

**222- B.Sc. Artificial Intelligence**

Programme Structure and Scheme of Examination (under CBCS)  
(Applicable to the candidates admitted from the academic year 2023 -2024 onwards)

Course Code	Part	Study Components & Course Title	Credit	Hours/ Week	Maximum Marks		
					CIA	ESE	Total
<b>SEMESTER – I</b>							
23UTAML11/ 23UHINL11/ 23UFREL11	I	Language– I: பொது தமிழ்- I: தமிழிலக்கிய வரலாறு-1/ Hindi-I/ French-I	3	6	25	75	100
23UENGL12	II	General English – I	3	6	25	75	100
23UAICC13	III	Core – I : Programming for Problem Solving	5	5	25	75	100
23UAICP14		Core –II : Practical–I: Problem Solving using C Lab	5	5	25	75	100
23UAICE15		Elective – Discrete Mathematics – I	3	4	25	75	100
23UTAMB16 23UTAMA16	IV	Skill Enhancement Course-I* NME-I / Basic Tamil – I / Advanced Tamil - I	2	2	25	75	100
23UAIFC17		Foundation Course : Office Automation	2	2	25	75	100
<b>Total</b>			<b>23</b>	<b>30</b>			<b>700</b>
<b>SEMESTER – II</b>							
23UTAML21/ 23UHINL21/ 23UFREL21	I	Language– II: பொதுதமிழ் -II: தமிழிலக்கியவரலாறு-2/ Hindi-II/ French-II	3	6	25	75	100
23UENGL22	II	General English – II:	3	6	25	75	100
23UAICC23	III	Core –III:Python Programming	5	5	25	75	100
23UAICP24		Core –IV: Practical-II: Python Programming Lab	5	5	25	75	100
23UAICE25		Elective – II Discrete Mathematics - II	3	4	25	75	100
23UTAMB26 23UTAMA26	IV	Skill Enhancement Course – II* NME-II / Basic Tamil – II / Advanced Tamil – II	2	2	25	75	100
23USECG27		Skill Enhancement Course – III: Internet and its Applications(Common Paper)	2	2	25	75	100
23UNMSD01		Language Proficiency for employability: Overview of English Communication**	2	-			100
<b>Total</b>			<b>25</b>	<b>30</b>			<b>800</b>

Course Code	Part	Study Components & Course Title	Credit	Hours/Week	Maximum Marks		
					CIA	ESE	Total
<b>SEMESTER – III</b>							
23UTAML31/ 23UHINL31/ 23UFREL31	I	Language– III: பொதுதமிழ்-III/ தமிழக வரலாறும் பண்பாடும் Hindi-III/ French-III	3	6	25	75	100
23UENGL32	II	General English – III	3	6	25	75	100
23UAICC33	III	Core – V:Object Oriented Programming(Theory & Practical)	5	5	25	75	100
23UAICP34		Core – VI: Practical –III: Data Structures and Algorithms (Theory & Practical) (Exam: Practical only)	5	5	25	75	100
23USMAE35		Elective – III: Statistical Methods and its Application - I	3	4	25	75	100
23UAICS36	IV	Skill Enhancement Course – IV: Organizational Behavior	1	1	25	75	100
23UAICS37		Skill Enhancement Course – V: PHP Programming	2	2	25	75	100
		Environmental Studies	-	1	-	-	-
<b>Total</b>			<b>22</b>	<b>30</b>			<b>700</b>
<b>SEMESTER – IV</b>							
23UTAML41/ 23UHINL41/ 23UFREL41	I	Language– IV: பொதுதமிழ் -IV: தமிழும் அறிவியலும் Hindi-IV/ French-IV	3	6	25	75	100
23UENGL42	II	General English – IV	3	6	25	75	100
23UAICC43	III	Core – VII: R Programming	5	5	25	75	100
23UAICP44		Core - VIII: Practical IV: R Programming– Lab	5	5	25	75	100
23USMAE45		Elective – IV: Statistical Methods and its Application-II	3	3	25	75	100
23UAICS46	IV	Skill Enhancement Course –VI: Software Testing	2	2	25	75	100
23UAICS47		Skill Enhancement Course-VII: Multimedia Systems	2	2	25	75	100
23UEVSG48		Environmental Studies	2	1	25	75	100
<b>Total</b>			<b>25</b>	<b>30</b>			<b>800</b>

Course Code	Part	Study Components & Course Title	Credit	Hours/Week	Maximum Marks		
					CIA	ESE	Total
<b>SEMESTER – V</b>							
23UAICC51	III	Core – IX: Introduction to Machine Learning	4	5	25	75	100
23UAICP52		Core – X: Practical V: Machine Learning Lab	4	5	25	75	100
23UAICC53		Core – XI: Deep learning (Theory & Practical)	4	5	25	75	100
23UAICD54		Core – XII: Project with Viva Voce	4	5	25	75	100
23UAICE55		Elective – V Internet of Things and its Applications	3	4	25	75	100
23UAICE56		Elective – VI Artificial Neural Network	3	4	25	75	100
23UVALG57	IV	Value Education	2	2	25	75	100
23UAICI58		Summer Internship <sup>++</sup>	2	-	25	75	100
<b>Total</b>			<b>26</b>	<b>30</b>			<b>800</b>
<b>SEMESTER – VI</b>							
23UAICC61	I	Core – XIII: Natural Language Processing (Theory & Practical)	4	6	25	75	100
23UAICC62	II	Core – XIV: Intelligent System	4	6	25	75	100
23UAICC63	III	Core – XV: Computer Vision	4	5	25	75	100
23UAICE64-1 23UAICE64-2		Elective – VII Robotics and its applications (or) Big Data Analytics	3	5	25	75	100
23UAICE65-1 23UAICE65-2	IV	Elective – VIII Introduction to Data Science (or) Agile Project Management	3	5	25	75	100
23UAICF66		Professional Competency Skill: Simulation and Modeling	2	2	25	75	100
23UAICX67	V	Extension Activity	1	-	100		100
<b>Total</b>			<b>21</b>	<b>30</b>			<b>700</b>
<b>Grand Total</b>			<b>142</b>				<b>4500</b>
<b>NME courses offered to other Department</b>							
Semester – I	23UAICN16	Fundamentals of Information Technology	2	2	25	75	100
Semester - II	23UAICN26	Computer Fundamentals	2	2	25	75	100

\* PART-IV: NME / Basic Tamil / Advanced Tamil (Any one)

Students who have not studied Tamil upto 12<sup>th</sup> Standard and have taken any Language other than Tamil in Part-I, must choose Basic Tamil-I in First Semester & Basic Tamil-II in Second Semester.

Students who have studied Tamil upto 10<sup>th</sup> & 12<sup>th</sup> Standard and have taken any Language other than Tamil in Part-I, must choose Advanced Tamil-I in First Semester and Advanced Tamil-II in Second Semester.

\*\* The course “23UNMSD01: Overview of English Communication” is to be taught by the experts from Naan Mudhalvan Scheme team. However, the faculty members of Department of English should coordinate with the Naan Mudhalvan Scheme team for smooth conduct of this course.

<sup>++</sup>Students should complete two weeks of internship before the commencement of V semester.

**Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF)  
Guideline Based Credit and Hours Distribution System  
for all UG courses including Lab Hours**

**First Year – Semester-I**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
Part I	Language – Tamil	3	6
Part II	English	3	6
Part III	Core Theory, Practical & Elective Courses	13	14
Part IV	Skill Enhancement Course SEC-1 (NME-I)	2	2
	Foundation Course	2	2
		<b>23</b>	<b>30</b>

**Semester-II**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
Part I	Language – Tamil	3	6
Part II	English	3	6
Part III	Core Theory, Practical & Elective Courses	13	14
Part IV	Skill Enhancement Course -SEC-2 (NME-II)	2	2
	Skill Enhancement Course -SEC-3 (Discipline / Subject Specific)	2	2
		<b>23</b>	<b>30</b>

**Second Year – Semester-III**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
Part I	Language - Tamil	3	6
Part II	English	3	6
Part III	Core Theory, Practical & Elective Courses	13	14
Part IV	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	E.V.S	-	1
		<b>22</b>	<b>30</b>

### Semester-IV

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
Part I	Language - Tamil	3	6
Part II	English	3	6
Part III	Core Theory, Practical & Elective Courses	13	13
Part IV	Skill Enhancement Course -SEC-6 (Discipline / Subject Specific)	2	2
	Skill Enhancement Course -SEC-7 (Discipline / Subject Specific)	2	2
	E.V.S	2	1
		<b>25</b>	<b>30</b>

### Third Year

#### Semester-V

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
Part III	Core Theory, Practical, Project & Elective Courses	22	28
Part IV	Value Education	2	2
	Internship / Industrial Visit / Field Visit	2	-
		<b>26</b>	<b>30</b>

#### Semester-VI

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
Part III	Core Theory, Practical & Elective Courses	18	28
Part IV	Professional Competency Skill	2	2
Part V	Extension Activity	1	-
		<b>21</b>	<b>30</b>

**Consolidated Semester wise and Component wise Credit distribution**

<b>Parts</b>	<b>Sem I</b>	<b>Sem II</b>	<b>Sem III</b>	<b>Sem IV</b>	<b>Sem V</b>	<b>Sem VI</b>	<b>Total Credits</b>
<b>Part I</b>	3	3	3	3	-	-	12
<b>Part II</b>	3	3	3	3	-	-	12
<b>Part III</b>	13	13	13	13	22	18	92
<b>Part IV</b>	4	4	3	6	4	2	23
<b>Part V</b>	-	-	-	-	-	1	1
<b>Total</b>	23	23	22	25	26	21	<b>140</b>

**\*Part I, II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components Part IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

**CREDIT DISTRIBUTION FOR U.G. PROGRAMME**

<b>Part</b>	<b>Course Details</b>	<b>No. of Courses</b>	<b>Credit per course</b>	<b>Total Credits</b>
<b>Part I</b>	Tamil	4	3	12
<b>Part II</b>	English	4	3	12
<b>Part III</b>	Core Courses	15	4/5	68
	Elective Courses: Generic / Discipline Specific (3 or 2+1 Credits)	8	3	24
<b>Part I, II and III Credits</b>				<b>116</b>
<b>Part IV</b>	Skill Enhancement Courses / NME / Language Courses	7	1/2	15
	Professional Competency Skill Course	1	2	2
	Environmental Science (EVS)	1	2	2
	Value Education	1	2	2
	Internship	1	2	2
<b>Part IV Credits</b>				<b>23</b>
<b>Part V</b>	Extension Activity (NSS / NCC / Physical Education)	1	1	1
<b>Total Credits for the UG Programme</b>				<b>140</b>

<b>Methods of Evaluation</b>			
<b>Internal Evaluation</b>	Continuous Internal Assessment Test		25 Marks
	Assignments		
	Seminars		
	Attendance and Class Participation		
<b>External Evaluation</b>	End Semester Examination		75 Marks
	Total		100 Marks
<b>Methods of Assessment</b>			
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions		
<b>Understand/Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, Short summary or overview		
<b>Application (K3)</b>	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain		
<b>Analyze(K4)</b>	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge		
<b>Evaluate(K5)</b>	Longer essay/Evaluation essay, Critique or justify with pros and cons		
<b>Create(K6)</b>	Check knowledge in specific or off beat situations, Discussion, Debating or Presentations		

<p><b>Programme Outcomes:</b></p>	<p>On successful completion of the programme the students will be able to</p> <p><b>PO1: Disciplinary Knowledge:</b> Possess comprehensive knowledge and understanding of one or more disciplines that are part of a program of study, and apply it effectively.</p> <p><b>PO2: Critical Thinking:</b> Demonstrate critical thinking abilities to evaluate evidence, arguments, claims, beliefs, and policies based on empirical evidence, identify assumptions and implications, formulate coherent arguments, and assess theories using a scientific approach to knowledge development.</p> <p><b>PO3: Problem Solving:</b> Utilize competencies to solve non-familiar problems and apply learning to real-life situations instead of simply replicating curriculum content knowledge.</p> <p><b>PO4: Analytical &amp; Scientific Reasoning:</b> Possess analytical and scientific reasoning skills to evaluate evidence reliability and relevance, identify logical flaws in others' arguments, synthesize data from various sources, draw valid conclusions supported by evidence, and address opposing viewpoints.</p> <p><b>PO5: Research related skills:</b> Possess research-related skills to analyze, interpret, and draw conclusions from quantitative/qualitative data, evaluate ideas, evidence, and experiences from an open-minded and reasoned research perspective, formulate hypotheses, test and analyze results, and derive conclusions.</p> <p><b>PO6: Self-directed &amp; Lifelong Learning:</b> Possess the ability to work independently, identify and manage a project, acquire knowledge and skills through self-directed learning for personal development, and meet economic, social, and cultural objectives. Possess the ability to learn how to learn and engage in lifelong learning.</p>
<p><b>Programme Specific Outcomes:</b></p>	<p>On successful completion of Bachelor of Science in Computer Science with Cognitive Systems programme, the student should be able to:</p> <p><b>PSO1: Disciplinary Knowledge:</b> Develop fundamental knowledge in computing technology and the importance of programming with its different programming paradigms.</p> <p><b>PSO2: Critical Thinking:</b> Ability to interpret complex problems, evaluate and synthesize information, apply theoretical concepts to practical situations, formulate and provide rational solution to computer oriented solvable real time problems</p> <p><b>PSO3: Problem Solving:</b> Solve problems computationally by applying different mathematical and algorithmic methods and wide range of emerging and newly-adopted technologies to facilitate knowledge discovery</p> <p><b>PSO4: Analytical &amp; Scientific Reasoning:</b> Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models</p>

	<p><b>PSO5: Research related skills:</b> Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects</p> <p><b>PSO6: Self-directed &amp; Lifelong Learning:</b> Set learning goals, Manage their own learning, Reflect on their learning, Adapt to new contexts, Seek out new knowledge, Collaborate with others and to continuously improve their skills and knowledge, through ongoing learning and professional development, contribute to the growth and development of their field and holistically enhance their Personality throughout their life.</p>
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PO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1	✓					
PO2		✓				
PO3			✓			
PO4				✓		
PO5					✓	
PO6						✓

**FIRST YEAR – SEMESTER – I**

<b>SEMESTER: I</b> <b>PART: III</b> <b>CORE: I</b>	<b>23UAICC13 : PROGRAMMING FOR PROBLEM SOLVING</b>	<b>CREDIT: 5</b> <b>HOURS: 5W</b>
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<b>Learning Objectives</b>		
<b>LO1</b>	recognize the need for programming languages and problem solving techniques	
<b>LO2</b>	apply memory management concepts and function based modularization	
<b>LO3</b>	Recognize the bugs in the C program	
<b>LO4</b>	Develop simple C programs to illustrate the applications of different data types such as arrays, pointers, functions.	
<b>LO5</b>	develop programming skills to solve real time computational problems	
<b>Unit</b>	<b>Contents</b>	<b>No. of Hours</b>
I	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.	<b>15</b>
II	Operators and Expressions:Identifiers and keywords, Data types, Constants, Variables, Declarations, Expressions, Statements, Arithmetic operators, Unary operators, Relational and logical operators, Assignment operators, Conditional operatorBranching, if-else statement, switch statement, goto statement, Looping, while statement, do- while statement, for statement, Nested control structures, break statement, continue statement.	<b>15</b>
III	Arrays andStrings: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.	<b>15</b>
IV	Functions:Functions, Overview, Defining a function, Accessing a function, Function prototypes, Passing arguments to a function, Passing arrays to functions, Recursion.	<b>15</b>
V	Pointers andStructures:Fundamentals, Pointer declarations, Passing pointers to functions, 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.	<b>15</b>
<b>TOTAL</b>		<b>75</b>
<b>CO</b>	<b>Course Outcomes</b>	
CO1	The Student can understand the fundamentals of computer and program development process.	

CO2	The Student 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.
<b>Textbooks</b>	
1.	Byron Gottfried, "Schaum's Outline of Programming with C", 3 <sup>rd</sup> edition, 2016, McGraw Hill Education (India), ISBN: 9780070145900
2.	Balagurusamy, E "Programming in ANSI C", 7 <sup>th</sup> edition, McGraw Higher Ed, 2016, ISBN: 9789339219666
<b>Reference Books</b>	
1.	Yashavant Kanetkar, "Let Us C", 15 <sup>th</sup> edition, 2016, Bpb Publications, ISBN:9788183331630
2.	Herbert Schildt, "The Complete Reference C", 4 <sup>th</sup> edition, 2017, McGraw Hill Education (India), 2017, ISBN:978007041183
3.	Beulah Christalin Latha, Anuja Beatrice, Carolin Jeeva & Anita Sofia, Fundamentals of Computing and Programming, 1 <sup>st</sup> edition, Pearson, 2018
4.	Sumitabha Das, "Computer Fundamentals and C Programming", 18 <sup>th</sup> edition, 2018, McGraw Hill Education (India), ISBN:9789387886070
5.	Stephen G. Kochan, "Programming in C", 4 <sup>th</sup> edition, 2015, ISBN: 9789332554665,

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>15</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>15</b>

<b>SEMESTER: I</b> <b>PART: III</b> <b>PRACITCAL: I</b>	<b>23UAICP14: PROBLEM SOLVING USING C</b> <b>LAB</b>	<b>CREDIT: 5</b> <b>HOURS: 5W</b>
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<b>Learning Objectives</b>	
<b>LO1</b>	understand the need for programming to solve computational problems.
<b>LO2</b>	discover the basic programming constructs to prepare the program.
<b>LO3</b>	Analyze and interpret data using array, functions and pointers
<b>LO4</b>	Recognize the bugs in the C program.
<b>LO5</b>	Apply problem-solving skills to real-world scenarios
<b>List of Exercises</b>	
<ol style="list-style-type: none"> <li>1. Implementation of Basic C programs</li> <li>2. Simple computational problems using arithmetic expressions and operators</li> <li>3. Problem solving using branching and logical expressions</li> <li>4. Iterative problems using Loops, while and for loops</li> <li>5. Implementation of linear searching, bubble sort, and Matrix Manipulation using Arrays</li> <li>6. Implementation of Text Processing using Strings</li> <li>7. Find Square Root, numerical differentiation, numerical integration using functions and recursion.</li> <li>8. Implementation of basic file operations</li> </ol>	
<b>Software Essentials: Code Block</b>	
<b>TOTAL</b>	
	<b>75</b>
<b>CO</b>	<b>Course Outcomes</b>
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.

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>Weightageof course contributedtoeachP SO</b>	<b>15</b>	<b>11</b>	<b>10</b>	<b>11</b>	<b>11</b>	<b>12</b>

**SEMESTER:I**  
**PART:III**

**23UAICE15: DISCRETE MATHEMATICS**

**CREDIT:3**  
**HOURS:4/W**

**ELECTIVE-I**

**LEARNING OBJECTIVES:**

The course aims to introduce the concepts of recurrence relations and generating functions, Mathematical logic, Duality law and Lattices, Boolean Algebra, Boolean Polynomials, Karnaugh Maps.

**COURSE LEARNING OUTCOME:**

At the end of the course, students will be able to

CLO1: know the basic concepts of recurrence relations and generating functions

CLO2: learn to solve the Mathematical logic

CLO3: know the concepts of Mathematical logic: Functionally complete sets of connectives and Duality law.

CLO4: understand the concepts of Lattices

CLO5: know the basic concepts of Boolean Algebra

**UNIT I: RECURRENCE RELATIONS AND GENERATING FUNCTIONS**

Recurrence - Polynomials and their Evaluations - Recurrence Relations - Solution of Finite Order Homogeneous [linear] Relations - Solutions of Non-homogeneous Relations.

**UNIT II: MATHEMATICAL LOGIC**

TF Statements - Connectives - Atomic and Compound Statements – Well-formed [Statement Formulae] - Parsing - Truth Table of a Formula - Tautology - Tautological Implications and Equivalence of Formulae.

**UNIT III: MATHEMATICAL LOGIC (Continued)**

Replacement process - Functionally complete sets of connectives and Duality law – Normal Forms - Principal Normal Forms.

**UNIT IV: LATTICES**

Lattices [omit example 15 Pp No.10.6) - Some properties of Lattices - New Lattices (omit remark PP: 10.14) - Modular and Distributive Lattices (omit theorem 10 and 17, Example 4 - Pp 10.23, Example 11 - Pp 10.24)

**UNIT-5: BOOLEAN ALGEBRA**

Boolean Algebra - Boolean Polynomials - Karnaugh Maps

**TEXT BOOK:**

1. Venkatraman M. K, Sridharan. N, N. Chandrasekaran, “Discrete Mathematics”, (2007) The National Publishing Company, Chennai.

Unit 1: Chapter 5: sec -1 to 5

Unit 2: Chapter 9: sec -1 to 8

Unit 3: Chapter 9: sec -9 to 12

Unit 4: Chapter 10 sec -1 to 4

Unit 5: Chapter 10:sec -5 to 7

**REFERENCE BOOKS:**

1. K. L. P Mishra and N. Chandrasekaran,” Theory of Computer Science”, Prentice Hall of India, Pvt Ltd.

2. Trembly & Manohar, "Discrete Mathematical Structures applications to Computer Science", Tata McGraw.
3. V. Ramaswamy, "Discrete Mathematical Structures with Applications to Combinatorics" Univ Press, 2006.
4. T. Veerarajan, "Discrete Mathematics with graph theory and Combinatorics", TMG, 2007.

**Table**

<b>CLO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CLO1</b>	3	3	3	2	3
<b>CLO2</b>	2	2	3	3	3
<b>CLO3</b>	3	3	3	3	3
<b>CLO4</b>	3	3	3	2	3
<b>CLO5</b>	3	2	3	3	3

<b>SEMESTER: I</b> <b>PART: III</b> <b>NME – I</b>	<b>23UAIEN16: FUNDAMENDALS OF INFORMATION TECHNOLOGY</b>	<b>CREDIT: 2</b> <b>HOURS: 2/W</b>
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<b>Learning Objectives</b>		
<b>LO1</b>	Understand basic concepts and terminology of information technology.	
<b>LO2</b>	Have a basic understanding of personal computers and their operation	
<b>LO3</b>	Be able to identify data storage and its usage	
<b>LO4</b>	Get great knowledge of software and its functionalities	
<b>LO5</b>	Understand about operating system and their uses	
<b>UNIT</b>	<b>Contents</b>	<b>No. Of. Hours</b>
I	<b>Introduction to Computers:</b> Introduction, Definition, .Characteristics of computer, Evolution of Computer, Block Diagram Of a computer, Generations of Computer, Classification Of Computers, Applications of Computer, Capabilities and limitations of computer	<b>6</b>
II	<b>Basic Computer Organization:</b> Role of I/O devices in a computer system. Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, Output Units: Monitors and its types. Printers: Impact Printers and its types. Non Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers.	<b>6</b>
III	<b>Storage Fundamentals:</b> Primary Vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives	<b>6</b>
IV	<b>Software:</b> Software and its needs, Types of S/W. System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w	<b>6</b>
V	<b>Operating System:</b> Functions, Measuring System Performance, Assemblers, Compilers and Interpreters. Batch Processing, Multiprogramming, Multi Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.	<b>6</b>
<b>TOTAL HOURS</b>		<b>30</b>

<b>Course Outcomes</b>		<b>Programme Outcomes</b>
CO	On completion of this course, students will	
CO1	Learn the basics of computer, Construct the structure of the required things in computer, learn how to use it.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Develop organizational structure using for the devices present currently under input or output unit.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Concept of storing data in computer using two header namely RAM and ROM with different types of ROM with advancement in storage basis.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Work with different software, Write program in the software and applications of software.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Usage of Operating system in information technology which really acts as a interpreter between software and hardware.	PO1, PO2, PO3, PO4, PO5, PO6
<b>Textbooks</b>		
1	Anoop Mathew, S. Kavitha Murugesan (2009), “ Fundamental of Information Technology”, Majestic Books.	
2	Alexis Leon, Mathews Leon,” Fundamental of Information Technology”, 2 <sup>nd</sup> Edition.	
3	S. K Bansal, “Fundamental of Information Technology”.	
<b>Reference Books</b>		
1.	Bhardwaj Sushil Puneet Kumar, “Fundamental of Information Technology”	
2.	GG WILKINSON, “Fundamentals of Information Technology”, Wiley-Blackwell	
3.	A Ravichandran , “Fundamentals of Information Technology”, Khanna Book Publishing	
<b>Web Resources</b>		
1.	<a href="https://testbook.com/learn/computer-fundamentals">https://testbook.com/learn/computer-fundamentals</a>	
2.	<a href="https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html">https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html</a>	
3.	<a href="https://www.javatpoint.com/computer-fundamentals-tutorial">https://www.javatpoint.com/computer-fundamentals-tutorial</a>	
4.	<a href="https://www.tutorialspoint.com/computer_fundamentals/index.htm">https://www.tutorialspoint.com/computer_fundamentals/index.htm</a>	
5.	<a href="https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf">https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf</a>	

**Mapping with Programme Outcomes:**

<b>CO/PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO 1</b>	3	3	3	3	3	3
<b>CO 2</b>	3	3	3	3	3	3
<b>CO 3</b>	3	3	3	3	3	3
<b>CO 4</b>	3	3	3	3	2	3
<b>CO 5</b>	3	3	2	3	3	2
<b>Weightage of course contributed to each PSO</b>	15	15	14	15	14	14

**S-Strong-3    M-Medium-2    L-Low-1**

<b>SEMESTER: I PART: III FOUNDATION COURSE – I</b>	<b>23UAIFC17: OFFICE AUTOMATION</b>	<b>CREDIT: 2 HOURS: 2W</b>
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<b>Course Objective</b>		
C1	Understand the basics of computer systems and its components.	
C2	Understand and apply the basic concepts of a word processing package.	
C3	Understand and apply the basic concepts of electronic spreadsheet software.	
C4	Understand and apply the basic concepts of database management system.	
C5	Understand and create a presentation using PowerPoint tool.	
<b>UNIT</b>	<b>Details</b>	<b>No. of Hours</b>
I	<b>Introductory concepts:</b> Memory unit– CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating systems & its features: DOS– UNIX– Windows. Introduction to Programming Languages.	6
II	<b>Word Processing:</b> Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing Preview, options, merge.	6
III	<b>Spreadsheets:</b> 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
IV	<b>Database Concepts:</b> The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of datafiles; Understanding Programming environment in DBMS; Developing menu drive applications in query language (MS– Access).	6
V	<b>Power point:</b> Introduction to Power point - Features – Understanding slide typecasting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slidetransition– Animation effects, audio inclusion, timers.	6
	<b>Total</b>	<b>30</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
CO	On completion of this course, students will	
1	Possess the knowledge on the basics of computers and its components	PO1, PO2, PO3, PO6, PO8
2	Gain knowledge on Creating Documents, spreadsheet and presentation.	PO1, PO2, PO3, PO6
3	Learn the concepts of Database and implement the Query in Database.	PO3, PO5, PO7
4	Demonstrate the understanding of different automation tools.	PO3, PO4, PO5, PO7
5	Utilize the automation tools for documentation, calculation and presentation purpose.	PO4, PO6, PO7, PO8

<b>Text Book</b>	
1	PeterNorton,“IntroductiontoComputers”–TataMcGraw-Hill.
<b>Reference Books</b>	
1.	Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, “Microsoft 2003”, Tata McGrawHill.
<b>Web Resources</b>	
1.	<a href="https://www.udemy.com/course/office-automation-certificate-course/">https://www.udemy.com/course/office-automation-certificate-course/</a>
2.	<a href="https://www.javatpoint.com/automation-tools">https://www.javatpoint.com/automation-tools</a>

**Mapping with Programme Outcomes:**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	M	S	M			M		L
CO 2	S	M	S			M		
CO 3		S	S		M		L	
CO 4			S	L	M		M	
CO 5				M		S	M	S

**S-Strong      M-Medium      L-Low**

**FIRST YEAR – SEMESTER – II**

<b>SEMESTER: II</b> <b>PART: III</b> <b>CORE: III</b>	<b>23UAICC23 : PYTHON PROGRAMMING</b>	<b>CREDIT: 5</b> <b>HOURS: 5W</b>
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<b>Learning Objectives</b>		
<b>LO1</b>	understand the most important libraries of Python, and its recommended programming styles and idioms.	
<b>LO2</b>	learn core Python scripting elements such as variables and flow control structures.	
<b>LO3</b>	develop applications using Python.	
<b>Unit</b>	<b>Contents</b>	<b>No. of Hours</b>
<b>I</b>	Python, Data Types, Expressions: Python Programming - Running Code in the Interactive Shell, Input, Processing and Output, Editing, Saving and Running a Script - Data Types, String Literals, Escape Sequences, String Concatenation, Variables and the Assignment Statement - Numeric Data Types and Character Sets - Integers and Long Integers, Floating-Point Numbers and Character Sets - Expressions - Arithmetic Expressions and Mixed-Mode Arithmetic and Type Conversions.	<b>15</b>
<b>II</b>	Functions, Modules and Control Statements: Functions and Modules - Calling Functions, The math Module, The Main Module, Program Format and Structure and Running a Script from a Terminal Command Prompt - Iteration - for loop - Selection - Boolean Type, Comparisons, and Boolean Expressions, if-else Statements, One-Way Selection Statements, Multi-way if Statements, Logical Operators and Compound Boolean Expressions, Short-Circuit Evaluation and Testing Selection Statements - Conditional Iteration - while loop.	<b>15</b>
<b>III</b>	Strings and Text Files: Strings - Accessing Characters and Substrings in Strings, Strings and String Methods - Text Files - Text Files and Their Format, Writing Text to a File, Writing Numbers to a File, Reading Text from a File, Reading Numbers from a File and Accessing and Manipulating Files and Directories on Disk.	<b>15</b>
<b>IV</b>	Lists and Dictionaries: Lists - List Literals and Basic Operators, Replacing an Element in a List, List Methods for Inserting and Removing Elements, Searching and Sorting a List, Mutator Methods and the Value None, Aliasing and Side Effects, Equality and Tuples - Defining Simple Functions - Syntax, Parameters and Arguments, return Statement, Boolean Functions and main function, DICTIONARIES - Dictionary Literals, Adding Keys and Replacing Values, Accessing Values, Removing Keys and Traversing a Dictionary.	<b>15</b>
<b>V</b>	<b>Design with Functions and Design with Classes</b> Design with Functions and Design with Classes - Functions as Abstraction Mechanisms, Problem Solving with Top-Down Design, Design with Recursive Functions and Managing a Program's Namespace - DESIGN WITH CLASSES - Objects and Classes, Data Modeling and Structuring Classes with Inheritance and Polymorphism.	<b>15</b>
<b>TOTAL</b>		<b>75</b>

<b>CO</b>	<b>Course Outcomes</b>
CO1	describe the datatypes, expressions and type conversions in Python
CO2	use functions, control statements, strings, lists and dictionaries in python programming.
CO3	demonstrate the concept of object, class inheritance and polymorphism in Python.
CO4	write user defined functions, classes in python.
CO5	develop programming skills to solve real time computational problems
<b>Textbooks</b>	
➤	Kenneth A. Lambert, Martin Osborne, “Fundamentals of Python: From First Programs Through Data Structures”, Course Technology, Cengage Learning, 2010, ISBN-13: 978-1-4239-0218-8.
➤	Paul Barry, “Head First Python 2e”, O’Reilly, 2nd Revised edition, 2016, ISBN-13: 978-1491919538.
<b>Reference Books</b>	
1.	Zed A. Shaw, “Learn Python the Hard Way”, Addison-Wesley, Third Edition, 2014, ISBN-13: 978-0-321-88491-6.
2.	Dave Kuhlman, “A Python Book: Beginning Python, Advanced Python, and Python Exercises”, 2013, ISBN: 9780984221233.
3.	Kent D Lee, “Python Programming Fundamentals”, Springer-Verlag London Limited, 2011, ISBN 978-1-84996-536-1.
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
<b>Web Resources</b>	
1.	<a href="http://docs.python.org/3/tutorial/index.html">http://docs.python.org/3/tutorial/index.html</a>
2.	<a href="http://interactivepython.org/courselib/static/pythonds">http://interactivepython.org/courselib/static/pythonds</a>

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>12</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>

<b>SEMESTER: II</b> <b>PART: III</b> <b>PRACTICAL : II</b>	<b>23UAICP24: PYTHON PROGRAMMING LAB</b>	<b>CREDIT: 5</b> <b>HOURS: 5W</b>
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<b>Learning Objectives</b>	
<b>LO1</b>	understand the basics of python programming concepts.
<b>LO2</b>	understand the high-performance programs designed to build up the real proficiency
<b>List of Exercises</b>	
1. Control Statements 2. Operators 3. Lists and List comprehensions 4. Set 5. Dictionary 6. Function 7. String 8. File 9. Polymorphism 10. Inheritance	
<b>Software Essentials: Pycharm</b>	
<b>TOTAL</b>	
<b>75</b>	
<b>CO</b>	<b>Course Outcomes</b>
CO1	Describe the Control statement, String, List, and Dictionaries in Python.
CO2	Use functions and represent Compound data using Lists, Tuples and Dictionaries
CO3	Implement Conditionals and Loops for Python Programs
CO4	understand and summarize different types of function and File handling operations.
CO5	interpret Object programming in Python

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>14</b>	<b>11</b>	<b>15</b>	<b>15</b>	<b>10</b>

<b>SEMESTER: II</b> <b>PART: III</b> <b>ELECTIVE – II</b>	<b>23UAICE25:DISCRETE MATHEMATICS – II</b>	<b>CREDIT: 3</b> <b>HOURS: 4/W</b>
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## **COURSE OBJECTIVES**

- Mathematical Logic
- Truth Table
- Relations and Ordering

### **Unit-I**

**Algebraic Systems:** Examples and General Properties-Definition and Examples-Some Simple Algebraic Systems and General Properties.

**Semigroups and Monoids:** Definitions and Examples-Homomorphism of Semigroups and Monoids-Sub semigroups and Sub monoids

**Grammars and languages:** Discuss of Grammars-Formal definition of a Language-Notion of Syntax Analysis

(Chapter-3: Sections 3.1 to 3.3)

### **Unit-II: Groups**

Definitions and Examples-Subgroups and homomorphisms-Cosets and Language's Theorem-Normal Subgroups-Algebraic systems with Two Binary operations-**The application of the residue arithmetic to computers:** Introduction to number system-residue arithmetic.

(Chapter 3: Sections 3.5(3.5.1 - 3.6.2)

### **Unit-III: Lattice and Boolean algebra**

Lattices as partially ordered sets-definition and examples-some properties of lattices-lattices as algebraic system-sublattices, Direct product, and homomorphism-some special lattices -**Boolean algebra**-definition and examples-subalgebra, direct product, and homomorphism.

(Chapter 4: Sections 4.1.1 to 4.2.2)

### **Unit-IV: Boolean function**

Boolean forms and free Boolean algebras-values of Boolean expressions and Boolean functions-Representation and minimization of Boolean functions: representation of Boolean functions-minimization of Boolean functions(Chapter 4: Sections 4.3.1 to 4.4.2)

### **Unit-V: Graph theory**

Basic concepts of graph theory-basic definitions-paths, reachability and connectedness-matrix representation of graphs-trees-storage representation and manipulation of graphs-Trees: their representation and operations-List: structures and graphs

(Chapter 5: Sections 5.1.1 to 5.2.2)

**Skills acquired from this course**

Knowledge, Problem Solving, Analytical ability.

**Textbooks:**

1. Discrete mathematics structures with application to computer science – J.P. Tremblay and R. Manohar

**Reference Books:**

1. Discrete Mathematics – Dr.S.P. Rajagopalan and Dr.R. Sattanathan
2. Discrete Mathematics – Dr.G.Balaji
3. Discrete Mathematics and its applications – Kenneth.H.Rosen.

<b>SEMESTER: II</b> <b>PART: III</b> <b>NME – II</b>	<b>23UAIEN26: INTRODUCTION To HTML</b>	<b>CREDIT: 2</b> <b>HOURS: 2/W</b>
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<b>Learning Objectives</b>		
LO1	Insert a graphic within a web page.	
LO2	Create a link within a web page.	
LO3	Create a table within a web page.	
LO4	Insert heading levels within a web page.	
LO5	Insert ordered and unordered lists within a web page. Create a web page.	
<b>UNIT</b>	<b>Contents</b>	<b>No. Of. Hours</b>
I	Introduction :WebBasics: WhatisInternet–Webbrowsers–WhatisWebpage – HTMLBasics:Understandingtags.	<b>6</b>
II	TagsforDocumentstructure(HTML,Head,BodyTag).Blockleveltextelements:Headin gsparagraph(<p> tag)– Fontstyleelements:(bold,italic,font,small,strong,strike,bigtags)	<b>6</b>
III	Lists:Typesoflists:Ordered,Unordered– NestingLists–Othertags:Marquee,HR,BR- UsingImages –CreatingHyperlinks.	<b>6</b>
IV	Tables:CreatingbasicTable,Tableelements,Caption–Tableandcellalignment– Rowspan,Colspan–Cellpadding.	<b>6</b>
V	Frames:Frameset–TargetedLinks–Noframe–Forms:Input, Textarea,Select,Option.	<b>6</b>
<b>TOTAL HOURS</b>		<b>30</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
CO	On completion of this course, students will	
CO 1	Knows the basic concept in HTML Concept of resources in HTML	PO1, PO2, PO3, PO4, PO5, PO6
CO 2	Knows Design concept. Concept of Meta Data Understand the concept of save the files.	PO1, PO2, PO3, PO4, PO5, PO6
CO 3	Understand the page formatting. Concept of list	PO1, PO2, PO3, PO4, PO5, PO6
CO 4	Creating Links. Know the concept of creating link to email address	PO1, PO2, PO3, PO4, PO5, PO6
CO 5	Concept of adding images Understand the table creation.	PO1, PO2, PO3, PO4, PO5, PO6

<b>Textbooks</b>	
1	“Mastering HTML5 and CSS3 Made Easy”, TeachUComp Inc., 2014.
2	Thomas Michaud, “Foundations of Web Design: Introduction to HTML & CSS”
<b>Web Resources</b>	
1	<a href="https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf">https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf</a>
2	<a href="https://www.w3schools.com/html/default.asp">https://www.w3schools.com/html/default.asp</a>

**Mapping with Programme Outcomes:**

<b>CO/PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO 1</b>	3	3	3	3	3	3
<b>CO 2</b>	3	3	2	3	3	3
<b>CO 3</b>	2	3	3	3	3	3
<b>CO 4</b>	3	3	3	3	3	3
<b>CO 5</b>	3	3	3	2	3	3
<b>Weightage of course contributed to each PSO</b>	14	15	14	14	15	15

**S-Strong-3    M-Medium-2    L-Low-1**

**CORE – V: OBJECT ORIENTED PROGRAMMING (THEORY & PRACTICAL)**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
23UAICC33	3	0	2	III	5	5	25	75	100
<b>Learning Objectives</b>									
<b>LO1</b>	understand the basic concepts of Java								
<b>LO2</b>	develop high quality, internally documented, well-structured object oriented program.								
<b>LO3</b>	adapt object oriented principles such as abstraction and information hiding in software development.								
<b>Unit</b>	<b>Contents</b>								<b>No. of Hours</b>
I	<b>Programming Basic, Decision Making and Functions Using JAVA</b> Basic program construction, Data types, Arrays, Operators, Control statements, Simple functions, Passing arguments to functions, Returning values from functions, Reference arguments, Recursion, Inline functions, Scope and storage class.								<b>9</b>
II	<b>Introduction to Java Programming, Classes and Objects</b> Features of Java, JDK, JRE and JVM, Structure of java program, Class fundamentals, Declaring objects, Constructors, Garbage collection, Overloading methods, Nested and inner classes. Member access and inheritance, Using super, Method overriding, Dynamic method dispatch, Defining a package, Access protection, Importing packages, Defining an interface and implementing interfaces.								<b>9</b>
III	<b>Exception Handling, Multithreading and Wrapper Classes</b> Exception-handling fundamentals, Exception types, Uncaught exceptions, Using try and catch, throw, throws, finally, Built-in exceptions, Creating user-defined exceptions, Java thread model, Creating threads, Boxing and unboxing.								<b>9</b>
IV	<b>Input Output Handling, File Handling, Collection and Generics</b> Input output basics, Reading console input, Writing console output, Reading and writing files, ArrayList, Generic class, Bounded types, Creating a generic method.								<b>9</b>
V	<b>Design Patterns, Graphical Programming and Software Development Process</b> Introduction to design patterns, Iterator pattern and model-view-controller pattern, Simple swing application, Event handling, Painting in swing, Swing user interface elements, Software development process.								<b>9</b>
<b>List of Exercises</b>									
	<ol style="list-style-type: none"> <li>1. Control Statements</li> <li>2. Array</li> <li>3. Class and Objects</li> <li>4. Inheritance</li> <li>5. Packages</li> <li>6. Interface</li> <li>7. Exception Handling</li> <li>8. String Handling</li> <li>9. File Handling</li> <li>10. GUI using Swing</li> </ol>								<b>30</b>

<b>TOTAL</b>		<b>75</b>
<b>CO</b>	<b>Course Outcomes</b>	
CO1	define the object-oriented programming concepts.	
CO2	select the relevant object oriented concepts to implement a real time application with design patterns.	
CO3	demonstrate the application of polymorphism in various ways.	
CO4	illustrate the use of inheritance, exceptions, generics and collection.	
CO5	develop applications with event-driven graphical user interface and file management .	
<b>Textbooks</b>		
➤	Herbert Schildt, “Java: The Complete Reference”, 10 <sup>th</sup> edition, McGraw Hill Education, 2017, ISBN-10: 1259589331.	
<b>Reference Books</b>		
1.	Harvey M. Dietel, “Java How to Program”, 7 <sup>th</sup> edition, Prentice Hall, 2007. ISBN:978-0132222204.	
2.	Elisabeth Freeman, “Head First Design Patterns”, O’Reilly, 1 <sup>st</sup> edition, 2004, ISBN-10: 0596007124.	
3.	Kathy Sierra, Bert Bates, “Head First Java”, 2 <sup>nd</sup> edition, O’Reilly Media, 2005. ISBN: 10- 0596004656, ISBN-13:9780596004651.	
<b>NOTE: Latest Edition of Textbooks May be Used</b>		
<b>Web Resources</b>		
1.	<a href="https://www.javatpoint.com/java-tutorial">https://www.javatpoint.com/java-tutorial</a>	
2.	<a href="https://www.w3schools.com/java/">https://www.w3schools.com/java/</a>	
3.	<a href="https://www.tutorialspoint.com/java/index.htm">https://www.tutorialspoint.com/java/index.htm</a>	

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightageof coursecontributedto eachPSO</b>	<b>15</b>	<b>14</b>	<b>14</b>	<b>15</b>	<b>15</b>	<b>15</b>

**S-Strong-3    M-Medium-2    L-Low-1**

**SECOND YEAR – SEMESTER – III**

**CORE – VI:DATA STRUCTURES AND ALGORITHMS (THEORY & PRACTICAL)**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
23UAICP34				III	5	5	25	75	100
<b>Learning Objectives</b>									
<b>LO1</b>	understand the concepts of linear data structures and algorithms.								
<b>LO2</b>	demonstrate the different searching and sorting techniques.								
<b>LO3</b>	relate the different non-linear data structures such as trees and graphs.								
Unit	Contents								No. of Hours
<b>I</b>	<b>Abstract Data Type</b> Data Abstraction - Abstract Data Type (ADT) - Algorithms - Fundamentals of Algorithmic Problem-solving - Analysis of Algorithms - Asymptotic Notations - Time-Space Trade-off								<b>9</b>
<b>II</b>	<b>Array based Linear Data Structures</b> Arrays - Stack ADT - Applications of Stack: Expression evaluation and conversion - Recursion - Queue ADT - Circular Queue - Applications of Queue								<b>9</b>
<b>III</b>	<b>Linked List based Linear Data Structures &amp; Sorting</b> Singly linked lists - Linked Stacks and Queues - Doubly linked lists - Circular linked lists – Applications. Sequential search - Bubble Sort - Selection Sort - Insertion Sort - Radix Sort - Merge Sort - Quick Sort.								<b>9</b>
<b>IV</b>	<b>Non-linear Data Structures, Trees</b> Introduction to Trees - Binary Tree - Representation - Traversals of Binary Tree and Implementation - Binary Search Trees - Priority Queues - Binary Heap and Applications - AVL Trees - B-trees.								<b>9</b>
<b>V</b>	<b>Graphs</b> Mathematical background- Graph Representation and Traversals - Depth First Search, Breadth First Search								<b>9</b>
<b>List of Exercises</b>									
<ul style="list-style-type: none"> <li>• Array Implementation of Stack and Queue ADTs</li> <li>• Application of Recursion</li> <li>• Linked list Implementation of List ADT.</li> <li>• Linked list Implementation of Stack ADT</li> <li>• Linked list Implementation of Queue ADT</li> <li>• Implementation of Doubly Linked List ADT</li> <li>• Implementation of Circular Linked List ADT</li> <li>• Applications of List, Stack and Queue ADTs.</li> <li>• Implementation of Sorting Algorithms</li> <li>• Implementation of Search Algorithms</li> </ul>								<b>15</b>	

Text Books:	
<ol style="list-style-type: none"> <li>1. Ellis Horowitz, SartajSahni and Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Second Edition, 2007, ISBN: 0-929306-40-6.</li> <li>2. Mark Allen Weiss, “Data Structures and Problem Solving using Java”, 4th Edition, Addison-Wesley, 2006.</li> <li>3. AnanyLevitin, “Introduction to the Design and Analysis of Algorithms”, Pearson Education, 2011. ISBN13: 978-013231681</li> </ol>	
Reference Book:	
<ol style="list-style-type: none"> <li>1. V. Aho, J. E. Hopcroft, and J. D. Ullman, “Data Structures and Algorithms”, Pearson Education, First Edition Reprint 2003.Fourth impression,2009, ISBN 978-81-7758-8262</li> <li>2. S. Tanenbaum, Y. Langsam, and M. J. Augenstein, Data Structures Using C and C++, Second Edition, PHI/Pearson Education, 1996. ISBN 978-81-203-1177-0.</li> <li>3. Ellis Horowitz, SartajShani, SanguthuvarRajasekaran, “Fundamentals of computer Algorithms”, Second Edition, 2008. ISBN- 978-81-7371-612-6</li> </ol>	
<b>TOTAL</b>	
<b>60</b>	
<b>CO</b>	<b>Course Outcomes</b>
CO1	understand the basics of abstract data type and algorithm analysis.
CO2	illustrate the use of array to implement stack and queue.
CO3	apply linked list to design stack and queue data structures.
CO4	understand the different types of tree data structures and demonstrate the methods for traversing trees.
CO5	differentiate the graph representations and traversals.

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightage ofcoursecontributedto eachPSO</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>

**S-Strong-3    M-Medium-2    L-Low-1**

<b>SEMESTER :III ELECTIVE-III PART: III</b>	<b>23USMAE35: STATISTICAL METHODS AND ITS APPLICATION - I</b>	<b>CREDIT : 3 HOURS : 4</b>
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**COURSE OUTCOME:**

- 1: develop the skill of statistical methods and its representations.
- 2: solve by mean ,median and mode
- 3: calculate range, deviation and its measures.
- 4: solve the skewness and its coefficients.
- 5: understand the correlation and regression analysis.

**UNIT-I: INTRODUCTION**

**Hours: 12**

scope and limitations of statistical methods - classification of data -Tabulation of data - Diagrammatic and Graphical representation of data - Graphical determination of Quartiles ,Deciles and Percentiles.

**UNIT-II: MEASURES OF LOCATION**

**Hours: 12**

Arithmetic mean, median, mode, geometric mean and Harmonic mean and their properties.

**UNIT -III: MEASURES OF DISPERSION**

**Hours: 12**

Measures of dispersion: Range, Quartile deviation, mean deviation, Standard deviation,combined Standard deviation, and their relative measures.

**UNIT -IV: MEASURES OF SKEWNESS**

**Hours: 12**

Measures of Skewness Karl Pearson's, Bowley's, and kelly's and co-efficient of Skewness and kurtosis based on moments.

**UNIT -V:CORRELATION**

**Hours: 12**

Correlation - Karl Pearson - Spearman's Rank correlation – concurrent deviation methods. Regression Analysis: Simple Regression Equations.

**TEXT BOOK:**

- 1.Fundamental of Mathematical Statistics - S.C. Gupta & V.K. Kapoor - Sultan Chand

**SUPPLEMENTARY READINGS:**

- 1.Statistical Methods - Snedecor G.W. & Cochran W.G. oxford & +DII
2. Elements of Statistics - Mode . E.B. - Prentice Hall
3. Statistical Methods - Dr. S.P. Gupta - Sultan Chand & Sons

## Outcome Mapping

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>1</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO4</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>

**1 – Low, 2 – Moderate, 3 – High (Preferably use 2 or 3 levels)**

Subject Code	Subject Name	Category	L	T	P	O	Credits	Inst. Hours	Marks		
									CIA	External	Total
23UAICS36	Organizational Behaviour	S EC -4 (NME-1)	Y	-	-	-	1	1	25	75	100
<b>Learning Objectives</b>											
CLO1	To have extensive knowledge on OB and the scope of OB.										
CLO2	To create awareness of Individual Behaviour.										
CLO3	To enhance the understanding of Group Behaviour										
CLO4	To know the basics of Organisational Culture and Organisational Structure										
CLO5	To understand Organisational Change, Conflict and Power										
UNIT	Details								No. of Hours	Learning Objectives	
I	INTRODUCTION : Concept of Organizational Behavior (OB): Nature, Scope and Role of OB: Disciplines that contribute to OB; Opportunities for OB (Globalization, Indian workforce diversity, customer service, innovation and change, networked organizations, work-life balance, people skills, positive work environment, ethics)								6	CLO1	
II	INDIVIDUAL BEHAVIOUR: 1. Learning, attitude and Job satisfaction: Concept of learning, conditioning, shaping and reinforcement. Concept of attitude, components, behavior and attitude. Job satisfaction: causation; impact of satisfied employees on workplace. 2. Motivation : Concept; Theories (Hierarchy of needs, X and Y, Two factor, McClelland, Goal setting, Self-efficacy, Equity theory); Job characteristics model; Redesigning jobs, 3. Personality and Values : Concept of personality; Myers-Briggs Type Indicator (MBTI); Big Five model. Relevance of values; Linking personality and values to the workplace (person-job fit, person-organization fit) 4. Perception, Decision Making : Perception and Judgements; Factors; Linking perception to individual decision making:								6	CLO2	
III	GROUP BEHAVIOUR : 1. Groups and Work Teams : Concept : Five Stage model of group development; Group norms, cohesiveness ; Group think and shift ; Teams; types of teams; Creating team players from individuals and team based work(TBW) 2. Leadership : Concept; Trait theories; Behavioral theories (Ohio and Michigan studies); Contingency theories (Fiedler, Hersey and Blanchard, Path-Goal);								6	CLO3	

IV	ORGANISATIONAL CULTURE AND STRUCTURE : Concept of culture; Impact (functions and liability); Creating and sustaining culture: Concept of structure, Prevalent organizational designs: New design options	6	CLO4
V	ORGANISATIONAL CHANGE, CONFLICT AND POWER: Forces of change; Planned change; Resistance; Approaches (Lewin's model, Organisational development);. Concept of conflict, Conflict process; Types, Functional/ Dysfunctional. Introduction to power and politics.	6	CLO5
		<b>30</b>	
<b>Course Outcomes</b>	<b>On Completion of the course the students will</b>	<b>Program Outcomes</b>	
<b>CO1</b>	To define Organisational Behaviour, Understand the opportunity through OB.	PO1, PO2, PO6, PO7	
<b>CO2</b>	To apply self-awareness, motivation, leadership and learning theories at workplace.	PO2, PO4, PO5, PO6	
<b>CO3</b>	To analyze the complexities and solutions of group behaviour.	PO1, PO2, PO4, PO5, PO6	
<b>CO4</b>	To impact and bring positive change in the culture of the organisation.	PO2, PO3, PO4, PO5, PO8	
<b>CO5</b>	To create a congenial climate in the organization.	PO1, PO2, PO5, PO6, PO8	
<b>Reading List</b>			
1.	Neharika Vohra Stephen P. Robbins, Timothy A. Judge , <i>Organizational Behaviour</i> , Pearson Education, 18 <sup>th</sup> Edition, 2022.		
2.	Fred Luthans, <i>Organizational Behaviour</i> , Tata McGraw Hill, 2017.		
3.	Ray French, Charlotte Rayner, Gary Rees & Sally Rumbles, <i>Organizational Behaviour</i> , John Wiley & Sons, 2011		
4.	Louis Bevoc, Allison Shearsett, Rachael Collinson, <i>Organizational Behaviour Reference</i> , Nutri Niche System LLC (28 April 2017)		
5.	Dr. Christopher P. Neck, Jeffery D. Houghton and Emma L. Murray, <i>Organizational Behaviour: A Skill-Building Approach</i> , SAGE Publications, Inc; 2nd edition (29 November 2018).		
<b>References Books</b>			
1.	Uma Sekaran, <i>Organizational Behaviour Text &amp; cases</i> , 2 <sup>nd</sup> edition, Tata McGraw Hill Publishing CO. Ltd		
2.	Gangadhar Rao, Narayana, V.S.P Rao, <i>Organizational Behaviour</i> 1987, Reprint 2000, Konark Publishers Pvt. Ltd, 1 <sup>st</sup> edition		
3.	S.S. Khanka, <i>Organizational Behaviour</i> , S. Chand & Co, New Delhi.		
4.	J. Jayasankar, <i>Organizational Behaviour</i> , Margham Publications, Chennai, 2017.		

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightage ofcoursecontributedto eachPSO</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>

**S-Strong-3    M-Medium-2    L-Low-1**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23UAICS37	PHP PROGRAMMING	SEC- 5	Y				2	2	25	75	100
<b>Course Objective</b>											
C1	To provide the necessary knowledge on basics of PHP.										
C2	To design and develop dynamic, database-driven web applications using PHP version.										
C3	To get an experience on various web application development techniques.										
C4	To learn the necessary concepts for working with the files using PHP.										
C5	To get a knowledge on OOPS with PHP.										
UNIT	Details								No. of Hours	Course Objectives	
I	Introduction to PHP -Basic Knowledge of websites - Introduction of Dynamic Website -Introduction to PHP - Scope of PHP -XAMPP and WAMP Installation								6	CO1	
II	PHP Programming Basics -Syntax of PHP -Embedding PHP in HTML -Embedding HTML in PHP. Introduction to PHP Variable -Understanding Data Types - Using Operators -Using Conditional Statements -If(), else if() and else if condition Statement.								6	CO2	
III	Switch() Statements -Using the while() Loop -Using the for() Loop PHP Functions. PHP Functions -Creating an Array -Modifying Array Elements -Processing Arrays with Loops - Grouping Form Selections with Arrays -Using Array Functions.								6	CO3	
IV	PHP Advanced Concepts -Reading and Writing Files - Reading Data from a File.								6	CO4	
V	Managing Sessions and Using Session Variables -Destroying a Session -Storing Data in Cookies -Setting Cookies.								6	CO5	
<b>Total</b>								<b>30</b>			
Course Outcomes						Programme Outcomes					
CO	On completion of this course, students will										
1	Write PHP scripts to handle HTML forms					PO1,PO4,PO6,PO8.					
2	Write regular expressions including modifiers, operators, and metacharacters.					PO2,PO5,PO7.					
3	Create PHP Program using the concept of array.					PO3,PO6,PO8.					
4	Create PHP programs that use various					PO2,PO3,PO5,PO8.					

	PHP library functions	
5	Manipulate files and directories.	PO3,PO5,PO6.
<b>Text Book</b>		
1	Head First PHP & MySQL: A Brain-Friendly Guide- 2009-Lynn mighley and Michael Morrison.	
2	The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL- Alan Forbes	
<b>Reference Books</b>		
1.	PHP: The Complete Reference-Steven Holzner.	
2.	DT Editorial Services (Author), " <i>HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)</i> ", Paperback 2016, 2 <sup>nd</sup> Edition.	
<b>Web Resources</b>		
1.	Refer MOOC Courses like NPTEL and SWAYAM	
2.	<a href="https://www.w3schools.com/php/default.asp">https://www.w3schools.com/php/default.asp</a>	

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>

**S-Strong-3    M-Medium-2    L-Low-1**

**SECOND YEAR – SEMESTER – IV****CORE – VII: R PROGRAMMING**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
23UAICC43	5	0	0	IV	5	5	25	75	100
<b>Learning Objectives</b>									
<b>LO1</b>	Understanding and being able to use basic programming concepts								
<b>LO2</b>	Automate data analysis								
<b>LO3</b>	Working collaboratively and openly on code								
<b>LO4</b>	Knowing how to generate dynamic documents								
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, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations								15
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								15
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								15
IV	FACTORS AND TABLES, Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Subtable, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions								15
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.								15
<b>TOTAL</b>								<b>75</b>	
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 recursion								
CO3	Applying mathematical and statistical operations data in R								

CO4	Examine data-sets to create testable hypotheses and identify appropriate statistical tests
CO5	Make use of appropriate statistical tests using R and Create and edit visualizations with regression models
<b>Textbooks</b>	
➤	R Programming for Data Science by Roger D. Peng
➤	The Art of R Programming by Prashanth singh, Vivek Mourya, Cengage Learning India.
<b>Reference Books</b>	
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
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
<b>Web Resources</b>	
1.	<a href="https://www.w3schools.com/r/">https://www.w3schools.com/r/</a>
2.	<a href="https://www.javatpoint.com/r-tutorial">https://www.javatpoint.com/r-tutorial</a>
3.	<a href="https://www.tutorialspoint.com/r/index.htm">https://www.tutorialspoint.com/r/index.htm</a>

### Outcome Mapping

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	2
CO2	1	2	2	3	1
CO3	3	3	3	2	2
CO4	1	2	3	2	2
CO5	1	3	3	3	1

1 – Low, 2 – Moderate, 3 – High (Preferably use 2 or 3 levels)

**SECOND YEAR – SEMESTER – IV**

**CORE – VIII:R PROGRAMMING--LAB**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
23UAICP44	0	0	5	IV	5	5	25	75	100
<b>Learning Objectives</b>									
LO1	Gain knowledge in developing basic R programs								
LO2	Knowing how to generate dynamic documents								
LO3	Being able to use a continuous test-driven development approach								
<b>List of Exercises</b>									
<ol style="list-style-type: none"><li>1. Write an R-Program to print Hello World</li><li>2. Write an R-Program to take input from user.</li><li>3. Write an R-Program to demonstrate working with operators (Arithmetic, Relational, Logical, Assignment operators).</li><li>4. Write an R Program to Check if a Number is Odd or Even</li><li>5. Write an R Program to check if the given Number is a Prime Number</li><li>6. Write an R Program to Find the Factorial of a Number</li><li>7. Write an R Program to Find the Factors of a Number</li><li>8. Write an R Program to Find the Fibonacci sequence Using Recursive Function</li><li>9. Write an R Program to Make a Simple Calculator</li><li>10. Write an R Program to Find L.C.M of two numbers</li><li>11. Write an R Program to create a Vector and to access elements in a Vector</li><li>12. Write an R Program to create a Matrix and access rows and columns using functions colnames() and rownames() .</li><li>13. Write an R Program to create a Matrix using cbind() and rbind() functions.</li><li>14. Write an R Program to create a Matrix from a Vector using dim() function.</li><li>15. Write an R Program to create a List and modify its components.</li><li>16. Write an R Program to create a Data Frame.</li><li>17. Write an R Program to access a Data Frame like a List.</li><li>18. Write an R Program to access a Data Frame like a Matrix.</li><li>19. Write an R Program to create a Factor.</li><li>20. Write an R Program to Access and Modify Components of a Factor.</li><li>21. Write an R Program to create an S3 Class and S3 Objects.</li><li>22. Write an R Program to write a own generic function in S3 Class.</li><li>23. Write an R Program to create an S4 Class and S4 Objects.</li><li>24. Write an R Program to write a own generic function in S4 Class.</li><li>25. Write an R Program to create Reference Class and modify its Methods.</li></ol>									
<b>TOTAL</b>									<b>60</b>
CO	<b>Course Outcomes</b>								
CO1	Understand the fundamental concepts in R								
CO2	Acquire programming skills in R								
CO3	be able to use R to solve statistical problems								
CO4	be able to implement and describe Monte Carlo the technology								

CO5	be able to minimize and maximize functions using R
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CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	1	2	1	1	2
CO2	2	2	2	2	2	2
CO3	2	2	2	2	2	2
CO4	3	2	2	3	2	2
CO5	3	3	2	3	3	2
<b>Weightageof coursecontributedt oeachPSO</b>	<b>13</b>	<b>10</b>	<b>10</b>	<b>11</b>	<b>10</b>	<b>10</b>

<b>SEMESTER:IV ELECTIVE: IV PART:III</b>	<b>23USMAE45 : STATISTICAL METHODS AND ITS APPLICATIONS -II</b>	<b>CREDIT:3 HOURS:3/W</b>
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### **COURSE OBJECTIVES**

To understand and compute statistical Methods by which to develop the programming Skills.

#### **UNIT I**

Curve fitting by the method of least squares-

$$Y = ax + b, Y = ax^2 + bx + c, Y = ax^b, Y = ae^{bx} \text{ and } Y = ab^x .$$

#### **UNIT II**

Sample Space - events - probability - Addition and Multiplication Theorem - conditional probability-

Baye's Theorem. Mathematical expectation Addition and Multiplication theorem.

#### **UNIT III**

Standard distributions- Binomial, Poisson, Normal distribution and fitting of these distributions.

#### **UNIT IV**

Test of Significance- small sample and large sample test based on mean, S.D. correlation and proportion - confidence interval.

#### **UNIT V**

Analysis of variance - One and Two way classifications - Basic principle of design of Experiments- Randomisation, Replication and Local control- C.R.D., R.B.D. and L.S.D.

#### **Text Books**

1. Fundamental of Mathematical Statistics- S.C. Gupta & V.K. Kapoor- S. Chand & Co.

#### **Supplementary Readings**

1. Fundamental of Applied Statistics - S.C. Gupta & V.K. Kapoor- S. Chand & Co.
2. Statistical Methods- Snedecor G.W. & Cochran W.G. Oxford & DII Elements of Statistics- Mode. E.B.- Prentice Hall

### Outcome Mapping

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	2	3	3	3	2
<b>CO2</b>	1	3	2	2	3
<b>CO3</b>	3	3	3	2	2
<b>CO4</b>	3	3	2	2	2
<b>CO5</b>	1	3	3	3	3

1 – Low, 2 – Moderate, 3 – High (Preferably use 2 or 3 levels)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks			
									CIA	External	Total	
<b>23UAICS46</b>	<b>SoftwareTesting</b>	SEC-6	Y	-	-	-	2	2	25	75	100	
<b>Course Objective</b>												
<b>C1</b>	To study fundamental concepts in software testing											
<b>C2</b>	To discuss various software testing issues and solutions in software unit test, integration and system testing.											
<b>C3</b>	To study the basic concept of Data flow testing and Domain testing.											
<b>C4</b>	To Acquire knowledge on path products and path expressions.											
<b>C5</b>	To learn about Logic based testing and decision tables											
<b>UNIT</b>	<b>Details</b>							<b>No. of Hours</b>	<b>Course Objective</b>			
<b>I</b>	Introduction: Purpose–Productivity and Quality in Software–TestingVsDebugging–Model for Testing–Bugs–Types of Bugs – Testing and Design Style.							6	C1			
<b>II</b>	Flow / Graphs and Path Testing – Achievable paths – Path instrumentation Application Transaction FlowTesting Techniques.							6	C2			
<b>III</b>	Data Flow Testing Strategies - Domain Testing:Domains and Paths – Domains and Interface Testing.							6	C3			
<b>IV</b>	Linguistic –Metrics – Structural Metric – Path Products and Path Expressions.SyntaxTesting–Formats–Test Cases							6	C4			
<b>V</b>	Logic Based Testing–Decision Tables–Transition Testing–States, State Graph, StateTesting.							6	C5			
	<b>Total</b>							<b>30</b>				
<b>Course Outcomes</b>							<b>Program Outcomes</b>					
<b>CO</b>	On completion of this course, students will											
<b>1</b>	Students learn to apply software testing knowledge and engineering methods							PO1				
<b>2</b>	Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.							PO1, PO2				

3	Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.	PO4, PO6
4	Have basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems	PO4, PO5, PO6
5	Have an ability to use software testing methods and modern software testing tools for their testing projects.	PO3, PO8
<b>Text Book</b>		
1	B.Beizer,“Software Testing Techniques”,IIEdn.,DreamTechIndia,NewDelhi,2003.	
2	K.V.K.Prasad,“Software Testing Tools”,DreamTech.India,NewDelhi,2005	
<b>Reference Books</b>		
1.	I.Burnstein,2003,“Practical Software Testing”,SpringerInternationalEdn.	
2.	E. Kit, 1995, “Software Testing in the Real World: Improving the Process”, PearsonEducation,Delhi.	
3.	R. Rajani,andP.P.Oak,2004,“Software Testing”,TataMcgrawHill,NewDelhi.	
<b>Web Resources</b>		
1.	<a href="https://www.javatpoint.com/software-testing-tutorial">https://www.javatpoint.com/software-testing-tutorial</a>	
2.	<a href="https://www.guru99.com/software-testing.html">https://www.guru99.com/software-testing.html</a>	

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>

**S-Strong-3    M-Medium-2    L-Low-1**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23UAICS47	Multimedia Systems	SEC-7	Y	-	-	-	2	2	25	75	100
<b>Course Objective</b>											
<b>C1</b>	Understand the definition of Multimedia										
<b>C2</b>	To study about the Image File Formats, Sounds Audio File Formats										
<b>C3</b>	Understand the concepts of Animation and Digital Video Containers										
<b>C4</b>	To study about the Stage of Multimedia Project										
<b>C5</b>	Understand the concept of Ownership of Content Created for Project Acquiring Talent										
<b>UNIT</b>	<b>Details</b>						<b>No. of Hours</b>		<b>Course Objective</b>		
<b>I</b>	Multimedia Definition-Use Of Multimedia-Delivering Multimedia- Text:About Fonts and Faces - Using Text in Multimedia -Computers and Text Font Editing and Design Tools-Hypermedia and Hypertext.						12		C1		
<b>II</b>	Images: Plan Approach - Organize Tools - Configure Computer Workspace -Making Still Images - Color - Image File Formats. Sound: The Power of Sound - Digital Audio-Midi Audio-Midi vs. Digital Audio-Multimedia System Sounds Audio File Formats - Vaughan's Law of Multimedia Minimums - Adding Sound to Multimedia Project						12		C2		
<b>III</b>	Animation:The Power of Motion-Principles of Animation-Animation by Computer - Making Animations that Work. Video: Using Video - Working with Video and Displays-Digital Video Containers-Obtaining Video Clips - Shooting and Editing Video						12		C3		
<b>IV</b>	Making Multimedia: The Stage of Multimedia Project - The Intangible Needs -The Hardware Needs - The Software Needs - An Authoring Systems Needs-Multimedia Production Team.						12		C4		
<b>V</b>	Planning and Costing: The Process of Making Multimedia -Scheduling-Estimating - RFPs and Bid Proposals. Designing and Producing - Content and Talent: Acquiring Content- Ownership of Content Created for Project- Acquiring Talent						12		C5		
<b>Total</b>							<b>60</b>				
<b>Course Outcomes</b>							<b>Programme Outcomes</b>				
<b>CO</b>	On completion of this course, students will										

1	understand the concepts, importance, application and the process of developing multimedia	PO1
2	to have basic knowledge and understanding about image related processings	PO1, PO2
3	To understand the framework of frames and bit images to animations	PO4, PO6
4	Speaks about the multimedia projects and stages of requirement in phases of project.	PO4, PO5, PO6
5	Understanding the concept of cost involved in multimedia planning, designing, and producing	PO3, PO8
<b>Text Book</b>		
1	TayVaughan, "Multimedia: Making It Work", 8th Edition, Osborne/McGraw-Hill, 2001.	
<b>Reference Books</b>		
1.	RalfSteinmetz&KlaraNahrstedt "Multimedia Computing, Communication & Applications", Pearson Education, 2012.	
<b>Web Resources</b>		
1.	<a href="https://www.geeksforgeeks.org/multimedia-systems-with-features-or-characteristics/">https://www.geeksforgeeks.org/multimedia-systems-with-features-or-characteristics/</a>	

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>

S-Strong-3    M-Medium-2    L-Low-1

**THIRD YEAR – SEMESTER – V**

**CORE – IX: INTRODUCTION TO MACHINE LEARNING**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
23UAICC51	5	0	0	V	4	5	25	75	100
<b>Learning Objectives</b>									
<b>LO1</b>	understand the human learning aspects and primitives in learning process by computer								
<b>LO2</b>	analyze the nature of problems solved with machine learning techniques								
<b>LO3</b>	design and implement suitable machine learning technique for a given application								
Unit	Contents								No. of Hours
I	<b>Introduction</b> Definition - Types of Machine Learning - Examples of Machine Learning Problems - Training versus Testing - Characteristics of Machine learning tasks - Predictive and descriptive tasks - Machine learning Models: Geometric Models, Logical Models, Probabilistic Models. Features: Feature types - Feature Construction and Transformation - Feature Selection.								15
II	<b>Classification and Concept Learning</b> Classification: Binary Classification- Assessing Classification performance - Class probability Estimation - Multiclass Classification - Regression: Assessing performance of Regression - Error measures - Overfitting- Theory of Generalization: Effective number of hypothesis - Bounding the Growth function.								15
III	<b>Linear and Probabilistic Models</b> Least Squares method - Multivariate Linear Regression - Perceptron, Multiple Layer Perceptron - Support Vector Machines - Obtaining probabilities from Linear classifiers - Kernel methods for non-Linearity - Probabilistic models for categorical data – Naïve Bayes Classifier								15
IV	<b>Distance Based Models</b> Distance Based Models: Neighbors and Examples - Nearest Neighbors Classification - Distance based clustering – K-Means Algorithm - K-Medoids Algorithm - Hierarchical clustering - Vector Quantization, Self-Organizing Feature Map - Principal Component Analysis.								15
V	<b>Rule Based and Tree Based Models</b> Rule Based Models: Rule learning for subgroup discovery - Association rule mining - Tree Based Models: Decision Trees - Ranking and Probability estimation Trees - Regression trees - Classification and Regression Trees (CART), Ensemble Learning, - Bagging and Boosting.								15
<b>TOTAL</b>								<b>75</b>	
CO	Course Outcomes								
CO1	describe the concepts, mathematical background, applicability, limitations of existing machine learning techniques.								

CO2	identify the performance evaluation criteria of the model developed
CO3	analyze and design various machine learning based applications with a modern outlook focusing on recent advances.
CO4	build the learning model for a given task
CO5	apply some state-of-the-art development frameworks and software libraries for implementation
<b>Textbooks</b>	
➤	P. Flach, “Machine Learning: The art and science of algorithms that make sense of data”, Cambridge University Press, 2012, ISBN-10: 1107422221, ISBN-13: 978-1107422223.
➤	Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning: Data Mining, Inference, and Prediction”, Second Edition (Springer Series in Statistics), 2016, ISBN-10: 0387848576, ISBN-13: 978-0387848570
<b>Reference Books</b>	
1.	Christopher Bishop, “Pattern Recognition and Machine Learning (Information Science and Statistics)”, Springer, 2007.
2.	Kevin Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012, ISBN-10: 0262018020, ISBN-13: 978-0262018029
3.	Y. S. Abu-Mostafa, M. Magdon-Ismail, and H.-T. Lin, “Learning from Data”, AMLBook Publishers, 2012 ISBN 13: 978-1600490064.
4.	Tom Mitchell, “Machine Learning”, McGraw-Hill, 1997, ISBN-10: 0071154671, ISBN-13: 978-0071154673.
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
<b>Web Resources</b>	
1.	<a href="https://www.javatpoint.com/machine-learning">https://www.javatpoint.com/machine-learning</a>
2.	<a href="https://www.geeksforgeeks.org/machine-learning/">https://www.geeksforgeeks.org/machine-learning/</a>
3.	<a href="https://www.tutorialspoint.com/machine_learning/index.htm">https://www.tutorialspoint.com/machine_learning/index.htm</a>
4.	<a href="https://www.w3schools.com/python/python_ml_getting_started.asp">https://www.w3schools.com/python/python_ml_getting_started.asp</a>

### Outcome Mapping

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	2
CO2	1	2	2	3	1
CO3	3	3	3	2	2
CO4	1	2	3	2	2
CO5	1	3	3	3	1

1 – Low, 2 – Moderate, 3 – High (Preferably use 2 or 3 levels)

**THIRD YEAR – SEMESTER – V**

**CORE – X: MACHINE LEARNING LAB**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
23UAICP52	0	0	5	V	4	5	25	75	100
<b>Learning Objectives</b>									
<b>LO1</b>	Understand the basic statistical and algorithmic concepts in the field of Machine Learning								
<b>LO2</b>	learn to handle the data								
<b>LO3</b>	develop data analytics applications especially in the context of current research								
<b>List of Exercises</b>									
1. Data Preprocessing 2. Feature Extraction 3. Model Training using Linear/ logistic regression for a recent application 4. Model Training using Decision Tree for a recent application 5. Model Training using Support Vector Machine for a recent application 6. Model Training using Ensemble models for a recent application 7. Bayesian learning 8. Instance based learning 9. Model Evaluation and Improvisation 10. Exporting the model as endpoint									
<b>TOTAL</b>									<b>75</b>
<b>CO</b>	<b>Course Outcomes</b>								
CO1	identify the most relevant features in a dataset								
CO2	understand the implementation procedures for the machine learning algorithms								
CO3	write Python programs for various Learning algorithms.								
CO4	apply appropriate Machine Learning algorithms for the given data sets.								
CO5	develop applications using Machine Learning algorithms to solve real world problems								

**Outcome Mapping**

	PO1	PO2	PO3	PO4	PO5
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>1</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO4</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>

**1 – Low, 2 – Moderate, 3 – High (Preferably use 2 or 3 levels)**

**THIRD YEAR – SEMESTER – V**

**CORE – XI: DEEP LEARNING (THEORY & PRACTICAL)**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
<b>23UAICC53</b>	<b>4</b>	<b>0</b>	<b>1</b>	<b>V</b>	<b>4</b>	<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>Learning Objectives</b>									
<b>LO1</b>	study the basic concepts of neural networks and deep learning								
<b>LO2</b>	comprehend deep learning techniques								
<b>LO3</b>	explore various applications for deep learning techniques								
<b>Unit</b>	<b>Contents</b>							<b>No. of Hours</b>	
I	<b>Machine Learning</b> Introduction to machine learning- Linear models (SVMs and Perceptron's, logistic regression) - Intro to Neural Networks - Training a neural network: loss functions, backpropagation and stochastic gradient descent - Neural networks as universal function approximates							<b>12</b>	
II	<b>Deep Neural Networks</b> Introduction to Deep Learning- A Probabilistic Theory of Deep Learning- Deep Forward Networks - Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks							<b>12</b>	
III	<b>Convolutional Neural Networks</b> Introduction to Convolutional Neural Network - Architectures - AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization							<b>12</b>	
IV	<b>Recurrent Neural Networks and Deep unsupervised Learning</b> Recurrent networks, LSTM, GRU - Architectures, Autoencoders and Variational Autoencoders, Adversarial Generative Networks, DBM - Deep Reinforcement Learning							<b>12</b>	
V	<b>Applications</b> Computer Vision- ImageNet- Detection- Face Recognition- Scene Understanding- Gathering Image Captions - Audio Wave Net - Natural Language Processing Word2Vec - Sentiment Analysis - Recent research							<b>12</b>	
<b>List of Exercises</b>									
<ol style="list-style-type: none"> <li>Basic image processing operations : Histogram equalization, thresholding, edge detection, data augmentation, morphological operations</li> <li>Implement SVM/Softmax classifier for CIFAR-10 dataset: (i) using KNN, (ii) using 3 layer neural network</li> <li>Study the effect of batch normalization and dropout in neural network classifier</li> <li>Familiarization of image labelling tools for object detection, segmentation</li> <li>Image segmentation using Mask RCNN, UNet, SegNet</li> <li>Object detection with single-stage and two-stage detectors (Yolo, SSD, FRCNN, etc.)</li> <li>Image Captioning with Vanilla RNNs</li> <li>Image Captioning with LSTMs</li> <li>Network Visualization: Saliency maps, Class Visualization</li> <li>Generative Adversarial Networks</li> <li>Chatbot using bi-directional LSTMs</li> <li>Familiarization of cloud based computing like Google colab</li> </ol>							<b>15</b>		

<b>TOTAL</b>		<b>75</b>
<b>CO</b>	<b>Course Outcomes</b>	
CO1	understand the basics of deep learning	
CO2	implement various deep learning models	
CO3	realign high dimensional data using reduction techniques	
CO4	analyze optimization and generalization in deep learning	
CO5	explore the deep learning applications	
<b>Textbooks</b>		
➤	Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning”, MIT Press, 2016. ISBN: 9780262035613	
<b>Reference Books</b>		
1.	Deng & Yu, “Deep Learning: Methods and Applications”, Now Publishers, 2013. ISBN: 1601988141, 9781601988140	
2.	Michael Nielsen, “Neural Networks and Deep Learning”, Determination Press, 2015.	
<b>NOTE: Latest Edition of Textbooks May be Used</b>		
<b>Web Resources</b>		
1.	<a href="https://www.javatpoint.com/deep-learning">https://www.javatpoint.com/deep-learning</a>	
2.	<a href="https://www.geeksforgeeks.org/deep-learning-tutorial/">https://www.geeksforgeeks.org/deep-learning-tutorial/</a>	
3.	<a href="https://www.simplilearn.com/tutorials/deep-learning-tutorial">https://www.simplilearn.com/tutorials/deep-learning-tutorial</a>	

### Outcome Mapping

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>1</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO4</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>

1 – Low, 2 – Moderate, 3 – High (Preferably use 2 or 3 levels)

**CORE – XII: PROJECT WORK WTH VIVA VOCE**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
23UAICD54				V	4	5	25	75	100

**(Refer to the Regulations)**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
<b>23UAICE55</b>	<b>Internet of Things and its applications</b>	Elective –V	Y	-	-	-	3	4	25	75	100
<b>Course Objective</b>											
C1	Use of Devices, Gateways and Data Management in IoT.										
C2	Design IoT applications in different domain and be able to analyze their performance										
C3	Implement basic IoT applications on embedded platform										
C4	To gain knowledge on Industry Internet of Things										
C5	To Learn about the privacy and Security issues in IoT										
UNIT	Details							No. of Hours	Course Objective		
I	IoT & Web 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, Recommendations on Research Topics.							15	C1		
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, An IoT architecture outline, standards considerations.							15	C2		
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							15	C3		

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	15	C4
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	15	C5
<b>Total</b>		<b>75</b>	
<b>Course Outcomes</b>		<b>Programme Outcomes</b>	
CO	On completion of this course, students will		
1	Work with big data tools and its analysis techniques.	PO1	
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2	
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6	
4	Perform analytics on data streams.	PO4, PO5, PO6	
5	Learn NoSQL databases and management.	PO3, PO8	
<b>Text Book</b>			
1	Vijay Madiseti and Arshdeep Bahga, “Internet of Things: (A Hands-on Approach)”, Universities Press (INDIA) Private Limited 2014, 1st Edition.		
<b>Reference Books</b>			
1.	Michael Miller, “The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World”, kindle version.		
2.	Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, Apress Publications 2013, 1st Edition,.		
3	Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice" 4..Cuno Pfister, “Getting Started with the Internet of Things”,		

	O'Reilly Media 2011
<b>Web Resources</b>	
1.	<a href="https://www.simplilearn.com">https://www.simplilearn.com</a>
2.	<a href="https://www.javatpoint.com">https://www.javatpoint.com</a>
3.	<a href="https://www.w3schools.com">https://www.w3schools.com</a>

**Mapping with Programme Outcomes:**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
<b>CO 1</b>	S							
<b>CO 2</b>	M	S						
<b>CO 3</b>				S		S		
<b>CO 4</b>				S	S	M		
<b>CO 5</b>			S					S

**S-Strong    M-Medium    L-Low**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
<b>23UAICE56</b>	<b>Artificial Neural Networks</b>	Elective -VI	-	Y	-	-	3	4	25	75	100
<b>Course Objective</b>											
C1	<b>Understand the basics of artificial neural networks, learning process, single layer and multi-layer perceptron networks.</b>										
C2	Understand the Error Correction and various learning algorithms and tasks.										
C3	Identify the various Single Layer Perception Learning Algorithm.										
C4	Identify the various Multi-Layer Perception Network.										
C5	Analyze the Deep Learning of various Neural network and its Applications.										
UNIT	Details										No. of Hours
I	Artificial Neural Model- Activation functions- Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem - Multilayer Networks.Learning Algorithms- Error correction - Gradient Descent Rules, Perception Learning Algorithm, Perception Convergence Theorem.										15
II	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
III	.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
IV	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

V	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
<b>Total</b>		<b>75</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
CO	On completion of this course, students will	
1	<b>Students will learn the basics of artificial neural networks with single layer and multi-layer perception networks.</b>	PO1
2	Learn about the Error Correction and various learning algorithms and tasks.	PO1, PO2
3	Learn the various Perception Learning Algorithm.	PO4, PO6
4	Learn about the various Multi-Layer Perception Network.	PO4, PO5, PO6
5	Understand the Deep Learning of various Neural network and its Applications.	PO3, PO8
<b>Text Book</b>		
1	Neural Networks A Classroom Approach- Satish Kumar, McGraw Hill- Second Edition.	
2.	“Neural Network- A Comprehensive Foundation”- Simon Haykins, Pearson Prentice Hall, 2nd Edition, 1999.	
<b>Reference Books</b>		
1.	Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998.	
<b>Web Resources</b>		
1.	<a href="https://www.w3schools.com/ai/ai_neural_networks.asp">https://www.w3schools.com/ai/ai_neural_networks.asp</a>	
2.	<a href="https://en.wikipedia.org/wiki/Artificial_neural_network">https://en.wikipedia.org/wiki/Artificial_neural_network</a>	
3.	<a href="https://link.springer.com/chapter/10.1007/978-3-642-21004-4_12">https://link.springer.com/chapter/10.1007/978-3-642-21004-4_12</a>	

**Mapping with Programme Outcomes:**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>
<b>CO 1</b>	<b>S</b>							
<b>CO 2</b>	<b>S</b>	<b>S</b>						
<b>CO 3</b>				<b>S</b>		<b>S</b>		
<b>CO 4</b>				<b>S</b>	<b>S</b>	<b>S</b>		
<b>CO 5</b>			<b>S</b>					<b>S</b>

**S-Strong      M-Medium      L-Low**

**THIRD YEAR – SEMESTER – VI**

**SUMMER INTERNSHIP**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
23UAICI58	-	-	-	-	2	-	25	75	100

**(Refer to the Regulations)**

**THIRD YEAR – SEMESTER – VI**

**CORE – XIII: NATURAL LANGUAGE PROCESSING (THEORY & PRACTICAL)**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
23UAIC61				VI	4	6	25	75	100
<b>Learning Objectives</b>									
<b>LO</b>	Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics.								
<b>Unit</b>	<b>Contents</b>								<b>No. of Hours</b>
I	Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches								12
II	Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues								12
III	Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.								12
IV	Predicate-Argument Structure, Meaning Representation Systems, Software.								12
V	Discourse Processing: Cohension, Reference Resolution, Discourse Cohension and Structure Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross lingual Language Modeling								12
<b>List of Exercises</b>									
	<ul style="list-style-type: none"> <li>• Preprocessing of text (Tokenization, Filtration, Script Validation, Stop Word Removal, Stemming)</li> <li>• Morphological Analysis</li> <li>• N-gram model</li> <li>• POS tagging</li> <li>• Chunking</li> <li>• Named Entity Recognition</li> <li>• Virtual Lab on Word Generator</li> </ul>								15
<b>TOTAL</b>									<b>75</b>
<b>CO</b>	<b>Course Outcomes</b>								
CO1	Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.								
CO2	Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems								
CO3	Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.								

CO4	Able to design, implement, and analyze NLP algorithms.
CO5	•Able to design different language modeling Techniques.
<b>Textbooks</b>	
➤	Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication.
➤	. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary.
<b>Reference Books</b>	
1.	Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications.
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
<b>Web Resources</b>	
1.	<a href="https://www.tutorialspoint.com/natural_language_processing/index.htm">https://www.tutorialspoint.com/natural_language_processing/index.htm</a>
2.	<a href="https://www.geeksforgeeks.org/natural-language-processing-nlp-tutorial/">https://www.geeksforgeeks.org/natural-language-processing-nlp-tutorial/</a>
3.	<a href="https://www.javatpoint.com/nlp">https://www.javatpoint.com/nlp</a>

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>1</b>
<b>CO4</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>
<b>CO5</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>10</b>	<b>12</b>	<b>10</b>	<b>10</b>	<b>13</b>	<b>10</b>

**THIRD YEAR – SEMESTER – VI**  
**CORE – XIV:INTELLIGENT SYSTEMS**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
23UAICC62				VI	4	6	25	75	100
<b>Learning Objectives</b>									
<b>LO1</b>	To acquire knowledge on various intelligent system techniques and methodologies								
<b>LO2</b>	Learn about Knowledge representation, problem solving, and learning methods in solving engineering problems								
<b>Unit</b>	<b>Contents</b>							<b>No. of Hours</b>	
I	<b>Artificial Intelligence:</b> AI problems-AI technique- <b>Problem Search:</b> -Production Systems – Problem Characteristics – Production system characteristics- <b>Heuristic Search techniques:</b> Generate and Test – Hill Climbing – Constraint Satisfaction, Means-end analysis							15	
II	<b>Knowledge representation issues:</b> Representations and mappings – Approaches to Knowledge representations –Frame problem –. <b>Using Predicate Logic:</b> Representing simple facts in logic-Representing Instance and ISA relationships – Computable functions and predicates – Resolution							15	
III	<b>Representing knowledge using rules:</b> Procedural Vs Declarative knowledge – Logic programming – Forward Vs Backward reasoning – Matching – Control knowledge. <b>Knowledge representation summary:</b> Syntactic and Semantic spectrum of representation-Logic and slot – and-filler structures-Other representational techniques							15	
IV	<b>Rule-based expert systems:</b> Introduction- Rules as a knowledge representation technique- players- Structure- Forward chaining and backward chaining inference techniques- <b>Fuzzy expert systems:</b> Introduction- Fuzzy sets- Linguistic variables and hedges- Operations - Fuzzy rules- - Building a fuzzy expert system							15	
V	<b>Artificial neural networks:</b> Neuron- perceptron- Multilayer neural networks- - The Hopfield network- <b>Robotics:</b> Introduction-Robot hardware-Perception-Moving-Robotic software architecture.							15	
<b>TOTAL</b>							<b>75</b>		
<b>CO</b>	<b>Course Outcomes</b>								
CO1	Outline the applicability, strength and weakness of artificial intelligence in solving computational problems								
CO2	Demonstrate the role of knowledge representation, problem solving and learning in Intelligent-system engineering								
CO3	Identify the characteristics of AI, Knowledge representation, Experts systems and its variants with ANN and robotics.								
CO4	Analyze a comprehensive background in both software and hardware to work with the future of robotics and adaptive systems								

CO5	Assess the scientific background through various real time examples
<b>Textbooks</b>	
➤	Elaine rich and Kelvin Knight, “Artificial Intelligence “, Tata McGraw hill Publication, 3rdEdition, 2009. [Unit -I,II,III] UnitI : Chapters 1, 2, 3 Unit II : Chapters 4, 5 Unit III : Chapters 6, 11
➤	Artificial Intelligence: A Guide to Intelligent Systems, 3rd edition, Michael Negnevitsky, Addison Wesley, 2011.[Unit IV-Chapter 1,2,4,V-Chapter6]
➤	Artificial Intelligence a modern Approach “– Stuart Russell & Peter Norvig, 3 <sup>rd</sup> Edition Pearson Education[Unit V-Chapter25-Robotics]
<b>Reference Books</b>	
1.	“Artificial Intelligence a modern Approach “– Stuart Russell & Peter Norvig, 3 <sup>rd</sup> Edition, Pearson Education
2.	“Artificial Intelligence “, George F Luger , 4thEdition , Pearsons Education Publ,2002.
3.	“Foundations of Artificial Intelligent And Expert Systems”, V S Janaki Raman, KSarukesi, P Gopalakrishnan, Macmillan IndiaLimited
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
<b>Web Resources</b>	
1	<a href="https://www.techopedia.com/definition/190/artificial-intelligence-ai">https://www.techopedia.com/definition/190/artificial-intelligence-ai</a>
2	<a href="https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligent_systems.htm">https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligent_systems.htm</a>
3	<a href="https://data-flair.training/blogs/heuristic-search-ai/">https://data-flair.training/blogs/heuristic-search-ai/</a>
4	<a href="http://teaching.csse.uwa.edu.au/units/CITS7212/Lectures/Students/Fuzzy.pdf">http://teaching.csse.uwa.edu.au/units/CITS7212/Lectures/Students/Fuzzy.pdf</a>
5	<a href="http://engineering.nyu.edu/mechatronics/smart/pdf/Intro2Robotics.pdf">http://engineering.nyu.edu/mechatronics/smart/pdf/Intro2Robotics.pdf</a>

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>Weightage ofcoursecontributedto eachPSO</b>	<b>15</b>	<b>12</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>

**THIRD YEAR – SEMESTER – VI**

**CORE XV – COMPUTER VISION**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
23UAICC63	6	0	0	VI	4	5	25	75	100
<b>Learning Objectives</b>									
<b>LO1</b>	describe the concepts of image processing in computer vision.								
<b>LO2</b>	understand the model for application of image analysis to computer vision.								
<b>LO3</b>	apply knowledge in developing applications using computer vision techniques.								
<b>Unit</b>	<b>Contents</b>								<b>No. of Hours</b>
I	<b>Image Formation Models</b> Monocular imaging system - Orthographic and perspective projection - Camera model and camera calibration - Binocular imaging systems – Perspective - Epipolar geometry - Homography estimation – DLT – RANSAC - 3-D reconstruction framework - Auto-calibration.								<b>18</b>
II	<b>Feature Extraction</b> Image representations (continuous and discrete) - Edge detection - Corner detection - Circle and ellipse detection – Textures - Binary shape analysis - Boundary pattern analysis - Shape from texture, color, motion and edges - Light at surfaces - Phong model - Reflectance map - Albedo estimation - Photometric stereo - Use of surface smoothness constraint.								<b>18</b>
III	<b>Shape Representation and Segmentation</b> Deformable curves and surfaces - Fourier and wavelet descriptors - Multi-resolution analysis - Region growing - Snakes and active contours - Level set representations - Edge based approaches to segmentation - Mean-shift – MRFs - Graph-cut - Texture segmentation.								<b>18</b>
IV	<b>Motion Detection and Estimation</b> Regularization theory - Optical computation - Stereo vision - Motion estimation - Background subtraction and modelling - Optical flow – KLT - Spatio-Temporal analysis - Dynamic stereo - Motion parameter estimation - Structure from motion - Motion tracking in video.								<b>18</b>
V	<b>Applications of Computer Vision</b> Automated visual inspection - Inspection of cereal grains – Surveillance - Vehicle vision systems – CBIR – CBVR - Activity recognition - Computational photography – Biometrics - Stitching and document processing.								<b>18</b>
<b>TOTAL</b>								<b>90</b>	

<b>CO</b>	<b>Course Outcomes</b>
CO1	define image formation models and light effects in computer vision.
CO2	identify the feature extraction methodology suitable for computer vision applications.
CO3	apply the segmentation approaches in image analysis.
CO4	analyze the motion detection and estimation techniques.
CO5	explain the computer vision techniques used for real time applications.
<b>Textbooks</b>	
➤	David A. Forsyth and Jean Ponce, “Computer Vision - A modern approach”, 2 <sup>nd</sup> Edition, Pearson, 2011. ISBN-13: 978-0136085928
➤	Richard Szeliski, “Computer Vision: Algorithms and Applications”, 1 <sup>st</sup> Edition, Springer-Verlag London Limited, 2011. ISBN-13: 978-1818829343
<b>Reference Books</b>	
1.	Linda G. Shapiro, George C. Stockman, “Computer Vision”, 1 <sup>st</sup> Edition, Pearson, 2001. ISBN-13: 978-0130307965
2.	Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing, 4 <sup>th</sup> Edition, Pearson, 2017. ISBN-13: 978-0133356724
3	Dana H. Ballard, Christopher M. Brown, “Computer Vision”, 1 <sup>st</sup> Edition, Prentice Hall, 1982. ISBN-13: 978-0131653160
4	B. K. P. Horn, “Robot Vision”, 1 <sup>st</sup> Edition, McGraw-Hill, 1986. ISBN-10: 007-0303495
5	Emanuele Trucco, Alessandro Verri, “Introductory Techniques for 3-D Computer Vision”, Prentice Hall, 1998. ISBN-13: 978-0132611084
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
<b>Web Resources</b>	
1	<a href="https://www.javatpoint.com/computer-vision">https://www.javatpoint.com/computer-vision</a>
2	<a href="https://towardsdatascience.com/computer-vision-for-beginners-part-1-7cca775f58ef">https://towardsdatascience.com/computer-vision-for-beginners-part-1-7cca775f58ef</a>

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>12</b>	<b>11</b>	<b>11</b>	<b>12</b>	<b>12</b>

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23UAICE64-1	Robotics and Its Applications	Specific Elective	Y	-	-	-	3	5	25	75	100
<b>Course Objective</b>											
C1	To understand the robotics fundamentals										
C2	Understand the sensors and matrix methods										
C3	Understand the Localization: Self-localizations and mapping										
C4	To study about the concept of Path Planning, Vision system										
C5	To learn about the concept of robot artificial intelligence										
UNIT	Details						No. of Hours	Course Objective			
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.						6	CO1			
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 Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot						6	CO2			
III	Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.						6	CO3			
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-visual inspection-software considerations						6	CO4			
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-continuous arc welding-spot welding-spray painting-assembly operation-cleaning-etc.						6	CO5			
<b>Total</b>											

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
1	Describe the different physical forms of robot architectures.	PO1
2	Kinematically model simple manipulator and mobile robots.	PO1, PO2
3	Mathematically describe a kinematic robot system	PO4, PO6
4	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	PO4, PO5, PO6
5	Program robotics algorithms related to kinematics, control, optimization, and uncertainty.	PO3, PO8
<b>Text Book</b>		
1	Richard 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, 2nd edition 2011	
<b>Reference Books</b>		
1.	Industrial robotic technology-programming and application by M.P. Groover et.al, McGrawhill 2008	
2.	Robotics technology and flexible automation by S.R. Deb, THH-2009	
<b>Web Resources</b>		
1.	<a href="https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm">https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm</a>	
2.	<a href="https://www.geeksforgeeks.org/robotics-introduction/">https://www.geeksforgeeks.org/robotics-introduction/</a>	

**Mapping with Programme Outcomes:**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

**S-Strong      M-Medium      L-Low**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23UAICE64-2	Big Data Analytics	Core	Y	-	-	-	3	5	25	75	100
<b>Course Objective</b>											
C1	Understand the Big Data Platform and its Use cases, Map Reduce Jobs										
C2	To identify and understand the basics of cluster and decision tree										
C3	To study about the Association Rules, Recommendation System										
C4	To learn about the concept of stream										
C5	Understand the concepts of NoSQL Databases										
UNIT	Details							No. of Hours	Course Objective		
I	Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value -Understanding Big Data Storage — A General Overview of High-Performance Architecture — HDFS — MapReduce and YARN — Map Reduce Programming Model							15	C1		
II	Advanced Analytical Theory and Methods: Overview of Clustering — K-means — Use Cases — Overview of the Method — Determining the Number of Clusters — Diagnostics — Reasons to Choose and Cautions .- Classification: Decision Trees — Overview of a Decision Tree — The General Algorithm — Decision Tree Algorithms — Evaluating a Decision Tree — Decision Trees in R — Naïve Bayes — Bayes? Theorem — Naïve Bayes Classifier.							15	C2		
III	Advanced Analytical Theory and Methods: Association Rules — Overview — Apriori Algorithm —							15	C3		

	Evaluation of Candidate Rules — Applications of Association Rules — Finding Association & finding similarity — Recommendation System: Collaborative Recommendation- Content Based Recommendation — Knowledge Based Recommendation- Hybrid Recommendation Approaches.		
IV	Introduction to Streams Concepts — Stream Data Model and Architecture — Stream Computing, Sampling Data in a Stream — Filtering Streams — Counting Distinct Elements in a Stream — Estimating moments — Counting oneness in a Window — Decaying Window — Real time Analytics Platform(RTAP) applications — Case Studies — Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics	15	C4
V	NoSQL Databases : Schema-less Models?: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores — Tabular Stores — Object Data Stores — Graph Databases Hive — Sharding —Hbase — Analyzing big data with twitter — Big data for E-Commerce Big data for blogs — Review of Basic Data Analytic Methods using R.	15	C5
<b>Total</b>		<b>75</b>	
<b>Course Outcomes</b>		<b>Programme Outcomes</b>	
CO	On completion of this course, students will		
1	Work with big data tools and its analysis techniques.	PO1	
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2	
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6	
4	Perform analytics on data streams.	PO4, PO5, PO6	

5	Learn NoSQL databases and management.	PO3, PO8
<b>Text Book</b>		
1	AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.	
<b>Reference Books</b>		
1.	David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph”, Morgan Kaufmann/Elsevier Publishers, 2013	
2.	EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley publishers, 2015.	
<b>Web Resources</b>		
1.	<a href="https://www.simplilearn.com">https://www.simplilearn.com</a>	
2.	<a href="https://www.sas.com/en_us/insights/analytics/big-data-analytics.html">https://www.sas.com/en_us/insights/analytics/big-data-analytics.html</a>	

**Mapping with Programme Outcomes:**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
<b>CO 1</b>	S							
<b>CO 2</b>	M	S						
<b>CO 3</b>				S		S		
<b>CO 4</b>				S	S	M		
<b>CO 5</b>			S					S

**S-Strong    M-Medium    L-Low**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
<b>23UAICE65-1</b>	<b>Introduction to Data Science</b>	Elective	-	Y	-	-	3	5	25	75	100
<b>Course Objective</b>											
C1	To learn about basics of Data Science and Big data.										
C2	To learn about overview and building process of Data Science.										
C3	To learn about various Algorithms in Data Science.										
C4	To learn about Hadoop Framework.										
C5	To learn about case study about Data Science.										
UNIT	Details										No. of Hours
I	<b>Introduction:</b> Benefits and uses – Facts of data – Data science process – Big data ecosystem and data science										15
II	<b>The Data science process:</b> Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building .										15
III	<b>Algorithms :</b> Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised										15
IV	<b>Introduction to Hadoop :</b> Hadoop framework – Spark – replacing MapReduce– NoSQL – ACID – CAP – BASE – types										15
V	<b>Case Study:</b> Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation										12
<b>Total</b>										<b>75</b>	
Course Outcomes							Programme Outcome				
CO	On completion of this course, students will										
1	Understand the basics in Data Science and Big data.										PO1
2	Understand overview and building process in Data Science.										PO1, PO2
3	Understand various Algorithms in Data Science.										PO4, PO6
4	Understand Hadoop Framework in Data Science.										PO4, PO5, PO6
5	Case study in Data Science.										PO3, PO8
<b>Text Book</b>											
1	Davy Cielen, Arno D. B. Meysman, Mohamed Ali, “Introducing Data Science”, manning publications 2016										

<b>Reference Books</b>	
1.	Roger Peng, “The Art of Data Science”, lulu.com 2016.
2.	MurtazaHaider, “Getting Started with Data Science – Making Sense of Data with Analytics”, IBM press, E-book.
3.	Davy Cielen, Arno D.B. Meysman, Mohamed Ali, “Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools”, Dreamtech Press 2016.
4.	Annalyn Ng, Kenneth Soo, “Numsense! Data Science for the Layman: No Math Added”, 2017, 1st Edition.
5.	Cathy O’Neil, Rachel Schutt, “Doing Data Science Straight Talk from the Frontline”, O’Reilly Media 2013.
6.	Lillian Pierson, “Data Science for Dummies”, 2017 II Edition
<b>Web Resources</b>	
1.	<a href="https://www.w3schools.com/datascience/">https://www.w3schools.com/datascience/</a>
2.	<a href="https://en.wikipedia.org/wiki/Data_science">https://en.wikipedia.org/wiki/Data_science</a>
3.	<a href="http://www.cmap.polytechnique.fr/~lepennec/en/post/references/refs/">http://www.cmap.polytechnique.fr/~lepennec/en/post/references/refs/</a>

**Mapping with Programme Outcomes:**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>
<b>CO 1</b>	<b>S</b>							
<b>CO 2</b>	<b>S</b>	<b>S</b>						
<b>CO 3</b>				<b>S</b>		<b>S</b>		
<b>CO 4</b>				<b>S</b>	<b>S</b>	<b>S</b>		
<b>CO 5</b>			<b>S</b>					<b>S</b>

**S-Strong    M-Medium    L-Low**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
<b>23UAIC65-2</b>	<b>Agile Project Management</b>	Elective	-	Y	-	-	3	5	25	75	100
<b>Course Objective</b>											
C1	Learning of software design, software technologies and APIs.										
C2	Detailed demonstration about Agile development and testing techniques.										
C3	Learning about Agile Planning and Execution.										
C4	ing of Agile Management Design and Quality Check.										
C5	Detailed examination of Agile development and testing techniques.										
UNIT	Details										No. of Hours
I	<p><b>Introduction:Modernizing Project Management:</b> Project Management Needed a Makeover – Introducing Agile Project Management.</p> <p><b>Applying the Agile Manifesto and Principles:</b> Understanding the Agile manifesto – Outlining the four values of the Agile manifesto – Defining the 15 Agile Principles – Adding the Platinum Principles – Changes as a result of Agile Values – The Agile litmus test.</p> <p><b>Why Being Agile Works Better:</b> Evaluating Agile benefits – How Agile approaches beat historical approaches – Why people like being Agile.</p>										15
II	<p><b>Being Agile</b></p> <p><b>Agile Approaches:</b> Diving under the umbrella of Agile approaches – Reviewing the Big Three: Lean, Scrum, Extreme Programming - Summary</p> <p><b>Agile Environments in Action:</b> Creating the physical environment – Low-tech communicating – High-tech communicating – Choosing tools.</p> <p><b>Agile Behaviours in Action:</b> Establishing Agile roles – Establishing new values – Changing team philosophy.</p>										15
III	<p><b>Agile Planning and Execution</b></p> <p><b>Defining the Product Vision and Roadmap:</b> Agile planning – Defining the product vision – Creating a product roadmap – Completing the product backlog.</p> <p><b>Planning Releases and Sprints:</b> Refining requirements and estimates – Release planning – Sprint planning.</p>										15

	<p><b>Working Throughout the Day:</b> Planning your day – Tracking progress – Agile roles in the sprint – Creating shippable functionality – The end of the day.</p> <p><b>Showcasing Work, Inspecting and Adapting:</b> The sprint review – The sprint retrospective.</p> <p><b>Preparing for Release:</b> Preparing the product for deployment (the release sprint) – Preparing the operational support – Preparing the organization for product deployment - Preparing the marketplace for product deployment</p>	
IV	<p><b>Agile Management</b></p> <p><b>Managing Scope and Procurement:</b> What’s different about Agile scope management – Managing Agile scope – What’s different about Agile procurement – Managing Agile procurement.</p> <p><b>Managing Time and Cost:</b> What’s different about Agile time management – Managing Agile schedules – What’s different about Agile cost management – Managing Agile budgets.</p> <p><b>Managing Team Dynamics and Communication:</b> What’s different about Agile team dynamics – Managing Agile team dynamics – What’s different about Agile communication – Managing Agile communication.</p> <p><b>Managing Quality and Risk:</b> What’s different about Agile quality – Managing Agile quality – What’s different about Agile risk management – Managing Agile risk.</p>	15
V	<p><b>Implementing Agile</b></p> <p><b>Building a Foundation:</b> Organizational and individual commitment – Choosing the right pilot team members – Creating and environment that enables Agility – Support Agility initially and over time.</p> <p><b>Being a Change Agent:</b> Becoming Agile requires change – why change doesn’t happen on its own – Platinum Edge’s Change Roadmap – Avoiding pitfalls – Signs your changes are slipping.</p> <p><b>Benefits, Factors for Success and Metrics:</b> Ten key benefits of Agile project management – Ten key factors for project success – Ten metrics for Agile Organizations.</p>	15
	<b>Total</b>	<b>75</b>
	<b>Course Outcomes</b>	<b>Programme Outcome</b>
CO	On completion of this course, students will	
1	Understanding of software design, software technologies and APIs using Agile Management.	PO1
2	Understanding of Agile development and testing techniques.	PO1, PO2
3	Understanding about Agile Planning and Execution using Sprint.	PO4, PO6
4	Understanding of Agile Management Design, scope , Procurement, managing Time and Cost and Quality Check.	PO4, PO5, PO6
5	Analysing of Agile development and testing techniques.	PO3, PO8

<b>Text Book</b>	
1	Mark C. Layton, Steven J. Ostermiller, <i>Agile Project Management for Dummies</i> , 2nd Edition, Wiley India Pvt. Ltd., 2018.
	Jeff Sutherland, <i>Scrum – The Art of Doing Twice the Work in Half the Time</i> , Penguin, 2014.
<b>Reference Books</b>	
1.	Mark C. Layton, David Morrow, <i>Scrum for Dummies</i> , 2 <sup>nd</sup> Edition, Wiley India Pvt. Ltd., 2018.
2.	Mike Cohn, <i>Succeeding with Agile – Software Development using Scrum</i> , Addison-Wesley Signature Series, 2010.
3.	Alex Moore, <i>Agile Project Management</i> , 2020.
4.	Alex Moore, <i>Scrum</i> , 2020.
5.	Andrew Stellman and Jennifer Greene, <i>Learning Agile: Understanding Scrum, XP, Lean, and Kanban</i> , Shroff/O'Reilly, First Edition, 2014.
<b>Web Resources</b>	
1.	<a href="http://www.agilealliance.org/resources">www.agilealliance.org/resources</a>

**Mapping with Programme Outcomes:**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	S	S						
CO 3				S		S		
CO 4				S	S	S		
CO 5			S					S

**S-Strong      M-Medium      L-Low**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23UAICF66	<b>Simulation and Modeling</b>	Professional Competency Skill	Y	-	-	-	4	4	25	75	100
<b>Course Objectives</b>											
CO1	Generates computer simulation technologies and techniques, lays the groundwork for students to comprehend computer simulation requirements, and implements and tests a variety of simulation and data analysis libraries and programmes. This course focuses on what is required to create simulation software environments rather than just simulations using pre-existing packages										
CO2	Discuss the concepts of modelling layers of critical infrastructure networks in society.										
CO3	Create tools for viewing and controlling simulations and their results.										
CO4	Understand the concept of Entity modelling, Path planning										
CO5	To learn about the Algorithms and Modelling.										

UNIT	Details	No. of Hours	Course Objectives
I	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.	6	CO1
II	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 - Mean, Standard Deviation and Confidence Interval - Analysis of Finite-Horizon Simulations - Single Run - Independent Replications - Sequential Estimation – Analysis of Steady-State Simulations - Removal of Initialization Bias (Warm-up Interval) - Replication-Deletion Approach - Batch-Means Method .	6	CO2
III	Comparing Systems via Simulation – Introduction – Comparison Problems - Comparing Two Systems - Screening Problems - Selecting the Best - Comparison with a Standard - Comparison with a Fixed	6	CO3

	Performance Discrete Event Simulations – Introduction - Next-Event Time Advance - Arithmetic and Logical Relationships - Discrete-Event Modeling Approaches – Event-Scheduling Approach – Process Interaction Approach.		
IV	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 - Neural Networks - Finite State Machines - Logic Programming - Production Systems – Path Planning - Off-Line Path Planning - Incremental Path Planning - Real-Time Path Planning – Script Programming -Script Parsing - Script Execution.	6	CO4
V	Optimization Algorithms – Genetic Algorithms – Simulated Annealing Examples: Sensor Systems Modeling – Human Eye Modeling – Optical Sensor Modeling – Radar Modeling.	6	CO5
	<b>Total</b>	<b>30</b>	

<b>Course Outcomes</b>		
<b>Course Outcomes</b>	On completion of this course, students will;	<b>Programme Outcomes</b>
<b>CO1</b>	Introduction To Modeling & Simulation, Input Data Analysis and Modeling.	PO1
<b>CO2</b>	Random Variate and Number Generation. Analysis of Simulations and methods.	PO1, PO2
<b>CO3</b>	Comparing Systems via Simulation	PO4, PO6
<b>CO4</b>	Entity Body Modeling, Visualization, Animation.	PO4, PO5, PO6
<b>CO5</b>	Algorithms and Sensor Modeling.	PO3, PO8
<b>Text Books</b>		
1.	Jerry Banks, “Handbook of Simulation: Principles, Methodology, Advances, Applications, and Practice”, John Wiley & Sons, Inc., 1998.	
2.	George S. Fishman, “Discrete-Event Simulation: Modeling, Programming and Analysis”, Springer-Verlag New York, Inc., 2001.	
<b>References Books</b>		
1.	Andrew F. Seila, Vlatko Ceric, PanduTadikamalla, “Applied Simulation Modeling”, Thomson Learning Inc., 2003.	
<b>Web Resources</b>		
1.	<a href="https://www.tutorialspoint.com/modelling_and_simulation/index.htm">https://www.tutorialspoint.com/modelling_and_simulation/index.htm</a>	
2.	<a href="https://www.javatpoint.com/verilog-simulation-basics">https://www.javatpoint.com/verilog-simulation-basics</a>	

**Mapping with Programme Outcomes:**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>
<b>CO 1</b>	S							
<b>CO 2</b>	M	S						
<b>CO 3</b>				S		S		
<b>CO 4</b>				S	S	M		
<b>CO 5</b>			S					S

**S-Strong(3) M-Medium (2) L-Low (1)**

**THIRD YEAR – SEMESTER – VI**

**EXTENSION ACTIVITY**

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
23UAICX67	-	-	-	-	1	-	100	-	100

**(Refer to the Regulations)**