Elements – Using Variables – Constants – Data types – Operators – Statements – Using Functions	6
2	Control structures: Decisions and Loop Making Decisions, Doing Repetitive task with looping, Mixing Decisions and looping with Html, PHP If, Else and Else if, PHP Switch, PHP While Loops, PHP For Loops.	6
3	Strings: String constant-printing strings-accessing individual's characters – comparing strings- concatenating strings-manipulating & searching strings – regular expressions. Array: Associative array – identifying elements of an array – storing data in arrays – multidimensional arrays – extracting multiple values – arrays and variable conversion – traversing- sorting.	6
4	Advanced PHP : Introduction to advanced PHP concept – Working With Forms – Processing Forms – Form Validation – Files: File and Directory Handling – Including Files – File Access	6
5	PHP and SQL database: PHP and LDAP – PHP Connectivity – Sending and receiving emails – Retrieving data from MySQL – Manipulating data in MySQL using PHP	6

CO	Course Outcomes
CO1	Describe about the basic concepts of PHP
CO2	Explain control structures.
CO3	Understand the concept of arrays and strings.
CO4	Understand the concepts of forms and files.
CO5	Create dynamic Web sites using PHP and MySQL.
Textbooks:	
1	PHP, a beginner guide
2	PHP and MYSQL Web development, Luke welling, 2003
Reference Books:	
1	Web Programming, Chris Bates, Wiley India, New Delhi, Third Edition, Reprint 2011
2	MySQL Bible: Steve Suchring, John Wiley sons,Mumbai, First Edition2002
3	Programming PHP, Rasmus Lerdorf and Levin Tatroe, O'Reilly Publications2002,Mumbai
Web resources:	
1	https://www.geeksforgeeks.org/object-oriented-programming-in-cpp/
2	https://www.cplusplus.com/doc/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	-	1	2	-	1	3	-
CO2	2	3	3	3	-	-	2	-	1	3	-
CO3	1	3	3	3	-	1	2	-	1	3	1
CO4	1	3	3	3	-	-	1	-	_	3	1
CO5	1	3	3	3	-	1	1	-	_	3	2
Total	8	15	15	15	0	3	8	0	3	15	4
Average	1.6	3	3	3	0	0.6	1.6	0	0.6	3	0.8

3 – Strong, 2- Medium, 1- Low

SECOND 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

SECOND 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

SECOND 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

SECOND 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	2.6	2.8	2.2	2.8	2.8	2.8	2.4

3– Strong, 2- Medium, 1- Low

SECOND YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIA33P	**RDBMS LAB**	**EC-5**	**0**	**0**	**2**	**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
	i) Execute a single line query and group functions. ii) Execute DDL Commands. iii) Execute DML Commands iv) Execute DCL and TCL Commands. v) Implement the Nested Queries. vi) Implement Join operations in SQL vii) Create views for a particular table viii) Implement Locks for a particular table. ix) Develop a PL/SQL procedure for an application using exception handling. x) Develop a PL/SQL procedure for an application using cursors. xi) Develop a PL/SQL procedure for an application using functions xii) 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	2.6	2.8	2.2	2.8	2.8	2.8	2.4

3– Strong, 2- Medium, 1- Low

SECOND 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**	**0**	**0**	**2**	**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
	i) Develop an application that uses GUI components, Font and Colors. ii) Develop an application that uses Intent and Activity. iii) Develop an application that uses Layout Managers and event listeners. iv) Write an application that draws basic graphical primitives on the screen. v) Develop an application that makes use of RSS Feed. 6. Implement an application that implements Multi-threading. ii) Develop an application that create alarm clock. iii) Develop an application Using Widgets. iv) Implement an application that writes data to the SD card. v) Implement an application that creates an alert upon receiving a message. vi) 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	2.6	2.8	2.2	2.8	2.8	2.8	2.4

3– Strong, 2- Medium, 1- Low

SECOND 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

SECOND 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

SECOND 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**
ii) Develop an R program to demonstrate the working of Arithmetic, Relational, Logical, and Assignment operators. iii) (a) Develop an R program to check if a number is Odd or Even. • Develop an R program to check if the given number is a Prime Number. iv) (a) Develop an R program to find the Factorial of a number. • Develop an R program to find the Factors of a number. v) Write an R Program to Find the Fibonacci sequence Using Recursive Function. vi) (a) Develop an R program to perform basic arithmetic operations using a Simple Calculator. • Extend the program to find the L.C.M of two numbers. vii) Write an R Program to create Vector and to access elements in a Vector. viii) Create an R program to implement an S3 class with objects and a user-defined generic function. ix) Develop an R program to create an S4 class and its objects. x) Create an R program to define a user-defined generic function in an S4 class. xi) 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

SECOND 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

SECOND 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

SECOND 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

SECOND 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

SECOND 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

SECOND 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

THIRD YEAR: FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIC51	**Artificial Neural Networks**	**CC – 9**	**4**	**1**	**0**	**0**	**5**	**5**	**25**	**75**	**100**

Learning Objectives

LO1	To understand artificial neural models, activation functions, and multilayer networks.
LO2	To understand different learning algorithms, memory-based learning, and adaptation.
LO3	To understand single-layer perceptrons, pattern recognition, and linear classifiers.
LO4	To understand multilayer perceptron networks, backpropagation, and delta learning rules.
LO5	To understand deep learning architectures, CNNs, RNNs, and applications of DNNs.

Unit	Content	Hours
1	Artificial Neural Model- Activation functions- Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, NonLinear Separable Problem - Multilayer Networks.Learning Algorithms- Error correction - Gradient Descent Rules, Perception Learning Algorithm, Perception Convergence Theorem.	15
2	Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation	15
3	Single layer Perception: Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, Learning in continuous perception. Limitation of Perception.	15
4	Multi-Layer Perception Networks: Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm	15
5	Deep learning- Introduction- Neuro architectures building blocks for the DL techniques, Deep Learning and Neocognitron, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzman Machines, Training of DNN and Applications	15

CO	Course Outcomes The Student will be able to
CO1	Explain artificial neural network models, activation functions, and perceptrons.
CO2	Apply learning algorithms including Hebbian, Boltzmann, and competitive learning.
CO3	Design and analyze single-layer perceptron networks for pattern recognition.
CO4	Develop multilayer perceptron models using back propagation and delta learning rules.
CO5	To apply deep learning architectures CNN, RNN, DBN for real world problems
Textbooks:	
1	Ian Goodfellow et al., Deep Learning, MIT Press (Latest Reprint),2016.
2	Charu Aggarwal, Neural Networks and Deep Learning, Springer, 2018.
Reference Books:	
1	Simon Haykin, Neural Networks and Learning Machines, **3rd Edition,2009.**
Web resources:	
1	NPTEL: https://nptel.ac.in/courses/106106184
2	https://pytorch.org/tutorials/
3	https://keras.io

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

THIRD YEAR: FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIC52P	Artificial Neural Networks Lab	CC – 10	0	0	4	0	3	4	25	75	100

Learning Objectives	
LO1	Understand fundamental neural network models, activation functions, and architectures.
LO2	Apply various learning algorithms such as Hebbian, competitive, and Boltzmann learning.
LO3	Design and implement single-layer perceptron models for classification tasks.
LO4	Develop multilayer perceptron models using backpropagation and gradient descent.
LO5	Implement deep learning architectures like CNNs and RNNs for real-world applications.

Unit	Content	Hours
	1. Develop basic activation functions (Step, Sigmoid, ReLU, Tanh) and visualize outputs. 2. Apply Gradient Descent algorithm to minimize a simple cost function. 3. Demonstrate Hebbian Learning rule for pattern association. 4. Design a Competitive Learning algorithm for clustering simple data. 5 .Construct Perceptron Learning Algorithm for AND/OR logic gates. 6. Build Adaptive Linear Neuron (Adaline) using Gradient Descent. 7. Create Backpropagation algorithm for XOR problem using MLP. 8. Train a Multilayer Perceptron using a dataset (e.g., Iris dataset). 9. Develop a simple Convolutional Neural Network (CNN) for image classification (MNIST). 10. Design a Recurrent Neural Network (RNN) for sequence prediction (text or time series).	60

CO	Course Outcomes The Student will be able to
CO1	Explain neural network models and activation functions.
CO2	Apply different learning algorithms to solve problems.
CO3	Design and implement single-layer perceptron models.
CO4	Develop multilayer neural networks using backpropagation.
CO5	Implement deep learning models for practical applications.
Textbooks:	
1	Ian Goodfellow, Yoshua Bengio, Aaron Courville,Deep Learning, MIT Press,2016.
Reference Books:	
1	Simon Haykin,Neural Networks and Learning Machines, **3rd Edition**,**2009, Pearson**.
2	François Chollet,Deep Learning with Python, **2nd Edition**, 2021.
Web resources:	
1	https://nptel.ac.in/courses/106106184 (Deep Learning)
2	https://nptel.ac.in/courses/106106201 (Neural Networks)

Mapping with Programme Outcomes and Programme Specific Outcomes

CO / PO	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

THIRD YEAR: FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIC53	Tensor Flow	CC – 11	2	1	1	0	4	4	25	75	100

Learning Objectives	
LO1	To understand TensorFlow basics, graphs, sessions, and operations.
LO2	To implement linear and logistic regression models.
LO3	To manage variables, experiments, and checkpoints.
LO4	To build CNNs, GANs, VAEs, and RNNs.
LO5	To apply Seq2Seq, transformers, and reinforcement learning with Keras.

Unit	Content	Hours
1	**Introduction:** Overview of Tensorflow: Why Tensorflow? Graphs and Sessions. Operations: Basic operations, constants, variables, Control dependencies, Data pipeline, Tensor Board	12
2	**Linear And Logistic Regression:** Tensor Flow's Optimizers, tf.data Example: Birth rate - life expectancy, MNIST dataset. Eager execution: Example: word2vec, linear regression	12
3	**Variable Sharing And Managing Experiments:** Interfaces Name scope, variable scope Saver object, checkpoints, Autodiff Example: word2vec. Introduction to ConvNet	12
4	**CONVNET IN TENSORFLOW:** image classification, GANs, Variational Auto- Encoders, Recurrent Neural Networks: Example: Character-level Language Modelling	12
5	**SEQ2SEQ WITH ATTENTION:** Neural machine translation, Beyond RNNs: Transformer, Tensor2Tensor: Dialogue agents, Reinforcement Learning in Tensor Flow, Keras	12

CO	Course Outcomes The Student will be able to
CO1	Explain Tensor Flow concepts and operations.
CO2	Train regression models with Tensor Flow optimizers.
CO3	Manage experiments and perform automatic differentiation.
CO4	Develop CNNs, GANs, VAEs, and RNNs for applications.
CO5	Implement Seq2Seq, transformers, and reinforcement learning models.
Textbooks:	
1	Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow,Aurélien Géron, 3rd Edition, O'Reilly Media, 2023.
2	Aurélien Géron, Hands-On Machine Learning, **3rd Edition**, 2023.
Reference Books:	
1	Giancarlo Zaccone,Md.Rezaul Karim, Ahmed Menshawy" Deep Learning with Tensorflow" , 2017
2	Zaccone et al., Deep Learning with TensorFlow 2, 2018.
3	Francois Chollet, "Deep Learning with Python", 2017.
Web resources:	
1	NPTEL: https://nptel.ac.in/courses/106106229
2	https://www.tensorflow.org/tutorials
3	https://keras.io

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

THIRD YEAR: FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIC54P	**Tensor Flow Lab**	**CC-12**	**0**	**0**	**3**	**0**	**2**	**3**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand Tensor Flow basics, graphs, sessions, and operations
LO2	To understand linear and logistic regression models.
LO3	To understand variable management, experiments, and checkpoints.
LO4	To understand building CNNs, GANs, VAEs, and RNNs.
LO5	To understand Seq2Seq, transformers, and reinforcement learning with Keras.

Unit	Content	Hours
	1. 1.1. Explain concepts of basic operations, constants, and variables. 2. Demonstrate concepts of control dependencies. 3. Illustrate concepts of data pipeline and TensorBoard. 4. Apply concepts of TensorFlow's optimizers. 5. Analyze concepts of linear regression. 6. Describe concepts of variable scopes, Saver object, and checkpoints. 7. Explore concepts of autodiff using word2vec. 8. Develop concepts of CNN for image classification. 9. Examine concepts of GANs and Variational Autoencoders. 10. Design concepts of Seq2Seq with attention or Transformer models.	45

CO	Course Outcomes The Student will be able to
CO1	Implement basic TensorFlow operations, constants, and variables.
CO2	Develop linear and logistic regression models using TensorFlow optimizers.
CO3	Apply variable scopes, checkpoints, and automatic differentiation in experiments.
CO4	Build and execute CNNs, GANs, and Variational Autoencoders for practical tasks.
CO5	Implement Seq2Seq, Transformer, and reinforcement learning models with Keras.
Textbooks:	
1	Reza Bosagh Zadeh, Bharath Ramsundar, "Tensor Flow for Deep Learning", 2018. Architecture, Pearson Education.
Reference Books:	
1	Giancarlo Zaccone,Md.Rezaul Karim, Ahmed Menshawy" Deep Learning with Tensorflow" , 2017
2	Ian Goodfellow, "Deep Learning", 2016
3	Francois Chollet, "Deep Learning with Python", 2017.
Web resources:	
1	NPTEL Lab: https://nptel.ac.in/courses/106106229
2	https://colab.research.google.com
3	https://www.kaggle.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

THIRD YEAR: FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIE51	Cryptography	EC – 8	4	1	0	0	4	5	25	75	100

Learning Objectives

LO1	To understand the fundamentals of Cryptography
LO2	To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
LO3	To understand the various key distribution and management schemes.
LO4	To understand how to deploy encryption techniques to secure data in transit across data networks
LO5	To design security applications in the field of Information technology

Unit	Content	Hours
1	**Introduction:** The OSI security Architecture – Security Attacks – Security Mechanisms – Security Services – A model for network Security.	15
2	**Classical Encryption Techniques:** Symmetric cipher model – Substitution Techniques: Caesar Cipher – Monoalphabetic cipher – Play fair cipher – Poly Alphabetic Cipher – Transposition techniques – Stenography	15
3	**Block Cipher and DES:** Block Cipher Principles – DES – The Strength of DES –RSA: The RSA algorithm.	15
4	**Network Security Practices:** IP Security overview - IP Security architecture – Authentication Header. Web Security: SecureSocketLayer and Transport Layer Security – Secure Electronic Transaction.	15
5	**Intruders** - Intruders Detection - Password Management - Recommended reading and writing sites – **Malicious software** - Types of Malicious Software - Viruses - Worms - Distributed denial of Service attacks – **Firewalls** - Need,Characteristics,Types - Firewall Basing - Firewall Location and Configuration .	15

CO	Course Outcomes The Student will be able to
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms
CO3	Apply the different cryptographic operations of public key cryptography
CO4	Apply the various Authentication schemes to simulate different applications.
CO5	Understand various Security practices and System security standards
Textbooks:	
1	William Stallings, "Cryptography and Network Security Principles and Practices".
Reference Books:	
1	Behrouz A. Foruzan, "Cryptography and Network Security", Tata McGraw-Hill, 2007.
2	AtulKahate, "Cryptography and Network Security", Second Edition, 2003,TMH.
3	M.V. Arun Kumar, "Network Security", 2011, First Edition,USP.
4	P.Rizwan Ahmed, Cryptography, Margham Publications, 2014
Web resources:	
1	https://www.tutorialspoint.com/cryptography/
2	https://gpgtools.tenderapp.com/kb/how-to/introduction-to-cryptography
3	https://nptel.ac.in/courses/106105162

Mapping with Programme Outcomes and Programme Specific Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	1	2	3	2	2	2	2	2	3
CO2	3	3	2	2	3	3	3	2	2	3	3
CO3	3	3	2	3	3	2	2	3	2	2	3
CO4	3	2	3	2	2	3	2	2	2	2	3
CO5	3	2	2	2	3	3	3	2	2	2	3
Total	15	12	10	11	13	13	12	11	10	11	15
Average	3	2.4	2.0	2.2	2.6	2.6	2.4	2.2	2.0	2.2	3

3 – Strong, 2- Medium, 1- Low

THIRD YEAR: FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIE52	**Big Data**	**EC – 8**	**4**	**1**	**0**	**0**	**4**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the basics of Big Data, its characteristics, and applications.
LO2	To learn analytical methods like clustering and classification.
LO3	To apply association rules and recommendation systems.
LO4	To understand stream data processing and real-time analytics.
LO5	To learn NoSQL databases and big data applications.

Unit	Content	Hours
1	Introduction to Big Data Analytics: Big data characteristics, Designing data architecture, Data Sources, Preprocessing, Data storage and analysis, Big data analytics Applications. Introduction to Hadoop: Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and programming model, Hadoop YARN.	15
2	NoSQL Database: Data store, Data architecture patterns, Managing big data, Shared-nothing architecture for big data tasks, MongoDB Database - Features, Dynamic schema, Auto sharing, Query language and commands. MapReduce: Map tasks, Reduce tasks, Execution, Composing MapReduce for calculations, Matrix vector multiplication by MapReduce, Relational algebra operations, Matrix multiplication	15
3	Hive: Architecture, Data types, Formats, Data model, Integration and workflow steps Builtin functions, Data definition language, Data manipulation language Aggregation, Join, Group by clause. Spark: Spark SQL, Data analysis operations, Programming using RDDs, Data ETL process,	15
4	Data Stream Mining: Data stream concepts, Model, Architecture, Data stream management system, stream queries, Stream processing issues, Stream computing, Sampling data, Filtering, Estimating moments, Decaying windows, Frequent itemsets - Finding frequent itemsets, Limited passes algorithm, Counting frequent itemsets in a stream; Apache Spark streaming architecture.	15

5	Graph Model: Representing graph as triples, Resource description framework for graph databases, Naïve DB graph database, Property graph model, Probabilistic Graphical Network Organization - Bayesian and Markov networks. Graph Analytics: Use cases, Stats Model and Probabilistic based analytics, Technical complexity in analyzing graphs; Spark GraphX platform – Features of graph analytics platform. Text Mining: What is Text Mining? Web mining- Web Content Mining, Web Usage mining	15

CO	**Course Outcomes** **The Student will be able to**
CO1	Explain big data characteristics and implement basic Hadoop and MapReduce concepts.
CO2	Apply NoSQL concepts and perform data processing using MapReduce techniques.
CO3	Use Hive and Spark for data querying, analysis, and ETL operations.
CO4	Analyze streaming data and implement stream processing using Spark Streaming.
CO5	Apply graph analytics and text mining methods for big data applications.

Textbooks:	
1	Seema Acharya & Subhasini Chellappan, Big Data and Analytics, Wiley, 2020.
2	Michael Minelli, Michelle Chambers, and Ambiga Dhiraj (2013), Big Data, Big Analytics: Emerging Business intelligence and Analytic trends for Today's Business, John Wiley & Sons
Reference Books:	
1	Jeffrey Aven, (2018), Data Analytics with SPARK using Python, Pearson, Addison-Wesley Data & Analytics Series.
2	Tom White (2014), Hadoop: The Definitive Guide, O'Reilly Publications, 4th Edition
3	NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence – Pramod J. Sadalage & Martin Fowler, Addison-Wesley, 2013.
4	Learning Spark: Lightning-Fast Big Data Analysis – Holden Karau et al., O'Reilly Media, 2nd Edition, 2020.
	Web Resources:
1	NPTEL: https://nptel.ac.in/courses/106104189
2	https://spark.apache.org/docs/latest/
3	https://hadoop.apache.org/docs/
4	https://hadoop.apache.org/docs/

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

THIRD YEAR: FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIE53	**Full Stack Development**	**EC-9**	**4**	**1**	**0**	**0**	**4**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	Learn web development basics, MERN stack, and JavaScript.
LO2	To Work with Node.js, npm, and server creation.
LO3	Understand MongoDB, CRUD operations, and Mongoose.
LO4	To Use Express.js for routing, middleware, and APIs.
LO5	Build frontend applications using React components and hooks.

Unit	Content	Hours
1	Understanding Web Development – Client–Server Architecture – User, Browser, Web Server, Backend Services – HTTP/HTTPS – MVC Architecture – Introduction to Full Stack Development – Overview of MERN Stack – Basics of JavaScript (ES6+) – Introduction to Asynchronous Programming (Promises,Async/Await).	15
2	Introduction to Node.js – Installation and Setup – Node.js Modules – Node Package Manager (npm) – File System (Basic I/O) – Creating Simple Node.js Applications – Events and Event Loop (overview) – Creating Basic HTTP Server – Handling Requests and Responses.	15
3	Introduction to NoSQL and MongoDB – MongoDB Atlas Setup – Database, Collections, Documents – Basic CRUD Operations – Introduction to Mongoose – Schema and Model – Connecting MongoDB with Node.js – Simple Database Applications.	15
4	Introduction to Express.js – Setting up Express Application – Routing (GET, POST, PUT, DELETE) – Middleware (basic concept) – Handling Request and Response – Building Simple REST APIs – Connecting Express with MongoDB.	15
5	Introduction to React – Creating React Applications – Components – Props and State – React Hooks (useState, useEffect) – Handling Forms – Fetching Data from APIs – Basic Routing (React Router) – Integration with Backend APIs	15

CO	Course Outcomes The Students will be able to
CO1	Explain full stack concepts and implement asynchronous programming using JavaScript.
CO2	Develop basic server-side applications using Node.js and handle HTTP requests/responses.
CO3	Build database-driven applications by integrating MongoDB with Node.js.
CO4	Develop RESTful APIs and connect Express applications with MongoDB.
CO5	Develop dynamic front-end applications and integrate them with backend services.
Textbooks:	
1	Alex Banks & Eve Porcello, Learning React, 3rd Edition, O'Reilly, 2023.
2	Ethan Brown, Web Development with Node and Express, O'Reilly Media, Second Edition, 2019.
Reference Books:	
1	Mario Casciaro & Luciano Mammino, *Node.js Design Patterns*, 3rd Edition, Packt, 2020.
2	Kristina Chodorow & Shannon Bradshaw, *MongoDB: The Definitive Guide*, 3rd Edition, O'Reilly, 2019.
3	Vasan Subramanian, *Pro MERN Stack*, Apress, 2019.
4	David Flanagan, *JavaScript: The Definitive Guide*, 7th Edition, O'Reilly, 2020.
Web resources:	
1	https://nodejs.org/en/docs
2	https://expressjs.com/
3	https://developer.mozilla.org/en-US/docs/Web/JavaScript
4	https://www.mongodb.com/docs/

Mapping with Programme Outcomes and Programme Specific Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	2	2	2	2	1	1
CO2	3	3	3	2	3	2	2	2	3	2	2
CO3	3	3	3	2	3	2	2	2	3	3	2
CO4	3	3	3	2	3	2	2	2	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	15	14	13	10	14	11	11	11	14	12	10
Average	3	2.8	2.6	2	2.8	2.1	2.1	2.1	2.8	2.2	2

3 – Strong, 2- Medium, 1- Low

THIRD YEAR: FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIE54	**Simulation and Modeling**	**EC – 9**	**4**	**1**	**0**	**0**	**4**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the basics of modeling and simulation.
LO2	To understand input data analysis and probability distributions.
LO3	To understand random number and random variate generation methods.
LO4	To understand output analysis and system comparison in simulation.
LO5	To understand discrete event simulation, modeling, and optimization techniques.

Unit	Content	Hours
1	Introduction To Modeling & Simulation – What is Modeling and Simulation? – Complexity Types – Model Types – Simulation Types – M&S Terms and Definitions Input Data Analysis – Simulation Input Modeling – Input Data Collection - Data Collection Problems - – Input Modeling Strategy - Histograms - Probability Distributions - Selecting a Probability Distribution.	15
2	Random Variate Generation – Random Numbers – Random Number Generators – General principles – Inverse Transform Method – Acceptance Rejection Method –Composition Method –Relocate and Rescale Method - Specific distributions- Output Data Analysis – Introduction -Types of Simulation With Respect to Output Analysis - Stochastic Process and Sample Path - Sampling and Systematic Errors.	15
3	Comparing Systems via Simulation – Introduction – Comparison Problems - Comparing Two Systems - Screening Problems - Selecting the Best - Comparison with a Standard - Comparison with a Fixed Performance Discrete Event Simulations – Introduction - Next-Event Time Advance - Arithmetic and Logical Relationships	15
4	Entity Modeling – Entity Body Modeling – Entity Body Visualization – Entity Body Animation – Entity Interaction Modeling – Building Modeling Distributed Simulation – High Level Architecture (HLA) – Federation Development and Execution Process (FEDEP) – SISO RPR FOM Behavior Modeling – General AI Algorithms - Decision Trees	15
5	Optimization Algorithms – Genetic Algorithms – Simulated Annealing Examples: Sensor Systems Modeling – Human Eye Modeling – Optical Sensor Modeling – Radar Modeling.	15

CO	Course Outcomes The Student will be able to
CO1	Explain the basic concepts of modeling and simulation.
CO2	Apply input data analysis and probability distributions in simulation models.
CO3	Use random number and random variate generation methods.
CO4	Analyze simulation outputs and compare different systems.
CO5	Develop simple simulation models and apply optimization techniques.
Textbooks:	
1	Averill Law, Simulation Modeling and Analysis, **6th Edition**, McGraw Hill, 2020.
2	George S. Fishman, "Discrete-Event Simulation: Modeling, Programming and Analysis", Springer-Verlag New York, Inc., 2001.
Reference Books:	
1	Jerry Banks, Discrete-Event System Simulation, **5th Edition**.
Web resources:	
1	NPTEL: https://nptel.ac.in/courses/112107086
2	https://www.anylogic.com/resources/
3	https://simpy.readthedocs.io

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

THIRD YEAR :FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAEC51	**GENDER EQUALITY AND SOCIAL INCLUSION**	**AEC**	**2**	**-**	-	-	2	**2**	25	75	100

Learning Objectives	
LO1	To understand the introduction to Gender and Social Inclusion
LO2	To acquire knowledge on Gender inequality in society
LO3	To equip Social Exclusion and Marginalized Group
LO4	To understand Legal Frameworks and Policies
LO5	To assimilate knowledge about Strategies for Promoting Equality and Inclusion

Unit	Content	Hours
1	**Introduction to Gender and Social Inclusion:** Concepts Gender-Gender roles, stereotypes, and socialization - Meaning and importance of social inclusion- Intersectionality (gender, caste, class, disability, etc.) - Historical perspectives on gender inequality.	6
2	**Gender Inequality in Society:** Forms of gender discrimination (education, health, employment) - Gender-based violence and its types - Wage gap and economic inequality - Representation of gender in media and culture - Case studies on gender inequality (local and global).	6
3	**Social Exclusion and Marginalized Groups:** Understanding social exclusion - Marginalized communities (women, LGBTQ+ individuals, persons with disabilities, minorities) - Barriers to inclusion (social, economic, political) - Role of culture, tradition, and norms in exclusion - Impact of exclusion on development.	6
4	**Legal Frameworks and Policies:** National and international laws promoting gender equality - Human rights perspective on inclusion - Government policies and welfare programs - Role of institutions (NGOs, UN, civil society).	6
5	**Strategies for Promoting Equality and Inclusion:** Gender mainstreaming and inclusive development - Education and awareness programs - Role of media and technology - Empowerment approaches (economic, social, political) - Community participation and leadership - Measuring progress (indicators like SDGs)	6
	Total	30

Theory 100%

CO	Course Outcomes
CO1	Understand the introduction to Gender and Social Inclusion
CO2	Acquire knowledge on Gender inequality in society
CO3	Equip the knowledge on Social Exclusion and Marginalized Group
CO4	Understand Legal Frameworks and Policies towards gender Equality
CO5	Gain knowledge about Strategies for Promoting Equality and Inclusion
Textbooks:	
1	Development as Freedom, Amartya Sen, Publisher: Oxford University Press (1999).
Reference Books:	
1	Gender Trouble: Feminism and the Subversion of Identity, 2nd Edition (1999 revised edition) Publisher: Routledge, London & New York.
2	David E. Newton, Gender Inequality: A Reference Handbook, Bloomsbury Academic, 2019.
3	Gender Inequality: A Reference Handbook, by David E. Newton ABC-CLIO, 2019.
Web resources:	
1	GESI-Traning-Module.pdf
2	Gender Equality_and_Social_Inclusion WV.pdf
3	integrity-action-gesi-strategy-version-2.pdf
4	Major Marginalized Groups: A Closer Look - Urban Studies
5	UNOPS GESI Mainstreaming in Projects Strategy (Final)

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	2	2	3	2	3	2	3	3	2	2	2
CO2	2	2	2	2	2	2	2	2	2	2	2
CO3	2	3	3	2	3	2	3	3	2	2	2
CO4	2	2	2	2	2	2	2	2	3	2	2
CO5	3	3	3	2	3	2	3	3	3	2	2
TOTAL	11	12	13	10	13	10	13	13	12	10	10
AVERAGE	2.2	2.4	2.6	2	2.6	2	2.6	2.6	2.4	2	2

3– Strong,2-Medium, 1-Low

THIRD YEAR: FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIIN51	**Internship**		**0**	**0**	**0**	**0**	**2**	**0**	**25**	**75**	**100**

Learning Objectives	
LO1	Understand professional work ethics, performance, and adaptability in a work environment.
LO2	Understand organizational and time management skills required in professional settings.
LO3	Understand interpersonal relationships and teamwork in an organization.
LO4	Understand documentation and presentation of internship work.
LO5	Exercise computational thinking over the entire software life cycle

Internship / Industrial Training:

The students to undergo 2 weeks of Internship / Industrial Training in the Industry

Sno	Area of Work	Maximum Marks
1	a) Work Related performance – Work Attitude/ Academic preparation/ problem solving ability/ Adaptability / Overall Attendance / Progress towards learning goals	**10**
	b) Organizational skills – Time management skills / Planning skills/ communication skills	**20**
	c) Relationship with others – Willingness to cooperate with co-works/ Ability to work with supervisor / Acceptance of constructive comments / Ability to take direction	**20**
2	Internship Report / Viva Voce Examination	**25**
	Total	75

* CIA Marks =25 marks (Internship Review 1, Review2 and Review 3)

CO	Course Outcomes- On completion of this course, students will be
CO1	Demonstrate effective work attitude, problem-solving ability, and progress toward learning goals.
CO2	Apply planning, communication, and time management skills in completing assigned tasks.
CO3	Exhibit teamwork, cooperation, and ability to accept feedback and guidance.
CO4	Prepare and present internship reports effectively and perform well in viva voce examination.
CO5	Apply best practices of IT industries by working in the Product or service domain.

Guidelines for internship

• Internship should be of 2 weeks duration.

• A student is expected to find internship by himself or herself. However, the institution should assist their students in getting internship in good organizations.

• The home institution cannot be taken as the place of internship.

• Internship can be on any topic covered in the syllabus mentioned in the syllabus, not restricted to the specialization.

• Internship can be done, in one of the following, but not restricted to, types of organizations:

- o Software development firms
- o Hardware/ manufacturing firms
- o Any small scale industries, service providers like banks
- o Clinics/ NGOs/professional institutions like that of CA, Advocate etc
- o Civic Depts like Ward office/post office/police station/ punchayat.

Guidelines for making Internship Report:

A student is expected to make a report based on the internship he or she has done in an organization. It should contain the following:

Certificate: A certificate in the prescribed Performa (given in appendix 1) from the organization where the internship done.

Evaluation form: The form filled by the supervisor or to whom the intern was reporting, in the prescribed Performa (given in appendix 2).

Title: A suitable title giving the idea about what work the student has performed during the internship.

Description of the organization: A small description of 1 to 2 pages on the organization where the student has interned

Description about the activities done by the section where the intern has worked: A description of

2 to 4 pages about the section or cell of the organization where the intern actually worked. This should give an idea about the type of activity a new employee is expected to do in that section of the organization.

Description of work allotted and actually done by the intern: A detailed description of the work allotted and actual work performed by the intern during the internship period. Intern may give a weekly report of the work by him or her if needed. It shall be of around 7 to 10 pages.

Self assessment: A self assessment by the intern on what he or she has learnt during the internship period. It shall contain both technical as well as inter personal skills learned in the process. It shall be of around 2 to 3 pages.

The internship report may be around 20 to 30 pages and this needs to be submitted to the external examiner at the time of examination.

THIRD YEAR: FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UCSIK51	Exploring Game Design for Cultural Heritage	IKS	0	0	0	2	-	2	25	75	100

Learning Objectives	
LO1	To Learn about the Game Design and Development
LO2	To know how to integrate Indian Culture into Game
LO3	To Explore and Develop 2D or 3D environment in Indian Culture
LO4	To get knowledge in Testing and Development in games
LO5	To create a Prototype for Gaming Techniques

Unit	Content	Hours
1	**Introduction to Game Design and Development** - Game Design Fundamentals - Key concepts game mechanics, storylines, player interaction, and aesthetics - Introduction to game engines (Unity, Godot, Unreal Engine): Choosing the right tool for your project.The Game Development Process - Game Genres and Their Application to Cultural Narratives - Exploring different game genres: action, adventure, puzzle, RPG	6
2	**Integrating Indian Culture into Game Design:** Storytelling in Games - integrate Indian mythology, history, and folklore into compelling game narratives - Designing interactive storylines - Creating playable characters inspired by mythological figures (e.g., warrior avatars, gods, or sages) - Designing NPCs (non-playable characters) to represent cultural heroes, historical figures, or deities.	6
3	**Game Development Tools and Techniques:** Introduction to Unity, Godot, or Unreal Engine - Setting up your game engine - Building basic 2D or 3D environments based on Indian cultural themes - Art and Audio for Cultural Representation - Designing textures, models, and animations inspired by Indian visual art.	6
4	**Testing and Deployment:** Debugging and testing games - Exporting Games for PC ,Console,and Mobile Platforms-Publishing on app stores and gaming platforms.	6
5	**Prototyping and Playtesting:** Prototyping and Iteration -Creating a simple game prototype that incorporates Indian cultural elements. Polishing the Prototype - Final touches: UI/UX design, animations, sound, and improving gameplay flow	6

CO	Course Outcomes The students will be able to
CO1	Understand the fundamentals of game design and development.
CO2	Create interactive digital experiences that integrate aspects of Indian culture.
CO3	Develop a simple game prototype using game engines like Unity or Godot.
CO4	Exploring the games in mobile Platforms
CO5	Explore the role of video games in UI/UX Design,animations
Textbooks:	
1	Jesse Schell, The Art of Game Design, **3rd Edition**, 2019.
2	Rules of Play: Game Design Fundamentals by Katie Salen and Eric Zimmerman,2004
Reference Books:	
1	Indian Mythology: A Captivating Guide to the Myths of India by M. K. Ghosh,2020.
2	The Penguin History of Early India: From the Origins to AD 1300 by Romila Thapar,2002.
Web resources:	
1	https://gamedesigning.org/learn/character-design/
2	https://learn.unity.com
3	https://www.inyteraction-design.org/literature/topic/ui-design

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	3	3	3	2	3	3	3	3	3	3
CO3	3	3	3	3	2	2	3	3	3	3	3
CO4	3	3	3	3	2	3	3	2	3	3	3
CO5	3	2	3	3	3	3	3	2	3	3	3
Total	15	14	15	15	12	14	15	13	15	15	15
Average	3	2.8	3	3	2.4	2.8	**3**	2.6	3	3	3

3 – Strong, 2- Medium, 1- Low

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIC61	**Machine Learning**	**CC- 13**	4	1	0	0	4	5	25	75	100

Learning Objectives

LO1	Understand fundamentals of AI, Machine Learning, and basic supervised/unsupervised models.
LO2	Understand neural networks, backpropagation, and genetic algorithms.
LO3	To Learn about Bayesian learning, probabilistic models, and hypothesis evaluation.
LO4	To Explore instance-based learning methods and function approximation techniques.
LO5	Understand advanced learning techniques including recommendation systems and reinforcement learning.

Unit	Content	Hours
1	**Introduction Machine Learning -** Machine Learning Concepts. Supervised and unsupervised learning, parametric vs nonparametric models, parametric models for classification and regression- Linear Regression, Logistic Regression, Naïve Bayes classifier, simple non-parametric classifier-K-nearest neighbour, support vector machines	**15**
2	**Neural networks and genetic algorithms :** Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.	**15**
3	**Bayesian and computational learning Bayes Theorem** – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.	**15**
4	**Instant based learning** K- Nearest Neighbour Learning, Distance- Weighted NEAREST NEIGHBOUR Algorithm, Remarks on K- NEAREST NEIGHBOUR Algorithm. A Note on Terminology – Locally weighted Regression – Radial Basis Functions – Case Based Learning.	**15**
5	**Advanced learning Recommendation systems** – opinion mining, sentiment analysis. Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning	**15**

CO	Course Outcomes The Students will be able to
CO1	Apply classification and regression algorithms like Linear Regression, Logistic Regression, Naïve Bayes, KNN, and SVM.
CO2	Implement neural network models and apply genetic algorithms for optimization problems.
CO3	Apply Bayesian techniques and learning models for decision making and prediction.
CO4	Implement KNN, locally weighted regression, and radial basis function methods.
CO5	Apply rule-based learning, sentiment analysis, and reinforcement learning algorithms.

Textbooks:	
1	Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Machine Learning-Pearson Education , Limited,2025.
2	Tom M. Mitchell, — Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
3	Machine Learning: A Probabilistic Perspective, MIT Press,2012.

Reference Books:	
1	EthemAlpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2	Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
3	Pattern Recognition and Machine Learning – Christopher Bishop
4	Deep Learning – Goodfellow, Bengio, Courville

Web resources:	
1	https://sklearn.org/stable/supervised_learning.html?utm_source=chatgpt.com#google_vignette
2	https://www.mygreatlearning.com/blog/perceptron-learning_algorithm/?
3	https://www.geeksforgeeks.org/data-science/bayes-theorem-in-machine-learning/

Mapping with Programme Outcomes and Programme Specific Outcomes

CO / PO	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

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIC62P	**Machine Learning Lab**	**CC -14**	0	0	5	0	3	5	25	75	100

Learning Objectives

LO1	To understand core concepts and models in machine learning.
LO2	To analyze the nature of problems that can be solved using machine learning techniques.
LO3	To design and implement suitable machine learning techniques for a given application.
LO4	To apply distance based learning models
LO5	To implement and evaluate rule based and tree based models

	Content	Hours
1	Design Logistic Regression for binary classification.	**75**
2	Implement K-Nearest Neighbour (KNN) classifier	
3	Implement Backpropagation algorithm (basic demonstration)	
4	Write a simple Genetic Algorithm for optimization (e.g., function maximization)	
5	Implement Bayes Theorem using a real dataset	
6	Implement Expectation-Maximization (EM) Algorithm (basic clustering example).	
7	Implement Locally Weighted Regression (LWR)	
8	Develop Radial Basis Function (RBF) Network	
9	Construct Sequential Covering Algorithm (rule learning)	
10	Implement a simple chatbot using rule-based learning	

CO	Course Outcomes The Students will be able to
CO1	Apply Logistic Regression and KNN for classification problems..
CO2	Demonstrate the Backpropagation algorithm for neural networks.
CO3	Use Genetic Algorithms for solving optimization problems.
CO4	Apply Bayes Theorem and EM algorithm for probabilistic analysis and clustering.
CO5	Develop rule-based models and a simple chatbot.

Textbooks:	
1	Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Machine Learning-Pearson Education , Limited,2025.
2	Tom M. Mitchell, — Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
3	Machine Learning: A Probabilistic Perspective, MIT Press,2012.

Reference Books:	
1	EthemAlpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2	Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
3	Pattern Recognition and Machine Learning – Christopher Bishop
4	Deep Learning – Goodfellow, Bengio, Courville

Web resources:	
1	https://nptel.ac.in/courses/106106202
2	https://sklearn.org/stable/supervised_learning.html?utm_source=chatgpt.com#google_vignette
3	https://www.mygreatlearning.com/blog/perceptron-learning_algorithm/?
4	https://www.geeksforgeeks.org/data-science/bayes-theorem-in-machine-learning/

Mapping with Programme Outcomes and Programme Specific Outcomes

CO / PO	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

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIC63P	**Project**	**CC-15**	**0**	**0**	**5**	**0**	**4**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	Advance from an intellectually curious student to a creator/maker and an industry professional
LO2	Apply verbal and written communication skills to explain technical problem solving techniques and solutions to an increasingly diverse and global audience
LO3	Collaborate within and across disciplinary boundaries to solve problems
LO4	Apply mathematical and/or statistical methods to facilitate problem solving.
LO5	Exercise computational thinking over the entire software life cycle

Unit	Content	Hours
1	1. The Candidates have to undergo a Minimum of 150 Hours of Project Work during the Course of Study either in an IT Industry / Public or Private Sector Organization / Research Institutes / Institution itself. 2. The Candidates need to identify and analyze real world problems on the selected project domain. 3. During the course of study, the Candidates need to Develop, Design, Test, etc., the Applications as per the directions by the Guide. 4. Then the Candidates have to prepare and submit the manuscript of the Project Work as a Report as per the requirements of the Institution / Department for Evaluation. 5. The submission of the Project Report will be done at the end of the Semester for Presentation and Viva-Voce during the Practical Examinations of the Semester. The Passing Minimum for Project Work is 50%. 7. If the Candidate fails to score 50% in the Project Work, the Candidate has to improve it during the next attempt. 8. A Faculty Member from the Department will act as a Guide to Supervise and Monitor the progress of the Candidates during the course of Project Work. 9. The Faculty Member will act as the Internal Examiner during the course of	**75**

	Project Work as well as at the time of conducting the Viva-Voce Examination. 10. The Internal Marks for the Project Work will be awarded by the concerned Guide / Internal Examiner. 11. The Internal and External Examiners shall both evaluate the Project Report, Presentation and conduct the Viva-Voce Examination.	
	INTERNAL MARKS AWARDED FOR THE PROJECT WORK **25 Marks**	
	1. Review 0 -Title Selection of the project 2. Review 1 – 5 Marks 3. Review 2 – 1 0 Marks 4. Review 3 – 10 Marks	
	EXTERNAL MARKS AWARDED FOR THE PROJECT WORK **75 Marks**	
	1. Evaluation of the Project Report – 25 Marks 2. Presentation – 25 Marks 3. Viva-Voce Examination – 25 Marks	

CO	Course Outcomes The Students will be able to
CO1	Show leadership skills and learn time management
CO2	Identify various tools to be applied to a specific problem
CO3	Evaluate the reports
CO4	Take part in a team as well as manage it to deliver stunning outcomes
CO5	Assess and develop the individual skills to present and organize projects

Mapping with Programme Outcomes and Programme Specific Outcomes

CO / PO	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	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	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	15	15	15	15	15	15	15	15	15	15
Average	3	3	3	3	3	3	3	3	3	3	3

3 – Strong, 2- Medium, 1- Low

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIE61	**Data Visualization (TABLEAU)**	**EC –10**	**4**	**1**	**0**	**0**	**4**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the Tableau analytics platform, workspace, and data preparation.
LO2	To create basic data visualizations including bar, line, and heat maps.
LO3	To apply advanced visualization techniques using calculated fields, parameters, and aggregation.
LO4	To design symbol maps, filled maps, density maps, and maps with pie charts.
LO5	To build interactive dashboards, apply dashboard actions, and visualize cloud data.

Unit	Content	Hours
1	**Introduction to Tableau:** Advantages of Tableau Analytics Platform, Data Preparation Tableau workspace, Working with measures and dimensions. Data types - Data collection - Setting up a Data Connector - Selecting Data Tables – Joins – Unions - Data extracts and live connections - Editing the model's metadata.	15
2	**Creating Basic Data Visualizations:** Creating Charts - Chart types -Bar Charts, Legends, Filters and Hierarchies - Line Charts - Highlight Tables - Heat Maps - Bullet Charts - Cumulative Sums with Waterfall Charts.	15
3	**Creating Advanced Data Visualizations:** Aggregate Functions - Calculated Fields - Aggregations in Calculated Fields - Text Operator - Data fields - Logical functions – Parameters - Types of calculations - Quick Table calculations - Level of detailed expression.	15
4	**Creating Symbol Maps:** Filled Maps - Density Maps - Map Layers - Maps embedded with Pie Charts.	15
5	**Creating Interactive Dashboards:** Creating a Dashboard - Dashboard Title - Navigation Buttons - Dashboard Actions - Templates for visualizing Cloud data.	15

CO	Course Outcomes The Student will be able to
CO1	Explain the Tableau environment, data connections, and data preparation techniques.
CO2	Create basic visualizations such as bar charts, line charts, and heat maps.
CO3	Apply calculated fields, aggregate functions, and parameters for advanced visualizations.
CO4	Design geographic visualizations using symbol maps, filled maps, and density maps.
CO5	Develop interactive dashboards with filters, actions, and navigation features.
Textbooks:	
1	Claus Wilke, Fundamentals of Data Visualization, 2019.
Reference Books:	
1	Alexander Loth, "Visual Analytics with Tableau", Wiley,2nd Edition., 2023
2	Davy Cielen, Arno D. B. Meysman and Mohamed Ali, "Introducing Data Science",Manning Publications, 2016
3	D J Patil, Hilary Mason & Mike Loukides, Ethics and Data Science, O' Reilly, 2018.
Web resources:	
1	NPTEL: https://nptel.ac.in/courses/106104179
2	https://www.tableau.com/learn/training
3	https://public.tableau.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	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

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIE62	**Virtual Reality**	**EC – 10**	**4**	**1**	**0**	**0**	**4**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the history and basic concepts of Virtual Reality and input devices.
LO2	To learn output devices, graphics systems, and haptic feedback in VR.
LO3	To understand VR architectures, modeling, and distributed virtual environments.
LO4	To learn VR programming tools, toolkits, and usability principles.
LO5	To apply VR concepts in real-world applications like education, medicine, and entertainment.

Unit	Content	Hours
1	**History of Virtual Reality:** Commercial VR Technology- Input Devices- Tracker Performance Parameters- Mechanical- Magnetic- Ultrasonic- Optical- Hybrid- Navigation and Manipulation Interfaces- Gesture Interfaces	15
2	**Output Devices:** Graphic Displays - Sound Displays-The Human Auditory System- The Convolvotron - Haptic Feedback: The Human Haptic System- Tactile- Force- The Graphics Rendering Pipeline- PC Graphics Architecture- Graphics Benchmarks	15
3	**Workstation Based Architectures:** The Sun Blade 1000 - The SGI Infinite Reality - Distributed VR -Multi pipeline Synchronization- Collocated Rendering- Distributed Virtual Environments- Geometric - Kinematics Modeling- Physical- Behavior- Model Management	15
4	**Virtual Reality Programming:** Toolkits and Scene Graphs- World Tool Kit- Java 3D- General Haptics Open Software Toolkit- People Shop-Usability Engineering Methodology	15
5	**Virtual Reality Applications Engineering:** Education – Medicine - Entertainment - Science - Training	15

CO	Course Outcomes The Student will be able to
CO1	Explain the fundamentals of Virtual Reality, including input devices and interaction
CO2	Describe output devices, rendering pipeline, and haptic systems in VR.
CO3	Analyze VR architectures, modeling techniques, and distributed environments.
CO4	Apply VR programming concepts using toolkits and usability methods.
CO5	Develop applications of VR in various domains such as education, medicine, and training.
Textbooks:	
1	Steven LaValle, Virtual Reality, 2017 (Latest widely used).
Reference Books:	
1	Alan Craig, Understanding Augmented Reality, Latest Edition,2013.
2	Gerard Kim, "Designing Virtual Reality Systems: The Structured Approach", Springer, 2007.
Web resources:	
1	NPTEL: https://nptel.ac.in/courses/106106228
2	https://developer.oculus.com
3	https://learn.unity.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	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

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIE63	**Cloud Computing**	**EC-11**	**4**	**1**	**0**	**0**	**4**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	Learning fundamental concepts and Technologies of Cloud Computing.
LO2	Learning various cloud service types and their uses and pitfalls.
LO3	To learn about Cloud Architecture and Application design.
LO4	To know the various aspects of application design, benchmarking and security on the Cloud.
LO5	To learn the various Case Studies in Cloud Computing.

Unit	Content	Hours
1	**Introduction to Cloud Computing:** Definition of Cloud Computing – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples – Cloud-based Services and Applications. **Cloud Concepts and Technologies:** Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring – Software Defined Networking – Network Function Virtualization – MapReduce – Identity and Access Management – Service Level Agreements – Billing.	15
2	**Cloud Services** Compute Services: Amazon Elastic Computer Cloud - Google Compute Engine - Windows Azure Virtual Machines **Storage Services:** Amazon Simple Storage Service - Google Cloud Storage - Windows Azure Storage - Microsoft Assesment - Microsoft Planning Toolkit- IBM: Cloud Models - IBM Smart Cloud **Database Services:** Amazon Relational Data Store - Amazon Dynamo DB - Google Cloud SQL - Google Cloud Data Store - Windows Azure SQL Database - Windows Azure Table Service **Application Services:** Application Runtimes and Frameworks - Queuing Services - Email Services - Notification Services - Media Services Content Delivery Services: Amazon CloudFront - Windows Azure Content Delivery Network	15

3	**Cloud Application Design:** Introduction – Design Consideration for Cloud Applications – Scalability – Reliability and Availability – Security – Maintenance and Upgradation – Performance – Reference Architectures for Cloud Applications – Cloud Application Design **Methodologies:** Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), RESTful Web Services – Data Storage Approaches: Relational Approach (SQL), Non Relational Approach (NoSQL).	15
4	**Cloud Application Benchmarking and Tuning:** Introduction to Benchmarking – Steps in Benchmarking – Workload Characteristics – Application Performance Metrics – Design Consideration for Benchmarking Methodology – Benchmarking Tools and Types of Tests – Deployment Prototyping.	15
5	**Case Studies:** Cloud Computing for Healthcare – Cloud Computing for Energy Systems - Cloud Computing for Transportation Systems - Cloud Computing for Manufacturing Industry - Cloud Computing for Education.	15

CO	**Course Outcomes**
CO1	Understand the fundamental concepts and Technologies in Cloud Computing.
CO2	Able to understand various cloud service types and their uses and pitfalls.
CO3	Able to understand Cloud Architecture and Application design.
CO4	Understand the various aspects of application design, benchmarking and security in the Cloud.
CO5	Understand various Case Studies in Cloud Computing.
Textbooks:	
1	Arshdeep Bahga, Vijay Madisetti, Cloud Computing – A Hands On Approach, Universities Press (India) Pvt. Ltd., 2018
Reference Books:	
1	Anthony T Velte, Toby J Velte, Robert Elsenpeter, Cloud Computing: A Practical
2	Approach, Tata McGraw-Hill, 2013.
3	Barrie Sosinsky, Cloud Computing Bible, Wiley India Pvt. Ltd., 2013.
4	David Crookes, Cloud Computing in Easy Steps, Tata McGraw Hill, 2015.
Web resources:	
1	**https://onlinecourses.nptel.ac.in/noc26_cs55/preview**
2	https://link.springer.com/chapter/10.1007/978-3-030-34957-8_7

Mapping with Programme Outcomes and Programme Specific Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	2	2	2	2	2	3
CO2	3	3	2	2	3	3	3	2	2	3	2
CO3	3	3	2	3	3	2	2	3	2	1	2
CO4	3	2	3	2	2	3	1	2	2	2	2
CO5	3	2	2	2	3	3	3	2	2	2	2
Total	15	12	10	11	12	13	11	11	10	10	11
Average	3.0	2.4	2.0	2.2	2.4	2.6	2.2	2.2	2.0	2.0	2.2

3 – Strong, 2- Medium, 1- Low

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIE64	**Natural Language Processing**	**EC – 11**	4	1	0	0	4	5	25	75	100

Learning Objectives	
LO1	To understand approaches to syntax and semantics in Natural Language Processing.
LO2	To learn Natural Language Processing and apply basic algorithms in this field.
LO3	To understand approaches to discourse, generation, dialogue, and summarization in NLP.
LO4	To understand algorithmic models of morphology, syntax, semantics, and pragmatics.
LO5	To understand current statistical methods used in machine translation.

Unit	Content	Hours
1	**Introduction :** Natural Language Processing tasks in syntax, semantics, and pragmatics – Issue- Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models.	15
2	**Word level and Syntactic Analysis:** Word Level Analysis: Regular Expressions-Finite-State Automata- Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.	15
3	**Semantic analysis and Discourse Processing:** Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation Supervised – Dictionary based and Unsupervised Approaches. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.	15
4	**Natural Language Generation:** Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation. Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.	15
5	**Information retrieval and lexical resources:** Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net Frame Net Stemmers- POS Tagger- Research Corpora SSAS.	15

CO	Course Outcomes The Student will be able to
CO1	Describe the fundamental concepts and applications of Natural Language Processing.
CO2	Apply NLP techniques for word level and syntactic analysis.
CO3	Analyze semantic and discourse processing in NLP.
CO4	Apply NLP methods for natural language generation and machine translation.
CO5	Use NLP techniques for information retrieval and lexical resource analysis.
Textbooks:	
1	Daniel Jurafsky & James H. Martin, Speech and Language Processing, **3rd Edition,2023,(Draft/Latest Online)**.
2	Jacob Eisenstein, Natural Language Processing, MIT Press, 2019.
Reference Books:	
1	Steven Bird et al., Natural Language Processing with Python, O'Reilly,2009, (Updated Edition).
Web resources:	
1	NPTEL: https://nptel.ac.in/courses/106106211
2	https://huggingface.co/learn
3	https://spacy.io/usage

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

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIP61	**Ethical Hacking**	**PEC – 1**	**1**	**1**	**0**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the fundamentals of ethical hacking and security concepts.
LO2	To learn footprinting, scanning, and enumeration techniques.
LO3	To understand password cracking methods and security countermeasures.
LO4	To learn system vulnerabilities and basic programming concepts.
LO5	To apply penetration testing concepts and tools for security assessment.

Unit	Content	Hours
1	Introduction to Hacking – Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hacktivism – Vulnerability Research – Introduction to Foot printing – Information Gathering Methodology – Foot printing Tools – WHOIS Tools – DNS Information Tools– Locating the Network Range – Meta Search Engines	6
2	Introduction to Scanning – Objectives – Scanning Methodology – Tools – Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools	6
3	Introduction – Cracking Passwords – Password Cracking Websites – Password Guessing –Password Cracking Tools – Password Cracking Countermeasures – Escalating Privileges –Executing Applications – Key loggers and Spyware	6
4	Programming Fundamentals – C language – HTML – Perl – Windows OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures – Linux OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures	6
5	Introduction – Security Assessments – Types of Penetration Testing- Phases of Penetration Testing– Tools – Choosing Different Types of Pen-Test Tools – Penetration Testing Tools	6

CO	Course Outcomes The Student will be able to
CO1	Explain ethical hacking concepts, types of attacks, and security elements.
CO2	Apply footprinting, scanning, and enumeration techniques.
CO3	Analyze password attacks and implement countermeasures.
CO4	Identify system vulnerabilities and apply basic programming knowledge.
CO5	Apply penetration testing methods and tools for security assessment.
Textbooks:	
1	CEH v12 Official Study Guide, 2023
Reference Books:	
1	Patrick Engebretson, "The Basics of Hacking and Penetration Testing – Ethical Hackingand Penetration Testing Made Easy", Second Edition, Elsevier, 2013.
2	RafayBoloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, 2014
Web resources:	
1	NPTEL: https://nptel.ac.in/courses/106105217
2	https://owasp.org/www-project-top-ten/
3	https://tryhackme.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	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

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAIL61	MongoDB	SLC – 1	0	0	0	3	2	3	25	75	100

Learning Objectives	
LO1	Introduce NoSQL databases and MongoDB fundamentals
LO2	Develop skills to manage and manipulate data using MongoDB
LO3	Enable querying, indexing, and performance optimization
LO4	Apply aggregation for data analysis
LO5	Integrate MongoDB with Python and data science tools

Unit	Content	Hours
1	Introduction to MongoDB - What is NoSQL- Difference between SQL and NoSQL- Features of MongoDB - Use cases in Data Science - Installation and setup	9
2	MongoDB Basics - Database, Collection, Documents - BSON format- CRUD Operations (Insert, Read, Update, Delete)- Data types in MongoDB	9
3	Querying Data- Query operators ($eq, $gt, $lt, $and, $or)- Projection-Sorting and limiting- Querying nested documents Indexing and Performance -Indexing concepts- Types of indexes -Performance optimization	9
4	Aggregation Framework - Aggregation pipeline - Stages: $match, $group, $sort, $project - Data analysis using aggregation Data Modeling- Schema design- Embedding vs Referencing- Efficient document structures - MongoDB with Python-PyMongo usage- CRUD operations using Python- JSON handling	9
5	MongoDB with Pandas-Loading data into Data Frames-Data preprocessing Exporting data MongoDB Atlas- Cloud database setup- Security basics- Remote connections- Visualization and Analytics-• Integration with Matplotlib, Seaborn- Tableau / Power BI usage -Replication and Sharding- Transactions- Change Streams	9

CO	Course Outcomes The Student will be able to
CO1	Understand NoSQL concepts and MongoDB architecture
CO2	Perform CRUD operations and manage MongoDB data structures
CO3	Apply querying techniques and optimize performance using indexing
CO4	Use aggregation framework and design efficient data models
CO5	Integrate MongoDB with Python, Pandas, and visualization tools
Textbooks:	
1	Kristina Chodorow, MongoDB: The Definitive Guide, **3rd Edition**, 2020.
2	Shannon Bradshaw, Eoin Brazil – MongoDB: The Complete Developer's Guide, Packt,2021.
Reference Books:	
1	Shannon Bradshaw, MongoDB: The Complete Developer's Guide, 2021.
2	Kyle Banker – MongoDB in Action, Manning Publications,2016.
3	Pramod J. Sadalage – NoSQL Distilled, Addison-Wesley,2012.
Web resources:	
1	NPTEL: https://nptel.ac.in/courses/106106210
2	https://www.mongodb.com/docs
3	https://pymongo.readthedocs.io

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	2	2	2	3	2	1
CO2	3	3	2	2	3	2	2	2	3	3	2
CO3	3	3	2	2	3	2	2	2	3	3	2
CO4	3	3	3	3	3	2	2	2	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	**15**	**14**	**11**	**11**	**14**	**11**	**11**	**11**	**15**	**14**	**11**
Average	**3.0**	**2.8**	**2.2**	**2.2**	**2.8**	**2.2**	**2.2**	**2**	**3.0**	**2.8**	**2.2**

Strong-3 Medium-2 Low-1