ANNAMALAI UNIVERSITY

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	CIA	ESE	Total
		SEMESTER – I					
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		Core – I : Programming for Problem Solving	5	5	25	75	100
23UAICP14	III	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
		Total	**23**	**30**			**700**
		SEMESTER – II					
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		Core –III:Python Programming	5	5	25	75	100
23UAICP24	III	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
		Total	**25**	**30**			**800**

Course Code	Part	Study Components & Course Title	Credit	Hours/Week	Maximum Marks		
					CIA	ESE	Total
		SEMESTER – III					
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	-	-	-
		Total	**22**	**30**			**700**
		SEMESTER – IV					
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		Core – VII: R Programming	5	5	25	75	100
23UAICP44	III	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
		Total	**25**	**30**			**800**

Course Code	Part	Study Components & Course Title	Credit	Hours/Week	CIA	ESE	Total
		SEMESTER – V					
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[++]	2	-	25	75	100
		Total	**26**	**30**			**800**
		SEMESTER – VI					
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
		Total	**21**	**30**			**700**
		Grand Total	**142**				**4500**
		NME courses offered to other Department					
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 12th Standardand 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 10th& 12th Standardand 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.

[++]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

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

Semester-II

Part	List of Courses	Credit	No. of Hours
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
		23	**30**

Second Year – Semester-III

Part	List of Courses	Credit	No. of Hours
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
		22	**30**

Semester-IV

Part	List of Courses	Credit	No. of Hours
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
		25	**30**

Third Year

Semester-V

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

Semester-VI

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

Consolidated Semester wise and Component wise Credit distribution

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

*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

Part	Course Details	No. of Courses	Credit per course	Total Credits
Part I	Tamil	4	3	12
Part II	English	4	3	12
Part III	Core Courses	15	4/5	68
	Elective Courses: Generic / Discipline Specific (3 or 2+1 Credits)	8	3	24
Part I, II and III Credits				116
Part IV	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
Part IV Credits				**23**
Part V	Extension Activity (NSS / NCC / Physical Education)	1	1	1
Total Credits for the UG Programme				**140**

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

Programme Outcomes:	Onsuccessfulcompletionoftheprogrammethe studentswillbeableto **PO1: Disciplinary Knowledge:** Possess comprehensive knowledge and understanding of one or more disciplines that are part of a program of study, and apply it effectively. **PO2: Critical Thinking:** 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. **PO3: Problem Solving:** Utilize competencies to solve non-familiar problems and apply learning to real-life situations instead of simply replicating curriculum content knowledge. **PO4: Analytical & Scientific Reasoning:** 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. **PO5: Research related skills:** 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. **PO6: Self-directed & Lifelong Learning**: 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.
Programme Specific Outcomes:	On successful completion of Bachelor of Science in Computer Science with Cognitive Systems programme, the student should be able to: **PSO1: Disciplinary Knowledge:**Develop fundamental knowledge in computing technology and the importance of programming with its different programming paradigms. **PSO2: Critical Thinking**: 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 **PSO3: Problem Solving:**Solve problems computationally by applying different mathematical and algorithmic methods and wide range of emerging and newly-adopted technologies to facilitate knowledge discovery **PSO4: Analytical & Scientific Reasoning**: Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models

	PSO5: Research related skills: Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects PSO6: Self-directed & Lifelong Learning: 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 holisticallyenhance their Personality throughout their life.

PO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1	✓					
PO2		✓				
PO3			✓			
PO4				✓		
PO5					✓	
PO6						✓

FIRST YEAR – SEMESTER – I

SEMESTER: I PART: III CORE: I	23UAICC13 : PROGRAMMING FOR PROBLEM SOLVING	CREDIT: 5 HOURS: 5/W

Learning Objectives	
LO1	recognize the need for programming languages and problem solving techniques
LO2	apply memory management concepts and function based modularization
LO3	Recognize the bugs in the C program
LO4	Develop simple C programs to illustrate the applications of different data types such as arrays, pointers, functions.
LO5	develop programming skills to solve real time computational problems

Unit	Contents	No. of Hours
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.	15
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.	15
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.	15
IV	Functions:Functions, Overview, Defining a function, Accessing a function, Function prototypes, Passing arguments to a function, Passing arrays to functions, Recursion.	15
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.	15
TOTAL		**75**

CO	Course Outcomes
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 toformulate algorithms and programs using arrays, pointers and structures
CO5	The Student will be able tocreate a new application software to solve real world problems.

Textbooks	
1.	Byron Gottfried, "Schaum's Outline of Programming with C", 3rd edition, 2016, McGraw Hill Education (India), ISBN: 9780070145900
2.	Balagurusamy, E "Programming in ANSI C", 7th edition, McGraw Higher Ed, 2016, ISBN: 9789339219666

Reference Books	
1.	YashavantKanetkar, "Let Us C", 15th edition, 2016, Bpb Publications, ISBN:9788183331630
2.	Herbert Schildit, "The Complete Reference C", 4th edition, 2017, McGraw Hill Education(India), 2017, ISBN:978007041183
3.	Beulah ChristalinLatha, Anuja Beatrice, Carolin Jeeva & Anita Sofia, Fundamentals of Computing and Programming, 1st edition, Pearson, 2018
4.	Sumitabha Das, "Computer Fundamentals and C Programming", 18th edition, 2018, McGraw Hill Education (India), ISBN:9789387886070
5.	Stephen G. Kochan, "Programming in C", 4th edition, 2015, ISBN: 9789332554665,

MAPPING TABLE						
CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	2	2	2	3
CO2	3	3	2	2	2	3
CO3	3	3	2	2	2	3
CO4	3	3	2	2	2	3
CO5	3	3	2	2	2	3
Weightageofcoursecontributedtoeach PSO	15	15	10	10	10	15

SEMESTER: I PART: III PRACITCAL: I	23UAICP14: PROBLEM SOLVING USING C LAB	CREDIT: 5 HOURS: 5/W

Learning Objectives	
LO1	understand the need for programming to solve computational problems.
LO2	discover the basic programming constructs to prepare the program.
LO3	Analyze and interpret data using array, functions and pointers
LO4	Recognize the bugs in the C program.
LO5	Apply problem-solving skills to real-world scenarios

List of Exercises

1. Implementation of Basic C programs
2. Simple computational problems using arithmetic expressions and operators
3. Problem solving using branching and logical expressions
4. Iterative problems using Loops, while and for loops
5. Implementation of linear searching, bubble sort, and Matrix Manipulation using Arrays
6. Implementation of Text Processing using Strings
7. Find Square Root, numerical differentiation, numerical integration using functions and recursion.
8. Implementation of basic file operations

Software Essentials: Code Block

TOTAL	75

CO	Course Outcomes
CO1	translate given algorithms to a working and correct program
CO2	identify and correct logical errors encountered at run time
CO3	create iterative as well as recursive programs.
CO4	represent data in arrays, strings and structures and manipulate them through a program.
CO5	declare pointers of different types and use them in defining self-referential structures.

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

SEMESTER: I PART: III ELECTIVE – I	23UAICE15:DISCRETE MATHEMATICS – I	CREDIT: 3 HOURS: 4/W

Unit-1:RECURRENCERELATIONSANDGENERATINGFUNCTIONS Hours:19.

Recurrence – PolynomialsandtheirEvaluations – RecurrenceRelations-SolutionofFiniteOrderHomogeneous[linear] Relations-Solutions of Non-homogeneousRelations.

Unit-2: MATHEMATICAL LOGIC   Hours: 18.

TFStatements -Connectives – Atomicand CompoundStatements – Well – formed[Statement Formulae] - Parsing - Truth Table of a Formula - Tautology – TautologicalImplicationsand EquivalenceofFormulae.

Unit-3: MATHEMATICAL LOGIC   Hours:18.

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

Unit-4: LATTICES   Hours:18.

Lattices [omit example 15 Pp No.10.6) - Some properties of Lattices - New Lattices (omitremarkPp10.14)-Modular andDistributiveLattices(omit theorem10 and17,Example4 -Pp 10.23,Example11 -Pp 10.24)

Unit-5: BOOLE ANALGEBRA   Hours:18.

Boolean Algebra – BooleanPolynomials –KarnaughMaps

Textbook:

1.P.DuraipandianandS.Udayabaskaran,(1997)AlliedMathematics,Vol.I&II.Mu hilPublishers,Chennai.

Reference Books:

1. P.Balasubramanian and K.G.Subramanian, (1997) *AncillaryMathematics.* Vol.I&II. TataMcGrawHill, NewDelhi.
2. S.P.Rajagopalan and R.Sattanathan, (2005) *Allied Mathematics.* Vol.I&II. Vikas Publications, NewDelhi.
3. P.R.Vittal (2003) *Allied Mathematics.* Marghan Publications, Chennai
4. P.Kandasamy, K.Thilagavathy (2003) Allied Mathematics Vol-I,IIS. Chand&company Ltd., NewDelhi-55.
5. Isaac, Allied Mathematics. New Gamma Publishing House, Palayamkottai.

CourseMaterial:website links, e-Books and e-journals

SEMESTER: I PART: III NME – I	23UAIEN16: FUNDAMENDALS OF INFORMATION TECHNOLOGY	CREDIT: 2 HOURS: 2/W

Learning Objectives	
LO1	Understand basic concepts and terminology of information technology.
LO2	Have a basic understanding of personal computers and their operation
LO3	Be able to identify data storage and its usage
LO4	Get great knowledge of software and its functionalities
LO5	Understand about operating system and their uses

UNIT	Contents	No. Of. Hours
I	**Introduction to Computers:** 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	6
II	**Basic Computer Organization:** 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.	6
III	**Storage Fundamentals:** 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	6
IV	**Software:** 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	6
V	**Operating System:** Functions, Measuring System Performance, Assemblers, Compilers and Interpreters.Batch Processing, Multiprogramming, Multi Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.	6
	TOTAL HOURS	30

Course Outcomes		Programme Outcomes
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

	Textbooks
1	Anoop Mathew, S. Kavitha Murugeshan (2009), " Fundamental of Information Technology", Majestic Books.
2	Alexis Leon, Mathews Leon," Fundamental of Information Technology", 2nd Edition.
3	S. K Bansal, "Fundamental of Information Technology".

	Reference Books
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

	Web Resources
1.	https://testbook.com/learn/computer-fundamentals
2.	https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html
3.	https://www.javatpoint.com/computer-fundamentals-tutorial
4.	https://www.tutorialspoint.com/computer_fundamentals/index.htm
5.	https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf

Mapping with Programme Outcomes:

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

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

SEMESTER: I PART: III FOUNDATION COURSE – I	23UAIFC17: OFFICE AUTOMATION	CREDIT: 2 HOURS: 2/W

Course Objective	
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.

UNIT	Details	No. of Hours
I	**Introductory concepts:** Memory unit– CPU-Input Devices: Key board, Mouse andScanner.Outputdevices:Monitor,Printer.IntroductiontoOperatingsystems& itsfeatures:DOS– UNIX–Windows. IntroductiontoProgrammingLanguages.	6
II	**Word Processing:** Open, Save and close word document; Editing text – tools, formatting, bullets;SpellChecker - Document formatting – Paragraph alignment, indentation, headers and footers,numbering;printingPreview,options,merge.	6
III	**Spreadsheets:**Excel– opening,enteringtextanddata,formatting,navigating;Formulas– entering,handlingand copying;Charts–creating,formatting and printing,analysistables,preparationoffinancialstatements,introductiontodataan alytics.	6
IV	**Database Concepts:** The concept of data base management system; Data field, records, and files,Sorting and indexing data; Searching records. Designing queries, and reports; Linking of datafiles; Understanding Programming environment in DBMS; Developing menu drive applicationsinquerylanguage(MS–Access).	6
V	**Power point:** Introduction to Power point - Features – Understanding slide typecasting &viewingslides – creating slide shows. Applying special object – including objects & pictures – Slidetransition– Animationeffects,audioinclusion,timers.	6
	Total	30

Course Outcomes		Programme Outcomes
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

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

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

SEMESTER: II PART: III CORE: III	23UAICC23 : PYTHON PROGRAMMING	CREDIT: 5 HOURS: 5/W

Learning Objectives	
LO1	understand the most important libraries of Python, and its recommended programming styles and idioms.
LO2	learn core Python scripting elements such as variables and flow control structures.
LO3	develop applications using Python.

Unit	Contents	No. of Hours
I	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 Typesand Character Sets - Integers and Long Integers, Floating-Point Numbers and Character Sets - Expressions - Arithmetic Expressions and Mixed-Mode Arithmetic and Type Conversions.	15
II	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.	15
III	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.	15
IV	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.	15
V	**Design with Functions and Design with Classes** 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.	15
	TOTAL	75

CO	Course Outcomes
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
Textbooks	
➢	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.
Reference Books	
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.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	http://docs.python.org/3/tutorial/index.html
2.	http://interactivepython.org/courselib/static/pythonds

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

SEMESTER: II PART: III PRACTICAL : II	23UAICP24: PYTHON PROGRAMMING LAB	CREDIT: 5 HOURS: 5/W

Learning Objectives	
LO1	understand the basics of python programming concepts.
LO2	understand the high-performance programs designed to build up the real proficiency

List of Exercises

1. Control Statements
2. Operators
3. Lists and List comprehensions
4. Set
5. Dictionary
6. Function
7. String
8. File
9. Polymorphism
10. Inheritance

Software Essentials: Pycharm

TOTAL	75

CO	Course Outcomes
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

MAPPING TABLE

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	2
CO2	3	3	2	3	3	2
CO3	3	3	3	3	3	2
CO4	3	3	2	3	3	2
CO5	3	3	2	3	3	2
Weightage ofcoursecontributedtoeachPSO	15	14	11	15	15	10

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-T**he 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: Latex 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.

SEMESTER: II PART: III NME – II	23UAIEN26: INTRODUCTION To HTML	CREDIT: 2 HOURS: 2/W

Learning Objectives	
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.

UNIT	Contents	No. Of. Hours
I	Introduction :WebBasics: WhatisInternet–Webbrowsers–WhatisWebpage – HTMLBasics:Understandingtags.	6
II	TagsforDocumentstructure(HTML,Head,BodyTag).Blockleveltextelements:Headingsparagraph(<p> tag)– Fontstyleelements:(bold,italic,font,small,strong,strike,bigtags)	6
III	Lists:Typesoflists:Ordered,Unordered– NestingLists–Othertags:Marquee,HR,BR-UsingImages –CreatingHyperlinks.	6
IV	Tables:CreatingbasicTable,Tableelements,Caption–Tableandcellalignment–Rowspan,Colspan–Cellpadding.	6
V	Frames:Frameset–TargetedLinks–Noframe–Forms:Input, Textarea,Select,Option.	6
	TOTAL HOURS	30

Course Outcomes		Programme Outcomes
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

	Textbooks
1	"Mastering HTML5 and CSS3 Made Easy", TeachUComp Inc., 2014.
2	Thomas Michaud, "Foundations of Web Design: Introduction to HTML & CSS"

	Web Resources
1.	https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf
2.	https://www.w3schools.com/html/default.asp

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	2	3	3	3
CO 3	2	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	2	3	3
Weightage of course contributed to each PSO	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

Learning Objectives	
LO1	understand the basic concepts of Java
LO2	develop high quality, internally documented, well-structured object oriented program.
LO3	adapt object oriented principles such as abstraction and information hiding in software development.

Unit	Contents	No. of Hours
I	**Programming Basic, Decision Making and Functions Using JAVA** 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.	9
II	**Introduction to Java Programming, Classes and Objects** 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.	9
III	**Exception Handling, Multithreading and Wrapper Classes** 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.	9
IV	**Input Output Handling, File Handling, Collection and Generics** Input output basics, Reading console input, Writing console output, Reading and writing files, ArrayList, Generic class, Bounded types, Creating a generic method.	9
V	**Design Patterns, Graphical Programming and Software Development Process** 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.	9
	List of Exercises	
	1. Control Statements 2. Array 3. Class and Objects 4. Inheritance 5. Packages 6. Interface 7. Exception Handling 8. String Handling 9. File Handling 10. GUI using Swing	30

	TOTAL	75

CO	Course Outcomes
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 .
Textbooks	
➢	Herbert Schildt, "Java: The Complete Reference", 10th edition, McGraw Hill Education, 2017, ISBN-10: 1259589331.
Reference Books	
1.	Harvey M. Dietel, "Java How to Program", 7th edition, Prentice Hall, 2007. ISBN:978-0132222204.
2.	Elisabeth Freeman, "Head First Design Patterns", O′Reilly, 1st edition, 2004, ISBN-10: 0596007124.
3.	Kathy Sierra, Bert Bates, "Head First Java", 2nd edition, O'Reilly Media, 2005. ISBN: 10- 0596004656, ISBN-13:9780596004651.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	https://www.javatpoint.com/java-tutorial
2.	https://www.w3schools.com/java/
3.	https://www.tutorialspoint.com/java/index.htm

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

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

	Learning Objectives	
LO1	understand the concepts of linear data structures and algorithms.
LO2	demonstrate the different searching and sorting techniques.
LO3	relate the different non-linear data structures such as trees and graphs.

Unit	Contents	No. of Hours
I	**Abstract Data Type** Data Abstraction - Abstract Data Type (ADT) - Algorithms - Fundamentals of Algorithmic Problem-solving - Analysis of Algorithms - Asymptotic Notations - Time-Space Trade-off	9
II	**Array based Linear Data Structures** Arrays - Stack ADT - Applications of Stack: Expression evaluation and conversion - Recursion - Queue ADT - Circular Queue - Applications of Queue	9
III	**Linked List based Linear Data Structures& Sorting** 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.	9
IV	**Non-linear Data Structures, Trees** 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.	9
V	**Graphs** Mathematical background- Graph Representation and Traversals - Depth First Search, Breadth First Search	9

List of Exercises	
- Array Implementation of Stack and Queue ADTs - Application of Recursion - Linked list Implementation of List ADT. - Linked list Implementation of Stack ADT - Linked list Implementation of Queue ADT - Implementation of Doubly Linked List ADT - Implementation of Circular Linked List ADT - Applications of List, Stack and Queue ADTs. - Implementation of Sorting Algorithms - Implementation of Search Algorithms	**15**

Text Books:
1. Ellis Horowitz, SartajSahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, 2007, ISBN: 0-929306-40-6.
2. Mark Allen Weiss, "Data Structures and Problem Solving using Java", 4th Edition, Addison-Wesley, 2006.
3. AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 2011. ISBN13: 978-013231681

Reference Book:
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
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.
3. Ellis Horowitz, SartajShani, SanguthuvarRajasekaran, "Fundamentals of computer Algorithms", Second Edition, 2008. ISBN- 978-81-7371-612-6

TOTAL	60

CO	Course Outcomes
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.

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

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

SEMESTER :III ELECTIVE-III PART: III	23USMAE35: STATISTICAL METHODS AND ITS APPLICATION - I	CREDIT : 3 HOURS : 4

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 correlationand 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

	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)

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

	Learning Objectives
CLO1	To have extensive knowledge onOB and the scope of OB.
CLO2	To create awareness of Individual Benaviour.
CLO3	To enhance the understanding of Group Behaviour
CLO4	To know the basics of Organisaitonal 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:	6	CLO4

	Concept of structure, Prevalent organizational designs: New design options			
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
		30	

Course Outcomes	On Completion of the course the students will	Program Outcomes
CO1	To define OrganisationalBehaviour, Understand the opportunity through OB.	PO1, PO2, PO6, PO7
CO2	To apply self-awareness, motivation, leadership and learning theories at workplace.	PO2,PO4. PO5, PO6
CO3	To analyze the complexities and solutions of group behaviour.	PO1, PO2, PO4, PO5, PO6
CO4	To impact and bring positive change in the culture of the organisaiton.	PO2, PO3, PO4 PO5, PO8
CO5	To create a congenial climate in the organization.	PO1, PO2, PO5 PO6, PO8

Reading List

1.	NeharikaVohra Stephen P. Robbins, Timothy A. Judge , *Organizational Behaviour*, Pearson Education, 18th Edition, 2022.
2.	Fred Luthans, *Organizational Behaviour*, Tata McGraw Hill, 2017.
3.	Ray French, Charlotte Rayner, Gary Rees & Sally Rumbles, *Organizational Behaviour*, John Wiley & Sons, 2011
4.	Louis Bevoc, Allison Shearsett, Rachael Collinson, *Organizational Behaviour Reference*, Nutri Niche System LLC (28 April 2017)
5.	Dr. Christopher P. Neck, Jeffery D. Houghton and Emma L. Murray, *Organizational Behaviour: A Skill-Building Approach,* SAGE Publications, Inc; 2nd edition (29 November 2018).

References Books

1.	Uma Sekaran, Organizational Behaviour Text & cases, 2nd edition, Tata McGraw Hill Publishing CO. Ltd
2.	GangadharRao, Narayana, V.S.P Rao, Organizational Behaviour 1987, Reprint 2000, Konark Publishers Pvt. Ltd, 1st edition
3.	S.S. Khanka, Organizational Behaviour, S. Chand & Co, New Delhi.
4.	J. Jayasankar, Organizational Behaviour, Margham Publications, Chennai, 2017.

MAPPING TABLE						
CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3
CO2	3	3	3	3	3	3
CO3	3	3	3	3	3	3
CO4	3	3	3	3	3	3
CO5	3	3	3	3	3	3

Weightage ofcoursecontributedto eachPSO	15	15	15	15	15	15

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	CIA	External	Total
									Marks		
23UAICS37	**PHP PROGRAMMING**	SEC- 5	Y				2	2	25	75	100

	Course Objective
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
	Total	**30**	

	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.

Text Book

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

Reference Books

1.	PHP: The Complete Reference-Steven Holzner.
2.	DT Editorial Services (Author), "*HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)*", Paperback 2016, 2ndEdition.

Web Resources

1.	Refer MOOC Courses like NPTEL and SWAYAM
2.	https://www.w3schools.com/php/default.asp

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

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

	Learning Objectives								

LO1	Understanding and being able to use basic programming concepts
LO2	Automate data analysiss
LO3	Working collaboratively and openly on code
LO4	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
TOTAL		75

CO	Course Outcomes
CO1	Demonstrationand 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 ofappropriate statistical tests using R and Create and edit visualizations with regression models	

Textbooks

➢	R Programming for Data Science by Roger D. Peng
➢	The Art of R Programming by Prashanth singh, Vivek Mourya, Cengage Learning India.

Reference Books

1.	Tilman M. Davies, The Book of R: A First Course in Programming and Statistics, 1st edition, 2019.
2.	Andy Field, Discovering Statistics Using R, 1st edition, SAGE Publications Ltd

NOTE: Latest Edition of Textbooks May be Used

Web Resources

1.	https://www.w3schools.com/r/
2.	https://www.javatpoint.com/r-tutorial
3.	https://www.tutorialspoint.com/r/index.htm

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)

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

Learning Objectives	
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

List of Exercises

1. Write an R-Program to print Hello World
2. Write an R-Program to take input from user.
3. Write an R-Program to demonstrate working with operators (Arithmetic, Relational, Logical, Assignment operators).
4. Write an R Program to Check if a Number is Odd or Even
5. Write an R Program to check if the given Number is a Prime Number
6. Write an R Program to Find the Factorial of a Number
7. Write an R Program to Find the Factors of a Number
8. Write an R Program to Find the Fibonacci sequence Using Recursive Function
9. Write an R Program to Make a Simple Calculator
10. Write an R Program to Find L.C.M of two numbers
11. Write an R Program to create a Vector and to access elements in a Vector
12. Write an R Program to create a Matrix and access rows and columns using functions colnames() and rownames() .
13. Write an R Program to create a Matrix using cbind() and rbind() functions.
14. Write an R Program to create a Matrix from a Vector using dim() function.
15. Write an R Program to create a List and modify its components.
16. Write an R Program to create a Data Frame.
17. Write an R Program to access a Data Frame like a List.
18. Write an R Program to access a Data Frame like a Matrix.
19. Write an R Program to create a Factor.
20. Write an R Program to Access and Modify Components of a Factor.
21. Write an R Program to create an S3 Class and S3 Objects.
22. Write an R Program to write a own generic function in S3 Class.
23. Write an R Program to create an S4 Class and S4 Objects.
24. Write an R Program to write a own generic function in S4 Class.
25. Write an R Program to create Reference Class and modify its Methods.

TOTAL	**60**

CO	**Course Outcomes**
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

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
Weightageof coursecontributedtoeachPSO	13	10	10	11	10	10

SEMESTER:IV ELECTIVE: IV PART:III	23USMAE45 : STATISTICAL METHODS AND ITS APPLICATIONS -II	CREDIT:3 HOURS:3/W

COURSE OBJECTIVES

Tounderstandandcomputingstatistical Methodsbywhichtodevelop theprogrammingSkills.

UNIT I

Curvefittingbythemethodsofleastsquares-

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

UNIT II

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

Baye'sTheorem.MathematicalexpectationAdditionandMultiplicationtheorem.

UNIT III

Standarddistributions- Binomial, Poisson,Normaldistributionandfittingof thesedistributions.

UNIT IV

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

UNIT V

Analysis of variance - One and Two way classifications - Basic principle of design ofExperiments-Randomisation,ReplicationandLocalcontrol-C.R.D.,R.B.D.andL.S.D.

Text Books

1. FundamentalofMathematicalStatistics-S.C.Gupta &V.K. Kapoor–S. Chand & Co.

Supplementary Readings

1. FundamentalofAppliedStatistics -S.C.Gupta&V.K.Kapoor–S. Chand & Co.
2. StatisticalMethods- SnedecorG.W.&CochranW.G.oxford&+DII Elementsof Statistics-Mode.E.B.–PrenticeHall

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	2
CO2	1	3	2	2	3
CO3	3	3	3	2	2
CO4	3	3	2	2	2
CO5	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	CIA	External	Total
									Marks		
23UAICS46	**SoftwareTesting**	SEC-6	Y	-	-	-	2	2	25	75	100

	Course Objective
C1	To study fundamental concepts in software testing
C2	To discuss various software testing issues and solutions in software unit test, integration and system testing.
C3	To study the basic concept of Data flow testing and Domain testing.
C4	To Acquire knowledge on path products and path expressions.
C5	To learn about Logic based testing and decision tables

UNIT	Details	No. of Hours	Course Objective
I	Introduction: Purpose–Productivity and Quality in Software–TestingVsDebugging–Model for Testing–Bugs–Types of Bugs – Testing and Design Style.	6	C1
II	Flow / Graphs and Path Testing – Achievable paths – Path instrumentation Application Transaction FlowTesting Techniques.	6	C2
III	Data Flow Testing Strategies - Domain Testing:Domains and Paths – Domains and Interface Testing.	6	C3
IV	Linguistic –Metrics – Structural Metric – Path Products and Path Expressions.SyntaxTesting–Formats–Test Cases	6	C4
V	Logic Based Testing–Decision Tables–Transition Testing–States, State Graph, StateTesting.	6	C5
	Total	**30**	

	Course Outcomes	**Program Outcomes**
CO	On completion of this course, students will	
1	Students learn to apply software testing knowledge and engineering methods	PO1
2	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

Text Book	
1	B.Beizer,"SoftwareTestingTechniques",IIEdn.,DreamTechIndia,NewDelhi,2003.
2	K.V.K.Prasad,"SoftwareTestingTools",DreamTech.India,NewDelhi,2005

Reference Books	
1.	I.Burnstein,2003,"PracticalSoftwareTesting",SpringerInternationalEdn.
2.	E. Kit, 1995, "Software Testing in the Real World: Improving the Process", PearsonEducation,Delhi.
3.	R. Rajani,andP.P.Oak,2004,"SoftwareTesting",TataMcgrawHill,New Delhi.

Web Resources	
1.	https://www.javatpoint.com/software-testing-tutorial
2.	https://www.guru99.com/software-testing.html

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

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

	Course Objective
C1	Understand the definition of Multimedia
C2	To study about the Image File Formats,SoundsAudio File Formats
C3	Understand the concepts of Animation and DigitalVideoContainers
C4	To study about the Stage of Multimedia Project
C5	Understand the concept of OwnershipofContentCreatedforProjectAcquiringTalent

UNIT	Details	No. of Hours	Course Objective
I	Multimedia Definition-Use Of Multimedia- Delivering Multimedia- Text:About Fonts and Faces - Using Text in Multimedia -Computers and Text Font Editing and DesignTools- HypermediaandHypertext.	12	C1
II	Images: Plan Approach - Organize Tools - Configure Computer Workspace -Making Still Images - Color - Image File Formats. Sound: The Power of Sound - DigitalAudio-MidiAudio-Midivs.DigitalAudio- MultimediaSystemSoundsAudio File Formats - Vaughan's Law of Multimedia Minimums - Adding SoundtoMultimediaProject	12	C2
III	Animation:The Power of Motion-Principles of Animation-Animation by Computer - Making Animations that Work. Video: Using Video - Working with Video and Displays- DigitalVideoContainers-ObtainingVideo Clips - ShootingandEditingVideo	12	C3
IV	Making Multimedia: The Stage of Multimedia Project - The Intangible Needs -The Hardware Needs - The Software Needs - An Authoring Systems Needs- MultimediaProductionTeam.	12	C4
V	PlanningandCosting:TheProcessofMakingMultimedia-Scheduling-Estimating - RFPs and Bid Proposals. Designing and Producing - Content andTalent:AcquiringContent- OwnershipofContentCreatedforProject- AcquiringTalent	12	C5
	Total	**60**	

	Course Outcomes	Programme Outcomes
CO	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

Text Book		
1	TayVaughan,"Multimedia:MakingItWork",8thEdition,Osborne/McGraw-Hill,2001.	

Reference Books		
1.	RalfSteinmetz&KlaraNahrstedt"MultimediaComputing,Communication&Applications",PearsonEducation,2012.	

Web Resources		
1.	https://www.geeksforgeeks.org/multimedia-systems-with-features-or-characteristics/	

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

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

	Learning Objectives
LO1	understand the human learning aspects and primitives in learning process by computer
LO2	analyze the nature of problems solved with machine learning techniques
LO3	design and implement suitable machine learning technique for a given application

Unit	Contents	No. of Hours
I	**Introduction** 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	**Classification and Concept Learning** 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	**Linear and Probabilistic Models** 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	**Distance Based Models** 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	**Rule Based and Tree Based Models** 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
	TOTAL	75

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

	Textbooks
➢	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

	Reference Books
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.

NOTE: Latest Edition of Textbooks May be Used

	Web Resources
1.	https://www.javatpoint.com/machine-learning
2.	https://www.geeksforgeeks.org/machine-learning/
3.	https://www.tutorialspoint.com/machine_learning/index.htm
4.	https://www.w3schools.com/python/python_ml_getting_started.asp

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)

CORE – X:MACHINE LEARNINGLAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
23UAICP52	0	0	5	V	4	5	25	75	100

Learning Objectives	
LO1	Understand the basic statistical and algorithmic concepts in the field of Machine Learning
LO2	learn to handle the data
LO3	develop data analytics applications especially in the context of current research

List of Exercises

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

TOTAL	75

CO	Course Outcomes
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
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 – XI: DEEP LEARNING (THEORY & PRACTICAL)

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
23UAICC53	4	0	1	V	4	5	25	75	100

	Learning Objectives	
LO1	study the basic concepts of neural networks and deep learning	
LO2	comprehend deep learning techniques	
LO3	explore various applications for deep learning techniques	

Unit	Contents	No. of Hours
I	**Machine Learning** 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	12
II	**Deep Neural Networks** 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	12
III	**Convolutional Neural Networks** Introduction to Convolutional Neural Network - Architectures - AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization	12
IV	**Recurrent Neural Networks and Deep unsupervised Learning** Recurrent networks, LSTM, GRU - Architectures, Autoencoders and VariationalAutoencoders, Adversarial Generative Networks, DBM - Deep Reinforcement Learning	12
V	**Applications** Computer Vision- ImageNet- Detection- Face Recognition- Scene Understanding- Gathering Image Captions - Audio Wave Net - Natural Language Processing Word2Vec - Sentiment Analysis - Recent research	12

List of Exercises	
1. Basic image processing operations : Histogram equalization, thresholding, edge detection, data augmentation, morphological operations 2. Implement SVM/Softmax classifier for CIFAR-10 dataset: (i) using KNN, (ii) using 3 layer neural network 3. Study the effect of batch normalization and dropout in neural network classifier 4. Familiarization of image labelling tools for object detection, segmentation 5. Image segmentation using Mask RCNN, UNet, SegNet 6. Object detection with single-stage and two-stage detectors (Yolo, SSD, FRCNN, etc.) 7. Image Captioning with Vanilla RNNs 8. Image Captioning with LSTMs 9. Network Visualization: Saliency maps, Class Visualization 10. Generative Adversarial Networks 11. Chatbot using bi-directional LSTMs 12. Familiarization of cloud based computing like Google colab	15

	TOTAL	75
CO	**Course Outcomes**	
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	
Textbooks		
➢	Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016. ISBN: 9780262035613	
Reference Books		
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.	
NOTE: Latest Edition of Textbooks May be Used		
Web Resources		
1.	https://www.javatpoint.com/deep-learning	
2.	https://www.geeksforgeeks.org/deep-learning-tutorial/	
3.	https://www.simplilearn.com/tutorials/deep-learning-tutorial	

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)

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
23UAICE55	**Internet of Things and its applications**	Elective –V	Y	-	-	-	3	4	25	75	100

	Course Objective
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 GasIndustry, 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
	Total	**75**	

	Course Outcomes	Programme Outcomes
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

	Text Book
1	Vijay Madisetti and Arshdeep Bahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited 2014, 1st Edition.

	Reference Books
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	WaltenegusDargie, ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice" 4..CunoPfister, "Getting Started with the Internet of Things",

	O"Reilly Media 2011	
	Web Resources	
1.	https://www.simplilearn.com	
2.	https://www.javatpoint.com	
3.	https://www.w3schools.com	

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	CIA	External	Total
									Marks		
23UAICE56	**Artificial Neural Networks**	Elective -VI	-	Y	-	-	3	4	25	75	100

	Course Objective
C1	**Understand the basics of artificial neural networks, learning process, single layer and multi-layer perceptron networks.**
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
	Total	**75**

	Course Outcomes	Programme Outcome
CO	On completion of this course, students will	
1	**Students will learn the basics of artificial neural networks with single layer and multi-layer perception networks.**	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

	Text Book
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.

	Reference Books
1.	Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998.

	Web Resources
1.	https://www.w3schools.com/ai/ai_neural_networks.asp
2.	https://en.wikipedia.org/wiki/Artificial_neural_network
3.	https://link.springer.com/chapter/10.1007/978-3-642-21004-4_12

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

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

	Learning Objectives	
LO	Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics.	
Unit	Contents	No. of Hours
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
	List of Exercises	
	- Preprocessing of text (Tokenization, Filtration, Script Validation, Stop Word Removal, Stemming) - Morphological Analysis - N-gram model - POS tagging - Chunking - Named Entity Recognition - Virtual Lab on Word Generator	15
	TOTAL	75
CO	Course Outcomes	
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.

Textbooks	
➢	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.

Reference Books	
1.	Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications.

NOTE: Latest Edition of Textbooks May be Used

Web Resources	
1.	https://www.tutorialspoint.com/natural_language_processing/index.htm
2.	https://www.geeksforgeeks.org/natural-language-processing-nlp-tutorial/
3.	https://www.javatpoint.com/nlp

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	2	3	2	2
CO2	2	3	2	3	2	2
CO3	2	3	2	2	3	1
CO4	1	2	2	1	3	2
CO5	2	2	2	1	3	3
Weightageof coursecontributedto each PSO	10	12	10	10	13	10

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**
Learning Objectives									
LO1	To acquire knowledge on various intelligent system techniques and methodologies								
LO2	Learn about Knowledge representation, problem solving, and learning methods in solving engineering problems								
Unit	**Contents**							**No. of Hours**	
I	**Artificial Intelligence:** AI problems-AI technique-**Problem Search:**-Production Systems – Problem Characteristics – Production system characteristics- **Heuristic Search techniques**: Generate and Test – Hill Climbing – Constraint Satisfaction, Means-end analysis							**15**	
II	**Knowledge representation issues**: Representations and mappings – Approaches to Knowledge representations –-Frame problem –. **Using Predicate Logic**: Representing simple facts in logic-Representing Instance and ISA relationships – Computable functions and predicates – Resolution							**15**	
III	**Representing knowledge using rules**: Procedural Vs Declarative knowledge – Logic programming – Forward Vs Backward reasoning – Matching – Control knowledge. **Knowledge representation summary**: Syntactic and Semantic spectrum of representation-Logic and slot – and-filler structures-Other representational techniques							**15**	
IV	**Rule-based expert systems**: Introduction- Rules as a knowledge representation technique- players- Structure- Forward chaining and backward chaining inference techniques- **Fuzzy expert systems**: Introduction- Fuzzy sets- Linguistic variables and hedges- Operations - Fuzzy rules- - Building a fuzzy expert system							**15**	
V	**Artificial neural networks**: Neuron- perceptron- Multilayer neural networks- - The Hopfield network- **Robotics**: Introduction-Robot hardware-Perception-Moving-Robotic software architecture.							**15**	
TOTAL								**75**	
CO	**Course Outcomes**								
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

	Textbooks
➢	Elaine rich and Kelvin Knight, "Artificial Intelligence ", Tata McGraw hill Publication, 3ndEdition, 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, 3rd Edition Pearson Education[Unit V-Chapter25-Robotics]

	Reference Books
1.	"Artificial Intelligence a modern Approach "– Stuart Russell & Peter Norvig, 3rdEdition, 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

NOTE: Latest Edition of Textbooks May be Used

	Web Resources
1	https://www.techopedia.com/definition/190/artificial-intelligence-ai
2	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligent_systems.htm
3	https://data-flair.training/blogs/heuristic-search-ai/
4	http://teaching.csse.uwa.edu.au/units/CITS7212/Lectures/Students/Fuzzy.pdf
5	http://engineering.nyu.edu/mechatronics/smart/pdf/Intro2Robotics.pdf

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

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

	Learning Objectives
LO1	describe the concepts of image processing in computer vision.
LO2	understand the model for application of image analysis to computer vision.
LO3	apply knowledge in developing applications using computer vision techniques.

Unit	Contents	No. of Hours
I	**Image Formation Models** 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.	18
II	**Feature Extraction** 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.	18
III	**Shape Representation and Segmentation** 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.	18
IV	**Motion Detection and Estimation** 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.	18
V	**Applications of Computer Vision** Automated visual inspection - Inspection of cereal grains – Surveillance - Vehicle vision systems – CBIR – CBVR - Activity recognition - Computational photography – Biometrics - Stitching and document processing.	18
TOTAL		**90**

CO	Course Outcomes
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	sexplain the computer vision techniques used for real time applications.

Textbooks	
➢	David A. Forsyth and Jean Ponce, "Computer Vision - A modern approach", 2nd Edition, Pearson, 2011. ISBN-13: 978-0136085928
➢	Richard Szeliski, "Computer Vision: Algorithms and Applications", 1st Edition, Springer-Verlag London Limited, 2011. ISBN-13: 978-1818829343

Reference Books	
1.	Linda G. Shapiro, George C. Stockman, "Computer Vision", 1st Edition, Pearson, 2001. ISBN-13: 978-0130307965
2.	Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing, 4th Edition, Pearson, 2017. ISBN-13: 978-0133356724
3	Dana H. Ballard, Christopher M. Brown, "Computer Vision", 1st Edition, Prentice Hall, 1982. ISBN-13: 978-0131653160
4	B. K. P. Horn, "Robot Vision", 1st 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

NOTE: Latest Edition of Textbooks May be Used

Web Resources	
1	**https://www.javatpoint.com/computer-vision**
2	https://towardsdatascience.com/computer-vision-for-beginners-part-1-7cca775f58ef

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	CIA	External	Total
										Marks	
23UAICE64-1	**Robotics and Its Applications**	Specific Elective	Y	-	-	-	3	5	25	75	100

Course Objective	
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
	Total		

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
Text Book		
1	RicharedD.Klafter. Thomas Achmielewski and MickaelNegin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001	
2	SaeedB.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2 nd edition 2011	
Reference Books		
1.	Industrial robotic technology-programming and application by M.P.Groover et.al, McGrawhill2008	
2.	Robotics technology and flexible automation by S.R.Deb, THH-2009	
Web Resources		
1.	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm	
2.	https://www.geeksforgeeks.org/robotics-introduction/	

Mapping with Programme Outcomes:

	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

	Course Objective
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	

Total	75	

Course Outcomes		Programme Outcomes
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 |

Text Book	
1	AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

Reference Books	
1.	David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013
2.	EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.

Web Resources	
1.	https://www.simplilearn.com
2.	https://www.sas.com/en_us/insights/analytics/big-data-analytics.html

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
23UAICE65-1	**Introduction to Data Science**	Elective	-	Y	-	-	3	5	25	75	100

	Course Objective
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	**Introduction:**Benefits and uses – Facts of data – Data science process – Big data ecosystem and data science	15
II	**The Data science process**:Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building .	15
III	**Algorithms** :Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised	15
IV	**Introduction to Hadoop** :Hadoop framework – Spark – replacing MapReduce– NoSQL – ACID – CAP – BASE – types	15
V	**Case Study**: Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation	12
	Total	**75**

	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

	Text Book
1	Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science", manning publications 2016

	Reference Books	
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	
	Web Resources	
1.	https://www.w3schools.com/datascience/	
2.	https://en.wikipedia.org/wiki/Data_science	
3.	http://www.cmap.polytechnique.fr/~lepennec/en/post/references/refs/	

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
23UAIC65-2	**Agile Project Management**	Elective	-	Y	-	-	3	5	25	75	100

Course Objective	
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	**Introduction:Modernizing Project Management:** Project Management Needed a Makeover – Introducing Agile Project Management. **Applying the Agile Manifesto and Principles:** 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. **Why Being Agile Works Better:** Evaluating Agile benefits – How Agile approaches beat historical approaches – Why people like being Agile.	15
II	**Being Agile** **Agile Approaches:** Diving under the umbrella of Agile approaches – Reviewing the Big Three: Lean, Scrum, Extreme Programming - Summary **Agile Environments in Action:** Creating the physical environment – Low-tech communicating – High-tech communicating – Choosing tools. **Agile Behaviours in Action:** Establishing Agile roles – Establishing new values – Changing team philosophy.	15
III	**Agile Planning and Execution** **Defining the Product Vision and Roadmap:** Agile planning – Defining the product vision – Creating a product roadmap – Completing the product backlog. **Planning Releases and Sprints:** Refining requirements and estimates – Release planning – Sprint planning.	15

	Working Throughout the Day: Planning your day – Tracking progress – Agile roles in the sprint – Creating shippable functionality – The end of the day. **Showcasing Work, Inspecting and Adapting:** The sprint review – The sprint retrospective. **Preparing for Release:** Preparing the product for deployment (the release sprint) – Preparing the operational support – Preparing the organization for product deployment - Preparing the marketplace for product deployment		
IV	**Agile Management** **Managing Scope and Procurement:** What's different about Agile scope management – Managing Agile scope – What's different about Agile procurement – Managing Agile procurement. **Managing Time and Cost:** What's different about Agile time management – Managing Agile schedules – What's different about Agile cost management – Managing Agile budgets. **Managing Team Dynamics and Communication:** What's different about Agile team dynamics – Managing Agile team dynamics – What's different about Agile communication – Managing Agile communication. **Managing Quality and Risk:** What'sdifferent about Agile quality – Managing Agile quality – What's different about Agile risk management – Managing Agile risk.	15	
V	**Implementing Agile** **Building a Foundation:** Organizational and individual commitment – Choosing the right pilot team members – Creating and environment that enables Agility – Support Agility initially and over time. **Being a Change Agent:** Becoming Agile requires change – why change doesn't happen on its own – Platinum Edge's Change Roadmap – Avoiding pitfalls – Signs your changes are slipping. **Benefits, Factors for Success and Metrics:** Ten key benefits of Agile project management – Ten key factors for project success – Ten metrics for Agile Organizations.	15	
	Total	**75**	

	Course Outcomes	**Programme Outcome**
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

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

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	**Simulation and Modeling**	Professional Competency Skill	Y	-	-	-	4	4	25	75	100

	Course Objectives
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
	Total	**30**	

Course Outcomes		
Course Outcomes	On completion of this course, students will;	**Programme Outcomes**
CO1	Introduction To Modeling & Simulation, Input Data Analysis and Modeling.	PO1
CO2	Random Variate and Number Generation. Analysis of Simulations and methods.	PO1, PO2
CO3	Comparing Systems via Simulation	PO4, PO6
CO4	Entity Body Modeling, Visualization, Animation.	PO4, PO5, PO6
CO5	Algorithms and Sensor Modeling.	PO3, PO8
Text Books		
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.	
References Books		
1.	Andrew F. Seila, Vlatko Ceric, PanduTadikamalla, "Applied Simulation Modeling", Thomson Learning Inc., 2003.	
Web Resources		
1.	https://www.tutorialspoint.com/modelling_and_simulation/index.htm	
2.	https://www.javatpoint.com/verilog-simulation-basics	

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(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)