ALAGAPPA UNIVERSITY – AFFILIATED COLLEGES

B. Sc., ARTIFICIAL INTELLIGENCE

SYLLABI

[For the candidates admitted from the Academic Year 2023 – 2024 onwards]

ALAGAPPA UNIVERSITY
(A State University Accredited with "A+" grade by NAAC (CGPA: 3.64) in the Third Cycle and
Graded as Category-I University by MHRD-UGC)
Karaikudi -630 003, Tamil Nadu.

ALAGAPPA UNIVERSITY, KARAIKUDI
NEW SYLLABUS UNDER CBCS PATTERN (w.e.f. 2023-24) FOR AFFILIATED COLLEGES
B. Sc (Artificial Intelligence)

Sem	Part	Course Code	Courses	Title of the paper	T/P	Credits	Hours/Week	Marks I	Marks E	Marks Total
1	I	2311T	T / OL	தமிழ் இலக்கிய வரலாறு-l /Other Languages -I	T	3	6	25	75	100
	II	2312E	E	General English - I	T	3	6	25	75	100
	III	23BAI1C1	CC – I	Programming for Problem Solving	T	4	5	25	75	100
		23BAI1P1	CC – II	Problem Solving using C Lab	P	4	4	25	75	100
		-	Generic Elective (Allied)	Maths/Electronics/Computer Science/IT/BCA	T	3	3	25	75	100
				Respective Allied Theory Practical	P	2	2	25	75	100
	IV	23BAI1S1	SEC – 1	Fundamentals of Information Technology	T	2	2	25	75	100
		23BAI1FC	FC – 1	Office Automation	T	2	2	25	75	100
				Total		**23**	**30**	**200**	**600**	**800**
2	I	2321T	T / OL	தமிழ் இலக்கிய வரலாறு-2 /Other Languages-II	T	3	6	25	75	100
	II	2322E	E	General English - II	T	3	6	25	75	100
	III	23BAI2C1	CC – III	Python Programming	T	4	5	25	75	100
		23BAI2P1	CC – IV	Python Programming Lab	P	4	4	25	75	100
		--	Generic Elective (Allied)	Maths/Electronics/Computer Science/IT/BCA	T	3	3	25	75	100
		--		Respective Allied Theory Practical	P	2	2	25	75	100
	IV	23BAI2S1	SEC – 2	Introduction to HTML	T	2	2	25	75	100
		23BAI2S2	SEC – 3	Multimedia Systems	T	2	2	25	75	100
		--		Naan Mudhalvan Course						
				Total		**23**	**30**	**200**	**600**	**800**
3	I	2331T	T / OL	தமிழக வரலாறும் பண்பாடும் /Other Languages-III	T	3	6	25	75	100
	II	2332E	E	General English - III	T	3	6	25	75	100
	III	23BAI3C1	CC – V	Object Oriented Programming (Theory & Practical)	T/P	4	5	25	75	100
		23BAI3C2	CC – VI	Data Structures and Algorithms (Theory & Practical)	T/P	4	4	25	75	100
		--	Generic Elective (Allied)	Maths/Electronics/Computer Science/IT/BCA	T	3	3	25	75	100
		--		Respective Allied Theory Practical	P	2	2	25	75	100
	IV	23BAI3S1	SEC – 4	Web Designing	T	2	2	25	75	100
		233AT/ 23BAI3S2	SEC – 5	Adipadai Tamil 1/PHP Programming	T	2	2	25	75	100
		--		Naan Mudhalvan Course						
				Total		**23**	**30**	**200**	**600**	**800**

Sem	Part	Course Code	Category	Title	T/P	Credits	Hours	CIA	ESE	Total
4	I	2341T	T / OL	தமிழும் அறிவியலும் /Other Languages -IV	T	3	6	25	75	100
	II	2342E	E	General English - IV	T	3	6	25	75	100
	III	23BAI4C1	CC – VII	R Programming	T	4	4	25	75	100
		23BAI4P1	CC – VIII	R Programming– Lab	P	3	3	25	75	100
		--	Generic Elective (Allied)	Maths/Electronics/Computer Science/IT/BCA	T	3	3	25	75	100
		--		Respective Allied Theory Practical	P	2	2	25	75	100
	IV	23BAI4S1	SEC – 6	Quantitative Aptitude	T	2	2	25	75	100
		234AT/ 23BAI4S2	SEC – 7	Adipadai Tamil 2/Introduction to Data Communication and Networking	T	2	2	25	75	100
		23BES4	EVS	Environmental Studies	T	2	2	25	75	100
		--		Naan Mudhalvan Course						
				Total		**24**	**30**	**225**	**675**	**900**
5	III	23BAI5C1	CC – IX	Intelligent Systems	T	4	5	25	75	100
		23BAI5C2	CC – X	Introduction to Machine Learning	T	4	5	25	75	100
		23BAI5P1	CC – XI	Machine Learning Lab	P	4	4	25	75	100
		23BAI5C3	CC – XII	Natural Language Processing (Theory & Practical)	T/P	4	6	25	75	100
		23BAI5E1/ 23BAI5E2	DSE – I	Social Network Analysis/ IOT and its Applications	T	3	4	25	75	100
		23BAI5E3/ 23BAI5E4	DSE – II	Software Project Management/ Virtualization and Cloud	T	3	4	25	75	100
	IV	23BVE5		Value Education	T	2	2	25	75	100
		23BAI5I/ 23BAI5IV/ 23BAI5FV		Internship/ Industrial Visit/ Field Visit	PR	2	--	25	75	100
		--		Naan Mudhalvan Course						
				Total		**26**	**30**	**200**	**600**	**800**
6	III	23BAI6C1	CC – XIII	Deep learning (Theory & Practical)	T/P	4	6	25	75	100
		23BAI6C2	CC – XIV	Computer Vision	T	4	4	25	75	100
		23BAI6PR	CC – XV	Project with Viva Voce	PR	6	8	25	75	100
		23BAI6E1/ 23BAI6E2	DSE – III	Robotics and its applications / Virtual Reality Technology	T	3	5	25	75	100
		23BAI6E3/ 23BAI6E4	DSE – IV	Big Data Analytics / Introduction to Data Science	T	3	5	25	75	100
	IV	23BAI6S1	PCS	Essential Reasoning and Quantitative Aptitude	T	2	2	25	75	100
	V	23BEA6		Extension Activity	P	1	--	25	75	100
		--		Naan Mudhalvan Course						
				Total		**23**	**30**	**175**	**525**	**700**
				Grand Total		**142**	**---**	**1200**	**3600**	**4800**

- T/OL – Tamil/Other Languages
- E – English
- CC – Core course – Core competency, critical thinking, analytical reasoning, research skill & teamwork
- Elective Course – Generic/Discipline Specific
- SEC – Skill Enhancement Course - Exposure beyond the discipline
  (Value Education, Entrepreneurship Course, Computer application for Science, etc.,)
- NME – Non-Major Elective – Exposure beyond the discipline
- DSE – Discipline specific elective
- Extension activity & MOOCs – Voluntary basis

Practical Subjects:

The following list of parameters are considered for the evaluation of practical examination.

Total Marks: 100 (Internal: 25 marks, External: 75 Marks)

For Internal Marks:

i. Internal test	:	20
ii. Record Work	:	5

Total	**:**	**25**

For External Marks:

i. Aim, Procedure / Algorithm and Program	:	15
ii. Coding and Compilation	:	20
iii. Debugging	:	20
iv. Results	:	20

Total	**:**	**75**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI1C1	**PROGRAMMING FOR PROBLEM SOLVING**	Core -I	5	0	0	I	4	5	25	75	100

	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 suchas arrays, pointers, functions.
LO5	Develop programming skills to solve real time computational problems

	Contents	No. of Hours
Unit 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
Unit 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 operator Branching, if- else statement, switch statement, goto statement, Looping, while statement, do- while statement, for statement, Nested control structures, break statement, continue statement.	15
Unit III	Arrays and Strings: Defining an array, Processing an array, Multidimensional arrays, Searching algorithm, Linear search, Sorting algorithm, Bubble sort algorithm, Strings, Defining a string, Initialization of strings, Reading and writing a string, Processing the strings.	15
Unit IV	Functions: Functions, Overview, Defining a function, Accessing a function, Function prototypes, Passing arguments to a function,Passing arrays to functions, Recursion.	15
Unit V	Pointers and Structures: 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 to formulate algorithms and programs using arrays, pointers and structures
CO5	The student will be able to create a new application software to solve real world problems

	Textbooks
1.	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.	Yashavant Kanetkar, "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 Christalin Latha, Anuja Beatrice, Carolin Jeeva & Anita Sofia, Fundamentals of Computing and Programming, 1st edition, Pearson, 2018
4.	Sumitabha Das, "Computer Fundamentals and C Programming", 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
Weightage of course contributed to each PSO	15	15	10	10	10	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
23BAI1P1	PROBLEM SOLVING USING C – PRACTICAL	Core Practical-I	0	0	4	I	4	4	25	75	100

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 andrecursion.

8. Implementation of basic file operations

Software Essentials: Code Block

	TOTAL	60

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

MAPPING TABLE						
CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
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
Weightage of course contributed to each PSO	15	11	10	11	11	12

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

SKILL ENHANCEMENT COURSE – I

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI1S1	FUNDAMENTALS OF INFORMATION TECHNOLOGY	SEC-I	2	0	0	I	2	2	25	75	100

	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

	Contents	No. of Hours
Unit 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
Unit 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
Unit 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
Unit 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
Unit 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	**30**

CO	Course Outcomes
CO1	Learn the basics of computer, Construct the structure of the required things in computer, learn how to use it.
CO2	Develop organizational structure using for the devices present currently under input or output unit
CO3	Concept of storing data in computer using two header namely RAM and ROM with

	different types of ROM with advancement in storage basis
CO4	Work with different software, Write program in the software and applications of software
CO5	Usage of Operating system in information technology which really acts as a interpreter between software and hardware

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 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	2
CO3	3	3	3	3	3	3
CO4	3	3	2	3	3	3
CO5	3	3	3	3	2	3
Weightage of course contributed to each PSO	**15**	**15**	**14**	**15**	**14**	**14**

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

FOUNDATION COURSE – I

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI1FC	OFFICE AUTOMATION	FC	2	0	0	I	2	2	25	75	100

	Learning Objectives	
LO1	Understand the basics of computer systems and its components.	
LO2	Understand and apply the basic concepts of a word processing package.	
LO3	Understand and apply the basic concepts of electronic spreadsheet software.	
LO4	Understand and apply the basic concepts of database management system.	
LO5	Understand and create a presentation using PowerPoint tool.	

	Contents	No. of Hours
Unit I	**Introductory concepts:** Memory unit– CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating systems & its features: DOS– UNIX–Windows. Introduction to Programming Languages.	6
Unit II	**Word Processing:** Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing Preview, options, merge.	6
Unit III	**Spreadsheets:** Excel – opening, entering text and data, formatting, navigating; Formulas– entering, handling and copying; Charts –creating, formatting and printing, analysis tables, preparation of financial statements, introduction to data analytics.	6
Unit IV	**Database Concepts:** The concept of database management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of datafiles; Understanding Programming environment in DBMS; Developing menu drive applications in query language(MS–Access).	6
Unit V	**Power point:** Introduction to Power point - Features –Understanding slide typecasting & viewing slides – creating slideshows. Applying special object – including objects & pictures –Slide transition–Animation effects, audio inclusion, timers.	6
	TOTAL	30

CO	Course Outcomes
CO1	Possess the knowledge on the basics of computers and its components
CO2	Gain knowledge on Creating Documents, spreadsheet and presentation.
CO3	Learn the concepts of Database and implement the Query in Database.
CO4	Demonstrate the understanding of different automation tools.
CO5	Utilize automation tools for documentation, calculation & presentation purpose

	Textbooks
1.	PeterNorton,"IntroductiontoComputers"–TataMcGraw-Hill.

Textbooks	
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 TABLE						
CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3
CO2	3	2	2	3	3	2
CO3	2	3	3	3	3	3
CO4	3	3	2	3	3	3
CO5	3	3	3	3	2	3
Weightage of course contributed to each PSO	14	14	13	15	14	14

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
23BAI2C1	**PYTHON PROGRAMMING**	Core-III	5	0	0	2	4	5	25	75	100

	Learning Objectives
LO1	Learn core Python scripting elements such as data types, expressions
LO2	Understand various flow control structures.
LO3	Learn the string and file handling in Python
LO4	Understand the most important libraries of Python, and its recommended programming styles and idioms.
LO5	Develop applications using Python.

	Contents	**No. of Hours**
Unit 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
Unit 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
Unit 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
Unit 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

Unit 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	
1.	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.
2.	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.

Web Resources	
1.	http://docs.python.org/3/tutorial/index.html
2.	http://interactivepython.org/courselib/static/pythonds

MAPPING TABLE						
CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
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 of course contributed to each PSO	**15**	**12**	**10**	**11**	**12**	**13**

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

CORE COURSE – IV

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI2P1	PYTHON PROGRAMMING LAB	Core Practical-II	0	0	4	2	4	4	25	75	100

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: Code Block

	TOTAL	60

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 of course contributed to each PSO	15	14	11	15	15	10

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

SKILL ENHANCEMENT COURSE – II

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	CIA	External	Total
									Marks		
23BAI2S1	**INTRODUCTION TO HTML**	SEC-II	2	0	0	2	2	2	25	75	100

	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.

	Contents	No. of Hours
Unit I	Introduction : Web Basics : What is Internet – Web browsers –What is Webpage – HTML Basics : Understanding tags	6
Unit II	Tags for Document structure (HTML, Head, Body Tag). Block level text elements : Headings paragraph (<p> tag)–Font style elements : (bold, italic, font, small, strong, strike, big tags)	6
Unit III	Lists: Types of lists : Ordered, Unordered – Nesting Lists –Other tags : Marquee, HR, BR – Using Images – Creating Hyperlinks.	6
Unit IV	Tables: Creating basic Table, Table elements, Caption –Table and cell alignment – Rowspan, Colspan–Cell padding.	6
Unit V	Frames: Frameset–Targeted Links–Noframe–Forms: Input, Textarea, Select, Option.	6
	TOTAL	30

CO	**Course Outcomes**
CO1	Knows the basic concept in HTML Concept of resources in HTML
CO2	Knows Design concept. Concept of Meta Data Understand the concept of save the files
CO3	Understand the page formatting. Concept of list
CO4	Creating Links. Know the concept of creating link to email address
CO5	Concept of adding images Understand the table creation

	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 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	2	3	3	3
CO3	2	3	3	3	3	3
CO4	3	3	3	3	3	3
CO5	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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI2S2	MULTIMEDIA SYSTEMS	SEC-III	2	0	0	2	2	2	25	75	100

	Learning Objectives
LO1	Understand the definition of Multimedia
LO2	To study about the Image File Formats, Sounds Audio File Formats
LO3	Understand the concepts of Animation and Digital Video Containers
LO4	To study about the Stage of Multimedia Project
LO5	Understand the concept of Ownership of Content Created for Project Acquiring Talent

	Contents	No. of Hours
Unit I	Multimedia Definition-Use Of Multimedia-Delivering Multimedia- Text: About Fonts and Faces - Using Text in Multimedia -Computers and Text Font Editing and Design Tools-Hypermedia and Hypertext.	6
Unit II	Images: Plan Approach - Organize Tools - Configure Computer Workspace - Making Still Images - Color - Image File Formats. Sound: The Power of Sound - Digital Audio-MidiAudio-Midivs.	6
Unit III	DigitalAudio-Multimedia System Sounds Audio File Formats -Vaughan's Law of Multimedia Minimums - Adding Sound to Multimedia Project.	6
Unit IV	Animation: The Power of Motion-Principles of Animation-Animation by Computer - Making Animations that Work. Video: Using Video - Working with Video and Displays-Digital Video Containers-Obtaining Video Clips -Shooting and Editing Video.	6
Unit V	Making Multimedia: The Stage of Multimedia Project - The Intangible Needs - The Hardware Needs - The Software Needs - An Authoring System's Needs-Multimedia Production Team.	6
	TOTAL	30

CO	Course Outcomes
CO1	Understand the concepts, importance, application and the process of developing multimedia
CO2	To have basic knowledge and understanding about image related processing
CO3	To understand the framework of frames and bit images to animations
CO4	Speaks about the multimedia projects and stages of requirement in phases of project.
CO5	Understanding the concept of cost involved in multimedia planning, designing, and producing

	Textbooks
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	2	2	3	3	3	2
CO2	2	3	2	3	2	1
CO3	1	2	3	3	3	2
CO4	3	2	2	2	1	2
CO5	2	3	1	3	3	3
Weightage of course contributed to each PSO	10	12	11	14	12	10

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

CORE COURSE – V

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI3C1	**OBJECT ORIENTED PROGRAMMING (THEORY & PRACTICAL)**	**CORE -V**	**3**	**0**	**2**	**3**	**4**	**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.	

	Contents	**No. of Hours**
Unit 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
Unit 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
Unit 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
Unit 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
Unit 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	30
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	
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
1.	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.

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

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

Note :
External exam will be conducted in two components.

    Practical Component   :   75 Marks

    Theory Component   :   75 Marks

Practical Exam   :   3 Hrs.   (Max Marks 75 should be converted to 30 i.e. 40% of total mark)

Theory Exam   :   3 Hrs.   (Max Marks 75 should be converted to 45 i.e. 60% of total mark)

Exam fees may be fixed accordingly.

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI3C2	DATA STRUCTURES AND ALGORITHMS (THEORY & PRACTICAL)	CORE -VI	3	0	1	3	4	4	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.

	Contents	No. of Hours
Unit 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
Unit 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
Unit 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
Unit 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
Unit V	**Graphs** Mathematical background- Graph Representation and Traversals - Depth First Search, Breadth First Search	9

List of Exercises		
1.	Array Implementation of Stack and Queue ADTs	15
2.	Application of Recursion	
3.	Linked list Implementation	
4.	Implementation of Doubly Linked List	
5.	Implementation of Circular Linked List	
6.	Implementation of Sorting & Search Algorithms	
7.	Implementation of Binary Tree Traversal	

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.

	Textbooks
1.	Herbert Schildt, "Java: The Complete Reference", 10th edition, McGraw Hill Education, 2017, ISBN-10: 1259589331
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 books
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

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 of course contributed to each PSO	15	15	15	15	15	15

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

Note :
External exam will be conducted in two components.

    Practical Component   :   75 Marks
    Theory Component   :   75 Marks
Practical Exam   :   3 Hrs.   (Max Marks 75 should be converted to 30 i.e. 40% of total mark)
Theory Exam   :   3 Hrs.   (Max Marks 75 should be converted to 45 i.e. 60% of total mark)
Exam fees may be fixed accordingly.

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	CIA	External	Total
									Marks		
23BAI3S1	WEB DESIGNING	SEC-IV	2	0	0	3	2	2	25	75	100

Learning Objectives	
LO1	Understand the basics of HTML and its components
LO2	To study about the Graphics in HTML
LO3	Understand and apply the concepts of XML and DHTML
LO4	Understand the concept of JavaScript
LO5	To identify and understand the goals and objectives of the Ajax

	Contents	No. of Hours
Unit I	XML & DHTML: Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your web pages-Grouping styles-extensible markup language (XML).	6
Unit II	Concept of CSS - Creating Style Sheet - CSS Properties - CSS Styling (Background, Text Format, Controlling Fonts) - Working with block elements and objects - Working with Lists and Tables - CSS Id and Class - Box Model (Introduction, Border properties, Padding Properties, Margin - properties) Navigation Bar - CSS Color - Creating page Layout and Site Design	6
Unit III	Dynamic HTML: Document object model (DCOM)-Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding.	6
Unit IV	JavaScript: Client-side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition	6
Unit V	Advance script, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations.	6
	TOTAL	30

CO	Course Outcomes
CO1	Develop working knowledge of CSS
CO2	Ability to Develop and publish Web pages using DHTML.
CO3	Ability to optimize page styles and layout with Cascading Style Sheets (CSS).
CO4	Ability to develop a java script
CO5	An ability to develop web application

Textbooks	
1.	Pankaj Sharma, "Web Technology", SkKataria& Sons Bangalore 2011.
2.	Mike Mcgrath, "Java Script", Dream Tech Press 2006, 1st Edition.
3.	Achyut S Godbole&AtulKahate, "Web Technologies", 2002, 2nd Edition.
Reference books	

1.	Laura Lemay, RafeColburn , Jennifer Kyrnin, "Mastering HTML, CSS &Javascript Web Publishing", 2016.
2.	DT Editorial Services (Author), "HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)", Paperback 2016, 2nd Edition.
Web Resources	
1.	NPTEL & MOOC courses titled Web Design and Development.
2.	https://www.geeksforgeeks.org

MAPPING TABLE						
CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
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 of course contributed to each PSO	15	12	10	11	12	13

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

SKILL ENHANCEMENT COURSE – V

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI3S2	PHP PROGRAMMING	SEC-V	2	0	0	3	2	2	25	75	100

Learning Objectives	
LO1	To provide the necessary knowledge on basics of PHP.
LO2	To design and develop dynamic, database-driven web applications using PHP version.
LO3	To get an experience on various web application development techniques.
LO4	To learn the necessary concepts for working with the files using PHP.
LO5	To get a knowledge on OOPS with PHP.

	Contents	No. of Hours
Unit I	Introduction to PHP -Basic Knowledge of websites -Introduction of Dynamic Website -Introduction to PHP -Scope of PHP -XAMPP and WAMP Installation	6
Unit 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
Unit 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
Unit IV	PHP Advanced Concepts -Reading and Writing Files -Reading Data from a File.	6
Unit V	Managing Sessions and Using Session Variables -Destroying a Session -Storing Data in Cookies -Setting Cookies.	6
	TOTAL	30

CO	Course Outcomes
CO1	Write PHP scripts to handle HTML forms
CO2	Write regular expressions including modifiers, operators, and metacharacters.
CO3	Create PHP Program using the concept of array.
CO4	Create PHP programs that use various PHP library functions
CO5	Manipulate files and directories.

Textbooks	
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.	Opensource digital libraries: PHP Programming
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	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 of course contributed to each PSO	15	12	10	11	12	13

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
23BAI4C1	R PROGRAMMING	CORE -VII	4	0	0	4	4	4	25	75	100

	Learning Objectives
LO1	Understanding and being able to use basic programming concepts
LO2	Automate data analysis
LO3	Working collaboratively and openly on code
LO4	Knowing how to generate dynamic documents

	Contents	No. of Hours
Unit 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	10
Unit 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	10
Unit 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	10
Unit 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	10
Unit 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.	10
	TOTAL	60

CO	Course Outcomes
CO1	Demonstration and implement of basic R programming framework and data structures
CO2	Explain critical R programming language concepts such as control structures and recursion

CO3	Applying mathematical and statistical operations data in R
CO4	Examine data-sets to create testable hypotheses and identify appropriate statistical tests
CO5	Make use of appropriate statistical tests using R and Create and edit visualizations with regression models

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

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

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

MAPPING TABLE						
CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	3	1	2	2	2	2
CO2	2	3	2	3	3	1
CO3	2	2	2	3	3	2
CO4	3	2	1	3	3	2
CO5	3	3	2	3	3	3
Weightage of course contributed to each PSO	13	11	9	14	14	10

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		
23BAI4P1	**R PROGRAMMING LAB**	Core Practical-IV	0	0	3	3	3	3	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.

Software Essentials: Code Block

	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

MAPPING TABLE						
CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
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
Weightage of course contributed to each PSO	13	10	10	11	10	10

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

SKILL ENHANCEMENT COURSE – VI

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI4S1	QUANTITATIVE APTITUDE	SEC-VI	2	0	0	0	2	2	25	75	100

	Learning Objectives
LO1	To understand the basic concepts of numbers
LO2	Understand and apply the concept of percentage, profit & loss
LO3	To study the basic concepts of time and work, interests
LO4	To learn the concepts of permutation, probability, discounts
LO5	To study about the concepts of data representation, graphs

	Contents	No. of Hours
Unit I	Numbers-HCF and LCM of numbers-Decimal fractions-Simplification-Square root and cube roots - Average-problems on Numbers	6
Unit II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership-Chain rule.	6
Unit III	Time and work - pipes and cisterns - Time and Distance - problems on trains - Boats and streams - simple interest - compound interest - Logarithms - Area-Volume and surface area -races and Games of skill.	6
Unit IV	Permutation and combination-probability-True Discount-Bankers Discount – Height and Distances-Odd man out & Series.	6
Unit V	Calendar - Clocks - stocks and shares - Data representation - Tabulation – Bar Graphs-Pie charts-Line graphs.	6
	TOTAL	30

CO	Course Outcomes
CO1	Understand the concepts, application, and the problems of numbers
CO2	To have basic knowledge and understanding about percentage, profit & loss related processing
CO3	To understand the concepts of time and work
CO4	Speaks about the concepts of probability, discount
CO5	Understanding the concept of problem solving involved in stocks & shares, graphs

	Textbooks
1.	"Quantitative Aptitude", R.S. AGGARWAL., S. Chand &Company Ltd.,

	Web Resources
1.	https://www.javatpoint.com/aptitude/quantitative
2.	https://www.toppr.com/guides/quantitative-aptitude/

MAPPING TABLE						
CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	3	3	3
CO2	2	3	2	3	2	2
CO3	2	2	3	2	2	3
CO4	2	2	2	2	3	3
CO5	3	1	2	3	2	3
Weightage of course contributed to each PSO	11	10	10	13	12	14

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

SKILL ENHANCEMENT COURSE – VII

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	CIA	External	Total
									Marks		
23BAI4S2	**INTRODUCTION TO DATA COMMUNICATION AND NETWORKING**	SEC-VII	2	0	0	-	2	2	25	75	100

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

	Contents	No. of Hours
Unit I	Data Communications: Introduction– Networks – The Internet – Protocols and Standards- Network Models: OSI model – TCP/IP protocol suite – Transmission Media: Guided media – Unguided Media.	6
Unit II	Data Link Layer: Error Detection and Correction: Introduction- Block coding – Linear block codes – Cyclic Codes – Checksum - Framing. Flow and Error Control: Protocols –Noiseless Channels: Simple protocol, Stop- and –Wait. Noisy Channel: Stop-and Wait Automatic Repeat Request-Go-Back –N – Piggybacking	7
Unit III	Medium Access and Network Layer: Multiple Access: Random Access – Controlled access- Channelization. Connecting LANs : Connecting Devices	5
Unit IV	Network Layer Logical addressing: IPv4 addresses – IPv6 addresses. Network Layer: Delivery, Forwarding, Unicast and Multicast Routing. Transport Layer: Process to Process delivery: UDP – TCP. Congestion Control – Quality of Service	7
Unit V	Application Layer: Domain Naming System: Name Space - Domain Name Space - Distribution of Name Space - DNS in the INTERNET - Resolution– Remote logging – E-mail – FTP	5
	TOTAL	30

CO	**Course Outcomes**
CO1	Understand the basics of data communication, networking, internet and their importance
CO2	Analyze the services and features of various protocol layers in data networks
CO3	Differentiate wired and wireless computer networks
CO4	Analyze TCP/IP and their protocols
CO5	Recognize the different internet devices and their functions

	Textbooks
1.	Forouzan, A. Behrouz. (2006), Data Communications & Networking, Fourth Edition, Tata McGraw Hill Education

Reference books		
1.	Fred Halsall(1996), Data Communications Computer Networks and Open Systems, Fourth Edition, Addison Wesley	
Web Resources		
1.	https://www.tutorialspoint.com/data_communication_computer_network/index.htm	
2.	https://www.geeksforgeeks.org/data-communication-definition-components-types-channels/	

MAPPING TABLE						
CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	3	3	3	3	3	3
CO2	2	3	3	3	2	3
CO3	3	3	3	3	3	2
CO4	3	3	3	3	2	3
CO5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	15	15	15	13	14

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

CORE COURSE – IX

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI5C1	**INTELLIGENT SYSTEMS**	**CORE -IX**	5	0	0	5	4	5	25	75	100
Learning Objectives											
LO1	To acquire knowledge on various intelligent system techniques and methodologies										
LO2	Learn about Knowledge representation										
LO3	To implement learning methods in solving engineering problems										
	Contents										**No. of Hours**
Unit 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**
Unit 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**
Unit 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**
Unit 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**
Unit 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	
1.	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
2.	Artificial Intelligence: A Guide to Intelligent Systems, 3rd edition, Michael Negnevitsky, Addison Wesley, 2011.[Unit IV-Chapter 1,2,4,V-Chapter6]
3.	Artificial Intelligence a modern Approach "– Stuart Russell & Peter Norvig, 3rd Edition Pearson Education[Unit V-Chapter25-Robotics]
Reference books	
1.	"Artificial Intelligence ", George F Luger, 4thEdition , Pearsons Education Publ,2002.
2.	"Foundations of Artificial Intelligent and Expert Systems", V S Janaki Raman, K. Sarukesi, P Gopalakrishnan, Macmillan India Limited
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	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	2	2	1	2
CO2	3	3	2	2	3	3
CO3	3	2	3	2	3	2
CO4	3	2	1	2	2	3
CO5	3	2	2	3	3	2
Weightage of course contributed to each PSO	15	12	10	11	12	13

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

CORE COURSE – X

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	CIA	External	Total
									Marks		
23BAI5C2	**INTRODUCTION TO MACHINE LEARNING**	CORE -X	5	0	0	5	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

	Contents	**No. of Hours**
Unit 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
Unit 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
Unit 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
Unit 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
Unit 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	
1.	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.
2.	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.

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

MAPPING TABLE							
CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	3	2	2	2	2	2
CO2	3	2	1	1	1	2
CO3	2	3	2	2	2	2
CO4	2	1	2	2	2	2
CO5	2	2	2	3	2	2
Weightage of course contributed to each PSO	12	10	9	10	9	10

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
23BAI5P1	**MACHINE LEARNING LAB**	Core Practical-V	0	0	4	5	4	4	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

MAPPING TABLE						
CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	2	3	3	3	2
CO2	1	3	2	3	2	1
CO3	3	2	3	3	3	2
CO4	3	2	2	2	1	2
CO5	2	3	1	3	3	3
Weightage of course contributed to each PSO	11	12	11	14	12	10

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
23BAI5C3	NATURAL LANGUAGE PROCESSING (THEORY & PRACTICAL)	CORE -XII	4	0	2	6	4	6	25	75	100

Learning Objectives	
LO1	Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics.

	Contents	No. of Hours
Unit 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
Unit 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
Unit III	Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software	12
Unit IV	Predicate-Argument Structure, Meaning Representation Systems, Software	12
Unit 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	
1. Preprocessing of text (Tokenization, Filtration, Script Validation, Stop Word Removal, Stemming) 2. Morphological Analysis 3. N-gram model 4. POS tagging 5. Chunking 6. Named Entity Recognition 7. Virtual Lab on Word Generator	30
TOTAL	90

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	
1.	Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication
2.	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
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	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
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
Weightage of course contributed to each PSO	10	12	10	10	13	10

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

Note :

External exam will be conducted in two components.

        Practical Component   :   75 Marks

        Theory Component   :   75 Marks

Practical Exam   :   3 Hrs.   (Max Marks 75 should be converted to 30 i.e. 40% of total mark)

Theory Exam   :   3 Hrs.   (Max Marks 75 should be converted to 45 i.e. 60% of total mark)

Exam fees may be fixed accordingly.

DISCIPLINE SPECIFIC ELECTIVE – I

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	CIA	External	Total
									Marks		
23BAI5E1	**SOCIAL NETWORK ANALYSIS**	DSE-IA	4	0	0	5	3	4	25	75	100

	Learning Objectives	
LO1	Learn the core aspects of collecting, visualizing, analyzing, and interpreting social network data	
LO2	Understand the concepts of research designs and measures of network analysis	
LO3	Design, collect and analyze social network data using relevant techniques and tools to address the real-world problems	

	Contents	No. of Hours
Unit I	Introduction : Natural Language Processing tasks in syntax, semantics, and pragmatics – Issue- Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models.	12
Unit II	Word level and Syntactic Analysis: Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing- Probabilistic Parsing.	12
Unit III	Semantic analysis and Discourse Processing: Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.	12
Unit IV	Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation. Characteristics of Indian Languages-Machine Translation Approaches-Translation involving Indian Languages.	12
Unit V	Information retrieval and lexical resources: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: WorldNet-Frame NetStemmers- POS Tagger- Research Corpora SSAS.	12
	TOTAL	60

CO	Course Outcomes
CO1	Describe the core concepts of social network analysis and the underlying mathematics
CO2	Summarize the research design methods and different options for collection and management of network data
CO3	Distinguish between the whole network and egocentric research designs
CO4	Apply suitable multivariate and statistical techniques for testing hypotheses with network data
CO5	Analyze the node's position and structural similarities of network using suitable measures

Textbooks	
1.	Stephen P Borgatti, Martin G. Everett, Jeffrey C. Johnson, "Analyzing Social Networks", SAGE Publications, 2018, ISBN-10: 1526404109, ISBN-13: 978-1526404107
Reference books	
1.	Albert-László Barabási, Márton Pósfai, "Network Science" 1st Edition, Cambridge University Press, 1st edition 2016, ISBN:978-1107076266
2.	Przemyslaw Kazienko, Nitesh Chawla, "Applications of Social Media and Social Network Analysis", Springer, 2015
3.	Charu C. Aggarwal, "Social Network Data Analytics", Springer, 2011, ISBN: 9781441984616
4.	Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, "Computational Social Network Analysis: Trends, Tools and Research Advances", Springer, 2010, ISBN-10: 1848822286, ISBN-13: 978-1848822283
Web Resources	
1.	https://www.tutorialride.com/big-data-analytics/social-network-analysis.htm
2.	https://towardsdatascience.com/social-network-analysis-from-theory-to-applications-with-python-d12e9a34c2c7

MAPPING TABLE						
CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3
CO2	2	3	3	3	2	3
CO3	3	3	3	3	3	3
CO4	3	2	3	3	2	3
CO5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	14	15	15	13	15

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

DISCIPLINE SPECIFIC ELECTIVE – I

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI5E2	**IOT AND ITS APPLICATIONS**	DSE-I B	4	0	0	5	3	4	25	75	100

	Learning Objectives
LO1	To use of Devices, Gateways and Data Management in IoT.
LO2	To design IoT applications in different domain and be able to analyze their performance
LO3	To implement basic IoT applications on embedded platform
LO4	To gain knowledge on Industry Internet of Things
LO5	To Learn about the privacy and Security issues in IoT

	Contents	**No. of Hours**
Unit 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	12
Unit 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.	12
Unit III	IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views	12
Unit 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	12
Unit V	Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	12
TOTAL		60

CO	Course Outcomes
CO1	Use of Devices, Gateways and Data Management in IoT.
CO2	Design IoT applications in different domain and be able to analyze their performance
CO3	Implement basic IoT applications on embedded platform
CO4	Gain knowledge on Industry Internet of Things
CO5	Learn about the privacy and Security issues in IoT
Textbooks	
1.	Vijay Madisetti and Arshdeep Bahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited 2014, 1st Edition
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 TABLE						
CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	2	2
CO2	2	3	3	3	3	2
CO3	2	3	3	2	3	2
CO4	1	2	2	1	3	2
CO5	2	2	3	1	3	3
Weightage of course contributed to each PSO	10	12	13	10	14	11

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

DISCIPLINE SPECIFIC ELECTIVE – II

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI5E3	**SOFTWARE PROJECT MANAGEMENT**	DSE-II A	4	0	0	5	3	4	25	75	100

	Learning Objectives										
LO1	To define and highlight importance of software project management										
LO2	To formulate and define the software management metrics & strategy in managing projects										
LO3	Understand to apply software testing techniques in commercial environment										

	Contents	No. of Hours
Unit I	Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organization for Standardization	12
Unit II	Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones - Work Packages - Building a WBS for Software	12
Unit III	Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning - Project Roles and Skills Needed.	12
Unit IV	Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling	12
Unit V	Quality: Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organizing - Tools - Benefits - Legal Issues in Software - Case Study	12
TOTAL		60

CO	Course Outcomes
CO1	Understand the principles and concepts of project management
CO2	Knowledge gained to train software project managers
CO3	Apply software project management methodologies
CO4	Able to create comprehensive project plans
CO5	Evaluate and mitigate risks associated with software development process

	Textbooks
1.	Robert T. Futrell, Donald F. Shafer, Linda I. Safer, "Quality Software Project Management", Pearson Education Asia 2002.

Reference books	
1.	Pankaj Jalote, "Software Project Management in Practice", Addison Wesley 2002.
2.	Hughes, "Software Project Management", Tata McGraw Hill 2004, 3rd Edition
Web Resources	
1.	NPTEL & MOOC courses titled Software Project Management
2.	www.smartworld.com/notes/software-project-management

MAPPING TABLE						
CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	3	2	1	2	2	2
CO2	3	1	3	2	2	2
CO3	2	3	2	3	3	3
CO4	3	2	2	3	3	2
CO5	2	3	2	3	3	3
Weightage of course contributed to each PSO	13	11	10	13	13	12

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

DISCIPLINE SPECIFIC ELECTIVE – II

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI5E4	**VIRTUALIZATION AND CLOUD**	DSE-II B	4	0	0	5	3	4	25	75	100

	Learning Objectives
LO1	Recognize the basic concepts of Distributed Systems
LO2	Understand about Cloud Computing
LO3	Understand about Virtualization and hypervisors
LO4	Understand Cloud Types and Cloud Service Deployment Models (IaaS*, PaaS*,SaaS*)
LO5	Learn to Create Virtual Machines (VM) using vSphere, Data centersand to work with AWS

	Contents	**No. of Hours**
Unit I	Distributed Systems Distribute a system - Distributed algorithm - Distributed Data Stores - Distributed Computing – File Systems - Distributed Messaging - Distributed Applications – Distributed Transaction - Parallel and distributed computing - Applications	**12**
Unit II	Cloud Concepts Introduction Cloud Computing - Advantages of Cloud - Public Cloud - five essential characteristics- three service models – Four deployment models - Benefits of Cloud Computing - Cloud Vendors - Traditional Infrastructure setup and Challenges – AWS.	**12**
Unit III	Virtualization Introduction to vsphere and the Software - Defined Data Center Creating Virtual Machines – vcenter Server - Configuring and Managing - Virtual Networks Configuring and Managing Virtual Storage – Virtual Machine Management - Resource Management and Monitoring.	**12**
Unit IV	Virtual Machines Vsphere HA - vsphere Fault Tolerance - Protecting Data vsphere DRS - Network Scalability -vsphere Update Manager and Host Maintenance - Storage Scalability - Securing Virtual Machines.	**12**
Unit V	Datacenter Data center overview -Components - Provisions - Need of Data Center - Data Center Architecture -Different Racks - Data center architecture for cloud computing - role of data center in cloud computing	**12**
	TOTAL	**60**

CO	**Course Outcomes**
CO1	Recognize the basic concepts of Distributed Systems
CO2	Understand about Cloud Computing
CO3	Understand about Virtualization and hypervisors
CO4	Understand Cloud Types and Cloud Service Deployment Models (IaaS*, PaaS*,SaaS*)
CO5	Learn to Create Virtual Machines (VM) using vSphere, Data centersand to work with AWS

Textbooks	
1.	Jean Dollimore formerly of Queen Mary, Tim Kindberg, "Distributed Systems Concepts and Design", 5th Edition Cambridge University, University of London
2.	Venkata Josyula , Malcolm Orr , Greg Page, "Cloud Computing: Automating the Virtualized Data Center", 1st Edition.
3.	Brian J.S. Chee, Curtis Franklin Jr., "Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center", 1st Edition
Reference books	
1.	Rajkumar Buyya, Christian Vecchiola, S Tamarai Selvi, (2013), "Mastering Cloud Computing", First Edition, McGraw Hill publications
2.	Barrie Sosinsky, (2011), "Cloud Computing Bible", First Edition, Wiley India Private Ltd
Web Resources	
1.	https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2.	https://www.w3schools.in/cloud-computing/cloud-computing-architecture/
3.	https://www.javatpoint.com/virtualization-in-cloud-computing
4.	https://www.kaspersky.co.in/resource-center/definitions/what-is-cloud-security
5.	https://www.tutorialspoint.com/cloud_computing/cloud_computing_applications.htm

MAPPING TABLE						
CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	3	3	3	3
CO2	2	1	2	2	2	3
CO3	2	3	3	1	3	2
CO4	2	2	3	2	2	2
CO5	3	3	2	3	3	3
Weightage of course contributed to each PSO	12	11	13	11	13	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
23BAI6C1	DEEP LEARNING (THEORY & PRACTICAL)	CORE -XIII	4	0	2	6	4	6	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

	Contents	No. of Hours
Unit I	Neural Networks Introduction to Neural Networks - Training a neural network: loss functions, backpropagation and stochastic gradient descent - Neural networks as universal function approximates	12
Unit 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
Unit III	Convolutional Neural Networks Introduction to Convolutional Neural Network - Architectures - AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization	12
Unit IV	Recurrent Neural Networks and Deep unsupervised Learning Recurrent networks, LSTM, GRU - Architectures, Autoencoders and Variational Autoencoders, Adversarial Generative Networks, DBM - Deep Reinforcement Learning	12
Unit 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		30

12. Familiarization of cloud based computing like Google colab	
TOTAL	**90**

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	
1.	Ian Goodfellow, Yoshua Bengio, 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.
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

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

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

Note :
External exam will be conducted in two components.

       Practical Component   :   75 Marks

       Theory Component   :   75 Marks

Practical Exam   :   3 Hrs.   (Max Marks 75 should be converted to 30 i.e. 40% of total mark)

Theory Exam   :   3 Hrs.   (Max Marks 75 should be converted to 45 i.e. 60% of total mark)

Exam fees may be fixed accordingly.

<div align="center">

CORE COURSE – XIV

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Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	CIA	External	Total
									**Marks**		
23BAI6C2	**COMPUTER VISION**	CORE-XIV	4	0	0	6	4	4	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

	Contents	No. of Hours
Unit 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.	12
Unit 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.	12
Unit 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	12
Unit 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.	12
Unit 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.	12
\multicolumn{2}{c}{**TOTAL**}	60

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	Explain the computer vision techniques used for real time applications

Textbooks	
1.	David A. Forsyth and Jean Ponce, "Computer Vision - A modern approach", 2nd Edition, Pearson, 2011. ISBN-13: 978-0136085928
2.	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
Web Resources	
1.	https://www.javatpoint.com/computer-vision
2.	https://towardsdatascience.com/computer-vision-for-beginners-part-1-7cca775f58ef

MAPPING TABLE

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
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 of course contributed to each PSO	15	12	11	11	12	12

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
23BAI6PR	PROJECT	CORE	0	0	10	6	6	8	50	150	200

Learning Objectives	
LO1	To solve real-world problems using Artificial Intelligence and Machine Learning

Contents	No. of Hours

• The students will be allowed to work on any project based on the concepts studied in core/elective courses.
• The project work should be compulsorily done in the college only under the supervision of the department staff.
• The project shall be undertaken by individual student.
• The students will be equally assigned to existing Staff members.
• The following list of parameters are considered for the evaluation of Project work and Viva-voce.
Parameters:
   For Internal Marks:
Two review meetings - 2 × 10 = 20 Marks
Debugging = 10 Marks
Execution = 10 Marks
Output = 10 Marks
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Total = 50 Marks
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   For External Marks:
Project Report = 50 Marks
Project demo &Presentation = 50 Marks
Viva-Voce = 50 Marks
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Total = 150 Marks
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TOTAL	**150**

CO	Course Outcomes
CO1	Get expertise in Software Development Lifecycle using real-world problems
CO2	Able to solve real-world problems using Artificial Intelligence and Machine Learning
CO3	Explore problem solving using the core / elective course studied
CO4	Recognize the technological recent trends of computer science.
CO5	Gain knowledge about technological components

DISCIPLINE SPECIFIC ELECTIVE – III

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI6E1	**ROBOTICS AND ITS APPLICATIONS**	DSE-III A	5	0	0	6	3	5	25	75	100

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

	Contents	No. of Hours
Unit I	Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics.	12
Unit 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	12
Unit III	Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.	12
Unit 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	12
Unit 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.	12
	TOTAL	60

CO	Course Outcomes
CO1	Describe the different physical forms of robot architectures
CO2	Kinematically model simple manipulator and mobile robots.

CO3	Mathematically describe a kinematic robot system
CO4	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.
CO5	Program robotics algorithms related to kinematics, control, optimization, and uncertainty

	Textbooks
1.	Richared D.Klafter. Thomas Achmielewski and Mickael Negin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001
2.	Saeed B.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2nd 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 TABLE						
CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	1	3	3	3	3	3
CO2	2	1	3	3	3	3
CO3	3	3	3	1	3	1
CO4	3	3	3	1	1	2
CO5	3	3	1	3	2	3
Weightage of course contributed to each PSO	12	13	13	11	12	12

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

DISCIPLINE SPECIFIC ELECTIVE – III

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI6E2	VIRTUAL REALITY TECHNOLOGY	DSE-III B	5	0	0	6	3	5	25	75	100

	Learning Objectives	
LO1	Understand the fundamental principles of virtual reality	
LO2	Infer the essential information about the hardware and software in virtual environment	
LO3	Design and construct a simple virtual environment	

	Contents	No. of Hours
Unit I	History of Virtual Reality Commercial VR Technology- Input Devices- Tracker Performance Parameters- Mechanical- Magnetic- Ultrasonic- Optical- Hybrid- Navigation and Manipulation Interfaces- Gesture Interfaces	12
Unit II	Output Devices Graphic Displays - Sound Displays-The Human Auditory System- The Convolvotron - Haptic Feedback: The Human Haptic System- Tactile- Force- The Graphics Rendering Pipeline- PC Graphics Architecture- Graphics Benchmarks	12
Unit III	Workstation based Architecture Workstation Based Architectures: The Sun Blade 1000 - The SGI Infinite Reality - Distributed VR -Multi pipeline Synchronization- Collocated Rendering- Distributed Virtual Environments- Geometric - Kinematics Modeling- Physical- Behavior- Model Management	12
Unit IV	Virtual Reality Programming VR Programming: Toolkits and Scene Graphs- World Tool Kit- Java 3D-General Haptics Open Software Toolkit- People Shop-Usability Engineering Methodology	12
Unit V	Virtual Reality Applications Engineering - Education - Medicine - Entertainment - Science - Training	12
	TOTAL	60

CO	Course Outcomes
CO1	Recognize the virtual technology and usage of input devices
CO2	Identify the essential output devices, sound displays, graphics and feedback
CO3	Demonstrate workstation-based architecture for modelling
CO4	Analyze the programming tool kits in engineering the virtual reality methods
CO5	Relate the user performance and multimodality feedbacks

	Textbooks
1.	Grigore C. Burdea and Philippe Coiffet, "Virtual Reality Technology", Third Edition, John Wiley and Sons, 2012, ISBN-13: 978-1118014806
2.	Gerard Kim, "Designing Virtual Reality Systems: The Structured Approach", Springer, 2007, ISBN: 1846282306, 9781846282300

Reference books	
1.	John Vince, "Introduction to Virtual Reality", Springer, 2004, ISBN: 1852337397
2.	William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application, and Design", Morgan Kaufmann publisher, 2003, ISBN: 1558603530, 9781558603530.
3.	Alan B. Craig, William R. Sherman, Jeffrey D. Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2009, ISBN: 0080959083, 9780080959085
Web Resources	
1.	https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/what-is-virtual-reality

MAPPING TABLE						
CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	3	2	2	3	2	2
CO2	2	3	3	3	3	2
CO3	2	3	3	2	3	2
CO4	1	2	2	1	3	2
CO5	2	2	3	1	3	3
Weightage of course contributed to each PSO	10	12	13	10	14	11

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

DISCIPLINE SPECIFIC ELECTIVE – IV

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	CIA	External	Total
									Marks		
23BAI6E3	BIG DATA ANALYTICS	DSE-IV A	5	0	0	6	3	5	25	75	100

Learning Objectives	
LO1	Understand the Big Data Platform and its Use cases, Map Reduce Jobs
LO2	To identify and understand the basics of cluster and decision tree
LO3	To study about the Association Rules, Recommendation System
LO4	To learn about the concept of stream
LO5	Understand the concepts of NoSQL Databases

	Contents	No. of Hours
Unit 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	12
Unit 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.	12
Unit III	Advanced Analytical Theory and Methods: Association Rules — Overview — Apriori Algorithm — 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.	12
Unit 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	12
Unit 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.	12
TOTAL		60

CO	Course Outcomes
CO1	Work with big data tools and its analysis techniques
CO2	Analyze data by utilizing clustering and classification algorithms
CO3	Learn and apply different mining algorithms and recommendation systems for large volumes of data
CO4	Perform analytics on data streams.
CO5	Learn NoSQL databases and management
Textbooks	
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 TABLE						
CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	1	3	2	3	2	2
CO2	2	1	3	2	2	2
CO3	3	3	2	3	3	3
CO4	3	2	3	3	3	2
CO5	3	3	2	3	3	3
Weightage of course contributed to each PSO	13	12	12	14	13	12

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

DISCIPLINE SPECIFIC ELECTIVE – IV

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BAI6E4	**INTRODUCTION TO DATA SCIENCE**	DSE-IV B	5	0	0	6	3	5	25	75	100

	Learning Objectives
LO1	To learn about basics of Data Science and Big data
LO2	To learn about overview and building process of Data Science
LO3	To learn about various Algorithms in Data Science
LO4	To learn about Hadoop Framework
LO5	To learn about case study about Data Science

	Contents	**No. of Hours**
Unit I	Introduction: Benefits and uses – Facts of data – Data science process – Big data ecosystem and data science	12
Unit II	The Data science process: Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building	12
Unit III	Algorithms :Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised	12
Unit IV	Introduction to Hadoop :Hadoop framework – Spark – replacing MapReduce– NoSQL – ACID – CAP – BASE – types	12
Unit V	Case Study: Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation	12
	TOTAL	**60**

CO	**Course Outcomes**
CO1	Understand the basics in Data Science and Big data
CO2	Understand overview and building process in Data Science
CO3	Understand various Algorithms in Data Science
CO4	Understand Hadoop Framework in Data Science
CO5	Case study in Data Science

	Textbooks
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 TABLE						
CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	3	2	3	2	3	3
CO2	3	3	2	1	2	2
CO3	2	2	3	3	3	2
CO4	2	2	3	3	2	2
CO5	3	3	3	3	3	3
Weightage of course contributed to each PSO	13	12	14	12	13	12

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

Title of the Course		ESSENTIAL REASONING AND QUANTITATIVE APTITUDE					
Paper Number		**Professional Competency Skill**					
Category	PCS	Year	III	Credits	2	Course Code 23BAI6S1	
		Semester	VI				
Instructional Hours per week		Lecture		Tutorial	Lab Practice		Total
		1		1	-		2
Objectives of the Course		• Develop Problem solving skills for competitative examinations • Understand the concepts of averages , simple interest , compound interest					
UNIT-I:		**Quantitative Aptitude:** Simplifications=averages-Concepts –problem-Problems on numbers-Short cuts- concepts –Problems					
UNIT-II:		Profit and Loss –short cuts-Concepts –Problems –Time and work -Short –uts -Concepts -Problems.					
UNIT-III:		Simple interest –compound interest- Concepts- Prolems					
UNIT-IV:		**Verbal Reasoning :** Analogy- coding and decoding –Directions and distance –Blood Relation					
UNIT-V:		**Analytical Reasoning :**Data sufficiency Non-Verbal Reasoning : Analogy ,Classification and series					
Skills acquired from this course		Studnets relating the concepts of compound interest and simple interest					
Recommended Text		1.”Quantitative Aptitude” by R.S aggarwal ,S.Chand & Company Ltd 2007					
Website and e-Learning Source		https://nptel.ac.in					

METHODS OF EVALUATION		
Internal Evaluation	Continuous Internal Assessment Test	**25 Marks**
	Assignments / Snap Test / Quiz	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	**75 Marks**
Total		**100 Marks**

METHODS OF ASSESSMENT	
Remembering (K1)	• The lowest level of questions requires students to recall information from the course content. • Knowledge questions usually require students to identify information in the textbook.
Understanding (K2)	• Understanding of facts and ideas by comprehending organizing, comparing, translating, interpolating, and interpreting in their own words. • The questions go beyond simple recall and require students to combine data together
Application (K3)	• Students must solve problems by using / applying a concept learned in the classroom. • Students must use their knowledge to determine a exact response.
Analyze (K4)	• Analyzing the question is one that asks the students to break down something into its component parts. • Analyzing requires students to identify reasons causes or motives and reach conclusions or generalizations.
Evaluate (K5)	• Evaluation requires an individual to make judgment on something. • Questions to be asked to judge the value of an idea, a character, a work of art, or a solution to a problem. • Students are engaged in decision-making and problem – solving. • Evaluation questions do not have single right answers.
Create (K6)	• The questions of this category challenge students to get engaged in creative and original thinking. • Developing original ideas and problem solving skills