MOTHER TERESA WOMEN'S UNIVERSITY, KODAIKANAL - 624101

DEPARTMENT OF COMPUTER APPLICATIONS

BCA

Curriculum Framework, Syllabus and Regulations

(Based on TANSCHE syllabus under Choice Based Credit System - CBCS)

(For the candidates to be admitted from the Academic Year 2023-24)

BCA (Bachelor of Computer Application)

Education is the key to development of any society. Role of higher education is crucial for securing right kind of employment and also to pursue further studies in best available world class institutes elsewhere within and outside India. Quality education in general and higher education in particular deserves high priority to enable the young and future generation of students to acquire skill, training and knowledge in order to enhance their thinking, creativity, comprehension and application abilities and prepare them to compete, succeed and excel globally. Learning Outcomes-based Curriculum Framework (LOCF) which makes it student-centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. LOCF also aims at ensuring uniform education standard and content delivery across the state which will help the students to ensure similar quality of education irrespective of the institute and location.

Computer Application is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer Application is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Computer Application can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer Application also has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain. Computer Application has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Computational Science, and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges.

Computer Application is practiced by mathematicians, scientists and engineers. Mathematics, the origins of Computer Science, provides reason and logic. Science provides the methodology for learning and refinement. Engineering provides the techniques for building hardware and software.

Programme Outcome, Programme Specific Outcome and Course Outcome

Computer Application is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. The key core areas of study in Mathematics include Algebra, Analysis (Real & Complex), Differential Equations, Geometry, and Mechanics.

The Students completing this programme will be able to present Software application clearly and precisely, make abstract ideas precise by formulating them in the Computer languages. Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in software industry, banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME	
Programme	**B.C.A.,**
Programme Code:	
Duration:	**3 years [UG]**
Programme Outcomes:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking

	relevant/appropriate questions, problem arising, synthesizing and articulating; Ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demon starting the ability to identify ethical issues related to ones work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

Programme Specific Outcomes:	**PSO1**: To enable students to apply basic microeconomic, macroeconomic and monetary concepts and theories in real life and decision making. **PSO 2**: To sensitize students to various economic issues related to Development, Growth, International Economics, Sustainable Development and Environment. **PSO 3**: To familiarize students to the concepts and theories related to Finance, Investments and Modern Marketing. **PSO 4**: Evaluate various social and economic problems in the society and develop answer to the problems as global citizens. **PSO 5:** Enhance skills of analytical and critical thinking to analyze effectiveness of economic policies.

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
PSO 1	Y	Y	Y	Y	Y	Y	Y	Y
PSO 2	Y	Y	Y	Y	Y	Y	Y	Y
PSO3	Y	Y	Y	Y	Y	Y	Y	Y
PSO 4	Y	Y	Y	Y	Y	Y	Y	Y
PSO 5	Y	Y	Y	Y	Y	Y	Y	Y

3 – Strong, 2- Medium, 1- Low

Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Mathematics based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.

- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest - Artificial Intelligence.

Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome/ Benefits
I	**Foundation Course** To ease the transition of learning from higher secondary to higher education, providing an over view of the pedagogy of learning Literature and analyzing the world through the literary lens Gives rise to a new perspective.	➢ Instill confidence among students ➢ Create interest for the subject
I,II,III,IV	**Skill Enhancement papers**(Discipline centric /Generic/Entrepreneurial)	➢ Industry ready graduates ➢ Skilled human resource ➢ Students are equipped with essential skills to make them employable
		➢ Training on language and communication skills enable the students gain knowledge and exposure in the competitive world.
		➢ Discipline centric skill will improve the Technical knowhow of solving real life problems.
III,IV,V& VI	Elective papers	➢ Strengthening the domain knowledge ➢ Introducing the stakeholders to the State-of Art techniques from the stream so for multi-disciplinary, cross disciplinary and inter disciplinary nature ➢ Emerging topics in higher education/industry/communication network/health sector etc. are introduced with hands-on-training.

IV	Elective Papers	➢ Exposure to industry modules students into solution providers ➢ Generates Industry ready graduates ➢ Employment opportunities enhanced
V	Elective papers	➢ Self-learning is enhanced ➢ Application of the concept to real situation is conceived resulting In tangible outcome
VI	Elective papers	➢ Enriches the study beyond the course. ➢ Developing are search framework and presenting their independent and intellectual ideas effectively.
Extra Credits: For Advanced Learners/Honors degree		➢ To cater to the needs of peer learners/research aspirants
Skills acquired from the Courses		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	11	11	11	11	22	18	84
Part IV	6	6	6	7	3	3	31
Part V	-	-	-	-	-	1	1
Total	23	23	23	24	25	22	**140**

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

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

Bachelor of Computer Applications

	Category	List of Courses	Credit	Hours		Int.	Ext.	Tot
				T	L			
		SEMESTER I						
U23TAL101/ U23MAL101/ U23FRL101/ U23HIL101	PART I	Language – 1: Tamil / Malayalam/French/Hindi	3	6	0	25	75	100
U23ENL101	PARTII	English	3	6	0	25	75	100
U23CAT101	PART III	Core Theory1 – Python Programming	5	5	0	25	75	100
U23CAP102		Core Practical1 - Python Programming Lab	5	0	5	25	75	100
U23CAE11A		Elective I – DBMS	3	4	0	25	75	100
U23CAS101	PART IV	Skill Enhancement Course1 – SEC-1 Office Automation Lab	2	0	2	25	75	100
U23CAF101		Foundation Course 1– Structured Programming in C	2	2	0	25	75	100
	Total		**23**	**30**				**700**
	SEMESTER II							
U23TAL202/ U23MAL202/ U23FRL202/ U23HIL202	PARTI	Language – 1: Tamil / Malayalam/French/Hindi	3	6	0	25	75	100
U23ENL202	PARTII	English	3	6	0	25	75	100
U23CAT203	PART III	Core Theory - 2: Object Oriented Programming concepts using C++	5	5	0	25	75	100
U23CAP204		Core Practical – 2: Practical : C++ Programming Lab	5	0	5	25	75	100
U23CAE22A		Elective Course – 2: – Graph Theory And its Applications	3	4	0	25	75	100
U23CAS202		Skill Enhancement Course2-SEC-2: Soft Skills	2	2				
U23CANM21	PART IV	Naan Mudhalvan Course1	2	2	0	25	75	100
U23CAS203	PART VI	Skill Enhancement Course3-SEC3- Web Designing Lab (**Additional Credit Course)**	Additional Credits 2		-	25	75	100
	TOTAL		**23**	**30**				**700**
	SEMESTER III							
U23TAL303/ U23MAL303/ U23FRL303/ U23HIL303	PART I	Language – 1: Tamil / Malayalam/French/Hindi	3	6	0	25	75	100
U23ENL303	PARTII	English	3	6	0	25	75	100
U23CAT305	PART III	Core Theory – 3: Data Structures & Algorithms	5	5	0	25	75	100
U23CAP306		Core Practical - 3: Data Structures & Algorithms Lab Using C++	5	0	5	25	75	100

U23CAE33A		Elective Course III – Accounting and Financial Management	3	4	0	25	75	100
U23CAS304	PART IV	Skill Enhancement Course 4-SEC4- Database Management System Lab	1	0	2	25	75	100
U23CANM32		Naan Mudhalvan Course2	2	2	0	25	75	100
	Total		**22**	**30**				**700**
	SEMESTER IV							
U23TAL404/ U23MAL404/ U23FRL404/ U23HIL404	PARTI	Language – 1: Tamil / Malayalam/French/Hindi	3	6	0	25	75	100
U23ENL404	PARTII	English	3	6	0	25	75	100
U23CAT407	PART III	Core Theory – 4: Programming in Java	5	5	0	25	75	100
U23CAP408		Core Practical - 4: Programming in Java Lab	5	0	5	25	75	100
U23CAE44A		Elective Course – 4: Statistical Methods & its applications	3	3	0	25	75	100
U23CAS405	PART IV	Skill Enhancement Course – 5: Excel for Data Analytics Lab	2	2	0	25	75	100
U23CANM43		Naan Mudhalvan Course3	2	0	2	25	75	100
U23EVS401		EVS	2	2	0			
	TOTAL		**25**	**31**				**700**
	SEMESTER V							
U23CAT509	PART III	Core Theory – 5: Operating System	4	5	0	25	75	100
U23CAT510		Core Theory – 6: ASP.Net Programming	4	5	0	25	75	100
U23CAP511		Core Practical - 5: ASP .Net Programming Lab	4	0	5	25	75	100
U23CAT512		Core Theory - 7- Data Mining and Warehousing	4	5	0	25	75	100
U23CAE55A/ U23CAE55B		Elective Course V – Natural Language Processing /Image Processing	3	3	0	25	75	100
U23CAE56A/ U23CAE56B		Elective Course VI – Digital Principles & Computer Organization/Numerical Methods	3	3	0	25	75	100
U23VAE501	PART IV	Value Education	2	0	2	25	75	100
U23CAI501		Internship (30 hours)	2					
U23CANM54		Naan Mudhalvan Course4	2	2				
	Total		**28**	**30**				**700**
	SEMESTER VI							
U23CAT613	PART III	Core Theory -8: Computer Networks	4	6	0	25	75	100
U23CAT614		Core Theory – 9: Data Analytics using R Programming	4	6	0	25	75	100
U23CAP615		Core Practical – 6: R Programming Lab	4	0	6	25	75	100
U23CAE67A		Elective Course - 7: Robotics and its	3	5	0	25	75	100

U23CAE67B		Applications / Information Security						
U23CAE68A/ U23CAE68B		Elective Course VIII – Internet of Things Lab / Cloud Computing	3	5	0	25	75	100
U23CANM65	PART IV	Professional Competency Skill – Naan Mudhalvan Course - 5	2	2	0	25	75	100
U23EAS601	PART V	Extension Activity (Outside college hours)	1					
	TOTAL		**21**	**30**				**600**

- **Students may take courses from MOOC/NPTEL as Additional Credits**

FIRST YEAR

SEMESTER - I

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
U23CAT101	**PYTHON PROGRAMMING**		5	-	-	-	4	25	75	100

Learning Objectives	
LO1	To make students understand the concepts of Python programming.
LO2	To apply the OOPs concept in PYTHON programming.
LO3	To impart knowledge on demand and supply concepts
LO4	To make the students learn best practices in PYTHON programming
LO5	To know the costs and profit maximization

UNIT	**Contents**	**No. of Hours**
I	**Basics of Python Programming:** History of Python-Features of Python-Literal-Constants-Variables - Identifiers–Keywords-Built-in Data Types-Output Statements – Input Statements-Comments – Indentation- Operators-Expressions-Type conversions. **Python Arrays:** Defining and Processing Arrays – Array methods.	**15**
II	**Control Statements:** Selection/Conditional Branching statements: if, if-else, nested if and if - else if - else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops. **Jump Statements:** break, continue and pass statements**.**	**15**

III	**Functions:** Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement. **Function Arguments**: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments- Recursion. **Python Strings:** String operations-Immutable Strings - Built-in String Methods and Functions - String Comparison. **Modules**: import statement- The Python module – dir( ) function – Modules and Namespace – Defining our own modules.	**15**
IV	Lists: Creating a list -Access values in List-Updating values in Lists-Nested lists -Basic list operations-List Methods. Tuples: Creating, Accessing, Updating and Deleting Elements in a tuple – Nested tuples– Difference between lists and tuples. Dictionaries: Creating, Accessing, Updating and Deleting Elements in a Dictionary – Dictionary Functions and Methods - Difference between Lists and Dictionaries.	**15**
V	**Python File Handling:** Types of files in Python - Opening and Closing files-Reading and Writing files: write() and writelines() methods- append() method – read() and readlines() methods – with keyword – Splitting words – File methods - File Positions- Renaming and deleting files.	**15**
	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Learn the basics of python, Do simple programs on python, Learn how to use an array.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Develop program using selection statement, Work with Looping and jump statements, Do programs on Loops and jump statements.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Concept of function, function arguments, Implementing the concept strings in various application, Significance of Modules, Work with functions, Strings and modules.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Work with List, tuples and dictionary, Write program using list, tuples and dictionary.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Usage of File handlings in python, Concept of reading and writing files, Do programs using files.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	Reema Thareja, "Python Programming using problem solving approach", First Edition, 2017, Oxford University Press.
2	Dr. R. Nageswara Rao, "Core Python Programming", First Edition, 2017, Dream tech Publishers.

Reference Books	
1.	Vamsi Kurama, "Python Programming: A Modern Approach", Pearson Education.
2.	Mark Lutz, "Learning Python", Orielly.
3.	Adam Stewarts, "Python Programming", Online.
4.	Fabio Nelli, "Python Data Analytics", APress.
5.	Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication.
Web Resources	
1.	https://www.programiz.com/python-programming
2.	https://www.guru99.com/python-tutorials.html
3.	https://www.w3schools.com/python/python_intro.asp
4.	https://www.geeksforgeeks.org/python-programming-language/
5.	https://en.wikipedia.org/wiki/Python_(programming_language)

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**3**	**2**	**2**	**3**	**3**	**3**
CO 2	**3**	**2**	**2**	**3**	**2**	**3**
CO 3	**3**	**2**	**2**	**3**	**2**	**2**
CO 4	**3**	**2**	**2**	**3**	**2**	**3**
CO 5	**3**	**2**	**2**	**3**	**3**	**3**
Weightage of course contributed to each PSO	15	10	10	15	13	14

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
U23CAP102	**PYTHON PROGRAMMING LAB**		-	-	4	-	4	25	75	100

Course Objectives:

1. Be able to design and program Python applications.
2. Be able to create loops and decision statements in Python.
3. Be able to work with functions and pass arguments in Python.
4. Be able to build and package Python modules for reusability.
5. Be able to read and write files in Python.

LAB EXERCISES	Required Hours
1. Program using variables, constants, I/O statements in Python. 2. Program using Operators in Python. 3. Program using Conditional Statements. 4. Program using Loops. 5. Program using Jump Statements. 6. Program using Functions. 7. Program using Recursion. 8. Program using Arrays. 9. Program using Strings. 10. Program using Modules. 11. Program using Lists. 12. Program using Tuples. 13. Program using Dictionaries. 14. Program for File Handling.	**75**

Course Outcomes

On completion of this course, students will

CO1	Demonstrate the understanding of syntax and semantics of
CO2	Identify the problem and solve using PYTHON programming techniques.
CO3	Identify suitable programming constructs for problem solving.
CO4	Analyze various concepts of PYTHON language to solve the problem in an efficient way.
CO5	Develop a PYTHON program for a given problem and test for its correctness.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**2**	**2**	**2**	**2**	**3**	**2**
CO 2	**2**	**1**	**3**	**2**	**-**	**2**
CO 3	**3**	**3**	**1**	**1**	**1**	**2**
CO 4	**2**	**3**	**3**	**1**	**-**	**1**
CO 5	**3**	**2**	**3**	**1**	**1**	**-**
Weightage of course contributed to each PSO	12	11	12	7	5	7

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
U23CAE11A	**DBMS**	Elective	-	Y	-	-	4	5	25	75	100

Course Objective	
LO1	Describe basic concepts of database system
LO2	Design a Data model and Schemas in RDBMS
LO3	Competent in use of SQL
LO4	Analyze functional dependencies for designing robust Database
LO5	Describe basic concepts of database system

UNIT	Details	No. of Hrs
I	Introduction to DBMS– Data and Information - Database – Database Management System – Objectives - Advantages – Components - Architecture. ER Model: Building blocks of ER Diagram – Relationship Degree – Classification – ER diagram to Tables – ISA relationship – Constraints – Aggregation and Composition – Advantages	12
II	Relational Model: CODD's Rule- Relational Data Model - Key - Integrity – Relational Algebra Operations – Advantages and limitations– Relational Calculus – Domain Relational Calculus - QBE.	12
III	Structure of Relational Database. Introduction to Relational Database Design - Objectives – Tools – Redundancy and Data Anomaly – Functional Dependency - Normalization – 1NF – 2NF– 3NF – BCNF. Transaction Processing – Database Security.	12
IV	SQL: Commands – Data types – DDL - Selection, Projection, Join and Set Operations – Aggregate Functions – DML – Modification - Truncation - Constraints – Subquery.	**12**
V	PL/SQL: Structure - Elements – Operators Precedence – Control Structure – Iterative Control - Cursors - Procedure - Function - Packages – Exceptional Handling - Triggers.	**12**
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand basic concepts of database system	PO1
2	Design a Data model and Schemas in RDBMS	PO1, PO2

3	Understand Competent in use of SQL	PO4, PO6
4	Analyze functional dependencies for designing robust Database	PO4, PO5, PO6
5	Understand basic concepts of database system	PO3, PO8
Text Book		
1	S. Sumathi, S. Esakkirajan, "Fundamentals of Relational Database Management System", Springer International Edition 2007.	
Reference Books		
2.	1. Abraham Silberchatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGrawHill 2019, 7th Edition.	
3.	2. Alexis Leon & Mathews Leon, "Fundamentals of DBMS", Vijay Nicole Publications 2014, 2nd Edition.	
Web Resources		
1.	NPTEL & MOOC courses titled Relational Database Management Systems	
2.	https://nptel.ac.in/courses/106106093/	
3.	https://nptel.ac.in/courses/106106095/	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**3**	**2**	**1**	**3**	**-**	**-**
CO 2	**-**	**-**	**1**	**-**	**2**	**2**
CO 3	**3**	**2**	**1**	**3**	**-**	**-**
CO 4	**3**	**-**	**1**	**-**	**2**	**2**
CO 5	**3**	**2**	**1**	**3**	**2**	**2**
Weightage of course contributed to each PSO	**12**	**6**	**5**	**9**	**6**	**6**

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
U23CAS101	**OFFICE AUTOMATION LAB**	Specific Elective		Y	-	-	2	2	25	75	100

Course Objective	
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.

MS-Word

1. Create a news-paper document with at least 200 words,
    a. Use margins as, top:1.5, bottom:2, left:2, right:1 inches.
    b. Use heading "Gandhi Jayanti", font size: 16, font color: red, font face: Arial Black.
    c. With first letter "dropped" (use drop cap option) of the first paragraph containing a picture at the right side
    d. Use three columns from the second paragraph onwards till the half of the page.
    e. Then use heading "Computer basics,
    f. Create paragraph using two columns till the end of the page.
2. Create a Mathematical question paper using, at least five equations 2 nd
    a. With fractions, exponents, summation function
    b. With at least one „m*n" matrix
    c. Basic mathematical and geometric operators.
3. Create a Table
    a. Use proper text formatting, page color and page border
    b. Merge the second row into one cell, then split the second row into three cells.
    c. Use proper table border and color.
    d. Insert proper content into the table with proper text formatting.
    e. Use proper table border and color, content into the table with proper text formatting.
4. Create a table using two columns,
    a. The left column contains all the shortcut keys and right side column contains the function of the short-cut keys
    b. Insert a left column using layout option. Name the heading as Serial No.
5. Create two letters with the following conditions in Ms Word and find the difference.
    a. Write a personal letter to your friend using at least 100 words and two paragraphs. The date must be in top-right corner. Use „justify" text-alignment and 1.5 line spacing for the body of the letter. Letter must contain

proper salutation and closing.

b. Use step by step mail-merge wizard to design a letter. (Mailing step by step mail merge wizard letters start from a template select template letters select proper template create new document OK

6. Create a letter, which must be sent to multiple recipients.
   a. Use Mail-Merge to create the recipient list.
   b. Use excel sheet to enter the recipient.
   c. Start the mail merge using letter and directory format.

MS – Excel

7. Create a table "Student result" with following conditions.
   a. The heading must contain, Sl. No., Name, Mark1, Mark2, Mark3, Total, average and result with manual entry.
   b. Use formulas for total and average.
   c. Find the name of the students who has secured the highest and lowest marks.
   d. Round the average to the nearest highest integer and lowest integer (use ceiling and floor function respectively).
8. Consider the problem of preparing a stationary order for the month of March. The item description, quantity and cost per item are available. The total cost per item is to be calculated and the final cost per item involves a sales tax of 2% over the total cost. The gross total and the net total are to be displayed.
9. Create a worksheet with the name, gender, attendance, assignment, midterm and final grades of five students. Find the total of the assessment marks. Students who pass need to have a total score greater than or equal to 50. Display the word "Pass" or "Fail" under a column called Description
10. Create a worksheet with minimum 10 students of 5 Course marks and alculate the Maximum mark, minimum mark, mean, median, standard deviation and variance for each Course.
11. Given the below worksheet Write appropriate text functions in excel to calculate first name, last name and email id.

Full Name	First Name	Last Name	Mail_Id
Raja Karikalan	Raja	Karikalan	Raja_Karikalan@gmail.com
Kulothunga Chozhan	Kulothunga	Chozhan	Kulothunga_Chozhan@gmail.com

Note: Use Right, Left, Len and Concatenate functions

12. Do as directed
    a. Create a notepad file as per the following fields Sl no name th1 th2 th3 th4 th5 total % grade,
    b. Import this notepad file into excel sheet using „data from text" option.
    c. Grade is calculated as, i. If %>=90, then grade A,ii. If %>=80 and =70 and =60 and =1000 with red color (use conditional formatting).

MS- Powerpoint

13. Create a power-point presentation with minimum 5 slides.
    a. The first slide must contain the topic of the presentation and name of the presentation.
    b. Must contain at least one table,
    c. Must contain at least 5 bullets, 5 numbers.

	14. Create a power-point presentation with minimum 10 slides, a. Insert at least one clip-art, one picture, b. Insert at least one audio and one video, c. Hide at least two slides 1 st 15. Create a power-point presentation with minimum 5 slides a. Use custom animation option to animate the text; the text must move left to right one line at a time, b. Use proper transition for the slides.	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Possess the knowledge on the basics of computers and its components	PO1,PO2,PO3,PO6,PO8
2	Gain knowledge on Creating Documents, spreadsheet and presentation.	PO1,PO2,PO3,PO6
3	Learn the concepts of Database and implement the Query in Database.	PO3,PO5,PO7
4	Demonstrate the understanding of different automation tools.	PO3,PO4,PO5,PO7
5	Utilize the automation tools for documentation, calculation and presentation purpose.	PO4,PO6,PO7,PO8
Text Book		
1	PeterNorton,"IntroductiontoComputers"–TataMcGraw-Hill.	
Reference Books		
1.	Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, "Microsoft 2003", Tata McGrawHill.	
Web Resources		
1.	https://www.udemy.com/course/office-automation-certificate-course/	
2.	https://www.javatpoint.com/automation-tools	

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	**2**	**2**	**2**	**3**	**3**	**1**
CO 2	**3**	**1**	**2**	**3**	**3**	**3**
CO 3	**3**	**2**	**1**	**2**	**1**	**3**
CO 4	**3**	**3**	**2**	**2**	**2**	**1**
CO 5	**2**	**2**	**1**	**3**	**1**	**3**
Weightage of course contributed to each PSO	13	10	8	13	10	11

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

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks	
									CIA	External
U23CAF101	**Structured Programming in C**	FC	Y	-	-	-	2	2	25	75

Course Objective	
LO1	To familiarize the students with the Programming basics and the fundamentals of C, Data types in C, Mathematical and logical operations.
LO2	To understand the concept using if statements and loops
LO3	This unit covers the concept of Arrays
LO4	This unit covers the concept of Functions
LO5	To understand the concept of implementing pointers.

UNIT	Details	No. of Hours	Course Objective
I	**Overview of C**: Importance of C, sample C program, C program structure, executing C program. Constants, Variables, and Data Types: Character set, C tokens, keywords and identifiers, constants, variables, data types, declarationof variables, Assigning values to variables-- -Assignment statement, declaring a variable as constant, as volatile. Operators and Expression.	6	CO1
II	**Decision Making and Branching**: Decision making with If, simple IF, IF ELSE, nested IF ELSE, ELSE IF ladder, switch,GOTO statement. **Decision Making and Looping**: While, Do-While, For, Jumps in loops.	6	CO2
III	**Arrays**: Declaration and accessing of one & two-dimensional arrays,initializing two-dimensional arrays, multidimensional arrays.	6	CO3
IV	**Functions**: The form of C functions, Return values and types, calling a function, categories of functions, Nested functions, Recursion, functions with arrays, call by value, call by reference, storage classes-character arrays and string functions	6	CO4
V	**Pointers:** definition, declaring and initializing pointers, accessing a variable through address and through pointer, pointer expressions, pointer increments and scale factor, pointers and arrays, pointers and	6	CO5

	functions, pointers and structures.			

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Remember the program structure of C with its syntax and semantics	PO1,PO3, PO5
2	Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files)	PO2,PO3,PO6,PO7
3	Apply the programming principles learnt in real-time problems	PO3,PO4 ,PO7
4	Analyze the various methods of solving a problem and choose the best method	PO4,PO5 ,PO6
5	Code, debug and test the programs with appropriate test Cases	PO7,P O8
Text Book		
1	E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010.	
Reference Books		
1.	Byron Gottfried, Schaum's Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018.	
2.	Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 199	
3.	Yashavant Kanetkar, Let Us C, Eighteenth Edition, BPB Publications,2021	
Web Resoucs		
https://codeforwin.org/		
https://www.geeksforgeeks.org/c-programming-language/		
http://en.cppreference.com/w/c		
http://learn-c.org/		
https://www.cprogramming.com/		

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**1**	**2**	**2**	**2**	**2**	**-**
CO 2	**2**	**2**	**2**	**2**	**-**	**2**
CO 3	**3**	**2**	**2**	**1**	**1**	**-**
CO 4	**3**	**2**	**2**	**1**	**-**	**1**
CO 5	**1**	**2**	**2**	**2**	**2**	**3**
Weightage of course contributed to each PSO	7	10	10	18	15	6

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

SEMESTER – II

Title of the Course/ Paper	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23CAT203	**OBJECT ORIENTED PROGRAMMING CONCEPTS USING C++**	Core	Y	-	-	-	4	5	25	75	

Course Objective	
LO1	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
LO2	Understand dynamic memory management techniques using pointers, constructor destructors, etc
LO3	Describe the concept of function overloading, operator overloading, virtual functions a polymorphism
LO4	Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
LO5	Demonstrate the use of various OOPs concepts with the help of programs

UNIT	**Details**	**No. of Hour**
I	Introduction to C++ - key concepts of Object-Oriented Programming – Advantages – Object Oriented Languages – I/O in C++ - C++ Declarations. Control Structures : - Decision Making and Statements : If ..else, jump, goto, break, continue, Switch case statements - Loops in C++ :for, while, do - functions in C++ - inline functions – Function Overloading.	15
II	Classes and Objects: Declaring Objects – Defining Member Functions – Static Member variables and functions – array of objects –friend functions – Overloading member functions – Bit fields and classes – Constructor and destructor with static members.	15
III	Operator Overloading: Overloading unary, binary operators – Overloading Friend functions –type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal, Hybrid, Multi path inheritance – Virtual base Classes – Abstract Classes.	15
IV	Pointers – Declaration – Pointer to Class , Object – this pointer – Pointers to derived classes and Base classes – Arrays – Characteristics – array of classes – Memory models – new and delete operators – dynamic object – Binding,	15

	Polymorphism and Virtual Functions.	
V	Files – File stream classes – file modes – Sequential Read / Write operations – Binary and ASCII Files – Random Access Operation – Templates – Exception Handling - String – Declaring and Initializing string objects – String Attributes – Miscellaneous functions .	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	Upon completion of the course the students would be able to:	
1	Remember the program structure of C with its syntax and semantics	PO1,PO6
2	Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files)	PO2
3	Apply the programming principles learnt in real-time problems	PO4 ,PO7
4	Analyze the various methods of solving a problem and choose the best method	PO6
5	Code, debug and test the programs with appropriate test cases	PO7,PO8
Text Book		
1	E. Balagurusamy, "Object-Oriented Programming with C++", TMH 2013, 7th Edition.	
Reference Books		
1.	Ashok N Kamthane, "Object-Oriented Programming with ANSI and Turbo C++", Pearson Education 2003.	
2.	Maria Litvin& Gray Litvin, "C++ for you", Vikas publication 2002.	
Web Resources		
1.	https://alison.com/course/introduction-to-c-plus-plus-programming	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**3**	**2**	**1**	**3**	**-**	**-**
CO 2	**-**	**-**	**1**	**-**	**2**	**2**
CO 3	**3**	**2**	**1**	**3**	**-**	**-**
CO 4	**3**	**-**	**1**	**-**	**2**	**2**
CO 5	**3**	**2**	**1**	**3**	**2**	**2**
Weightage of course contributed to each PSO	**12**	**6**	**5**	**9**	**6**	**6**

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

Title of the Course/ Paper	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23CAP204	**C++ PROGRAMMING LAB**	Core	-	-	Y	-	4	5	25	75	100
Course Objective											
LO1	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects										
LO2	Understand dynamic memory management techniques using pointers, constructors, destructors, etc										
LO3	Describe the concept of function overloading, operator overloading, virtual functions and polymorphism										
LO4	Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming										
LO5	Demonstrate the use of various OOPs concepts with the help of programs										

S. No.	Details
1	Write a C++ program to demonstrate function overloading, Default Arguments and Inline function.
2	Write a C++ program to demonstrate Class and Objects
3	Write a C++ program to demonstrate the concept of Passing Objects to Functions
4	Write a C++ program to demonstrate the Friend Functions.
5	Write a C++ program to demonstrate the concept of Passing Objects to Functions
6	Write a C++ program to demonstrate Constructor and Destructor
7	Write a C++ program to demonstrate Unary Operator Overloading
8	Write a C++ program to demonstrate Binary Operator Overloading
9	Write a C++ program to demonstrate: • Single Inheritance • Multilevel Inheritance • Multiple Inheritance • Hierarchical Inheritance

	• Hybrid Inheritance
10	Write a C++ program to demonstrate Virtual Functions.
11	Write a C++ program to manipulate a Text File.
12	Write a C++ program to perform Sequential I/O Operations on a file.
13	Write a C++ program to find the Biggest Number using Command Line Arguments
14	Write a C++ program to demonstrate Class Template
15	Write a C++ program to demonstrate Function Template.
16	Write a C++ program to demonstrate Exception Handling.

Course Code	Course Name	Category	L	T	P	S	Credits	Inst.	Marks		
									CIA	External	Total
U23CAE22A	Graph Theory and Its **Applications**	Specific Elective	Y	-	-	-	2	2	25	75	100

Course Objective	
LO1	To acquire knowledge of different types of graphs
LO2	To understand different Models of a graph
LO3	To understand how to solve different real life problems
LO4	To understand many techniques to solve a particular problem
LO5	To understand directed graphs.

UNIT	Details	No. of Hours	Course Objective
I	**Unit-I: Graphs:** Definition of Graph–Examples for Graph- various definitions in Graph – Pictorial representation - sub graphs definition – examples- Isomorphism between Graphs – degree of Graph - Walks and connected graphs-cycles in graphs –cut vertices and cut edges definition and examples ..	12	C1
II	**Unit-II: Eulerian Graphs** Introduction of Eulerian graphs - definition and examples of Eulerian graphs - Fleury's Algorithm for Graph–	12	C2
III	**Unit-III: Hamiltonian Graphs& Bipartite Graphs:** Introduction of Hamiltonian Graphs – Definition and example of Hamiltonian Graphs -Weighted graphs definition and examples .Introduction and definition of – algorithm and examples	12	C3
IV	**Unit-IV: Trees** Trees.- Definition –Example-Incident matrix in Graph algorithm and examples -adjacent matrix in Graph algorithm and examples - path matrix in Graph algorithm and examples and circuit matrix in Graph	12	C4
V	**Unit-V: Planar Graphs:** Defining of Planer graphs – Examples for Planer graphs - Euler's Formula for: Planar Graph –Platonic solids-Dual of a plane graphs	12	C5

	– definition and examples of dual of a plane graph – Characterization of planer graphs.		
	Total	**60**	

Text Book:

1. **S.A.Choudum**, —A first Course in Graph Theory‖, Macmillan india limited,1999.

Reference Books:

1. **Arumugam S and Thangapandi Issac** ,‖Graph theory‖, Scitech Publications Pvt ltd, Edition 2014.
2. **S.A.Choudum**, —A first Course in Graph Theory‖, Macmillan India limited, 2007.

Course Outcome:

On the successful course completion, students will be able to		Cognitive Level
CO1	Remember and understand the theoretical knowledge of graph theory to solve problems.	K1,K2
CO2	Understand theories and concepts to test and validate intuition and independent mathematical thinking in problem solving.	K2
CO3	Apply networks using the main concepts of graph theory.	K3
CO4	Definitions in graph theory to Analyze examples and to distinguish examples from non-example.	K4
CO5	coherent and technically accurate manner.	K5

K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5- Evaluate; K6–Create

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	M	M	M	S	S	M	M	M
CO2	S	S	M	M	M	S	M	S	S	M
CO3	S	M	S	M	M	M	M	M	S	S
CO4	S	M	M	S	M	S	S	M	S	S
CO5	S	S	M	M	M	M	S	M	S	S

*S-Strong;M-Medium;L-Low

U23CAS202 – SEC-2 – Soft Skills (Common Paper)

Title of the Course/ Paper	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	WEB DESIGNING LAB										
	Course Objective										
LO1	Understand the basics of HTML and its components										
LO2	Understand and apply the concepts of XML and DHTML										
LO3	To study about the Graphics in HTML										
LO4	Understand the concept of JavaScript										
LO5	To identify and understand the goals and objectives of the Ajax										
	Content										

HTML

1. Basic Html to display message with headings(h1-h6,Paragraphs & formatting tags).
2. Design a Time table using Row span and column span.
3. List the varies Confectionary Item using order and Unorder lists.
4. To create a web page using frames
5. To create a web page to show the block level elements and texts level elements (HR tags).
6. To create a Admission form using HTML.

CSS PROGRAMS

7. Link an external CSS file to an HTML document and style headings, paragraphs and lists.
8. Apply different border styles, margins and padding to a div element.
9. Changing font color, background color and adding a border to the elements.
10. Using different type of CSS selectors(elements, class, ID)

DHTML

11. Create the button that, when clicked, changes the style(eg: color, font, size) of a specific HTML element.
12. Develop a program that dynamically adds content (eg. New elements, text)
13. Create a web page with a button that changes the color of the text element when

	clicked. 14. Build a dynamic image gallery where users can navigate through images using DHTML techniques. 15. Create a real-time clock that updates dynamically without refreshing the entire page. **XML PROGRAMS** 16. Create an XML document with root element and a few child elements. 17. Apply CSS styles to an XML document to improve its presentation. 18. Create an XSL Style sheet to transform an XML Document. **JAVASCRIPT** 19. Write a java script program to display on alert box with a customized message. 20. Write a Java script program to Add two numbers and display the result. 21. Implement a program that checks if a given number is even or odd. 22. Write a java script code to increment and display the visit count. 23. Add a button to an HTML page and use JavaScript to show selected items when the button is clicked. 24. Create a simple form for Resume Building. (Use java script to validate and display the message)

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Develop working knowledge of HTML	PO1, PO3, PO6, PO8
2	Ability to Develop and publish Web pages using Hypertext Markup Language (HTML).	PO1,PO2,PO3,PO6
3	Ability to optimize page styles and layout with Cascading Style Sheets (CSS).	PO3, PO5
4	Ability to develop a java script	PO1, PO2, PO3, PO7
5	An ability to develop web application using Ajax.	P02, PO6, PO7

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**3**	**3**	**-**	**2**	**1**	**1**
CO 2	**3**	**3**	**-**	**2**	**-**	**1**
CO 3	**3**	**3**	**-**	**2**	**2**	**1**
CO 4	**3**	**3**	**-**	**2**	**-**	**1**

CO 5	**3**	**3**	**3**	**2**	**-**	**1**
Weightage of course contributed to each PSO	15	15	3	10	3	4

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

SECOND YEAR

Semester III

Title of the Course/ Paper	Subject Name	Category	L	T	P	S	Credits	Inst.	Marks		
									CIA	External	Total
U23CAT305	**DATA STRUCTURES AND ALGORITHMS**	Core	Y	-	-	-	5	5	25	75	100

Course Objective	
LO1	To understand the concepts of ADTs
LO2	To learn linear data structures-lists, stacks, queues
LO3	To learn Tree structures and application of trees
LO4	To learn graph structures and and application of graphs
LO5	To understand various sorting and searching

UNIT	**Details**	**No. of Hours**
I	Abstract Data Types (ADTs)- List ADT-array-based implementation-linked list implementation-singly linked lists-circular linked lists-doubly-linked lists-applications of lists-Polynomial Manipulation- All operations-Insertion-Deletion-Merge-Traversal	15
II	Stack ADT-Operations- Applications- Evaluating arithmetic expressions – Conversion of infix to postfix expression-Queue ADT-Operations-Circular Queue- Priority Queue- deQueue applications of queues.	15
III	Tree ADT-tree traversals-Binary Tree ADT-expression trees-applications of trees-binary search tree ADT- Threaded Binary Trees-AVL Trees- B-Tree- B+ Tree – Heap-Applications of heap.	15
IV	Definition- Representation of Graph- Types of graph-Breadth first traversal – Depth first traversal-Topological sort- Bi-connectivity – Cut vertex- Euler circuits-Applications of graphs.	15
V	Searching- Linear search-Binary search-Sorting-Bubble sort-Selection sort-Insertion sort-Shell sort-Radix sort-Hashing-Hash functions-Separate chaining- Open Addressing-Rehashing Extendible Hashing	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	

1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation	PO1,PO6
2	Understand basic data structures such as arrays, linked lists, stacks and queues	PO2
3	Describe the hash function and concepts of collision and its resolution methods	PO2,PO4
4	Solve problem involving graphs, trees and heaps	PO6,PO8
5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	PO7
Text Book		
1	1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education 2014, 4th Edition.	
2	Reema Thareja, "Data Structures Using C", Oxford Universities Press 2014, 2nd Edition	
Reference Books		
1.	Thomas H.Cormen, Chales E.Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", McGraw Hill 2009, 3rd Edition.	
2.	Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education 2003	
Web Resources		
1.	NPTEL & MOOC courses titled Data Structures	
2.	https://nptel.ac.in/courses/106106127/	

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	**3**	**3**	**3**	**-**	**1**	**-**
CO 2	**1**	**2**	**1**	**-**	**-**	**-**
CO 3	**3**	**1**	**2**	**1**	**-**	**-**
CO 4	**2**	**2**	**1**	**-**	**-**	**1**
CO 5	**3**	**1**	**1**	**-**	**-**	**-**
Weightage of course contributed to each PSO	12	9	8	1	1	1

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

Title of the Course/ Paper	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23CAP306	**DATA STRUCTURES AND ALGORITHMS LAB using C++**	Core	-	-	Y	-	5	5	25	75	100

Course Objective	
LO1	To understand the concepts of ADTs
LO2	To learn linear data structures-lists, stacks, queues
LO3	To learn Tree structures and application of trees
LO4	To learn graph structures and and application of graphs
LO5	To understand various sorting and searching

Sl. No	**Details**	**No. of Hours**
1.	Write a program to implement the List ADT using arrays and linked lists.	
2.	Write a programs to implement the following using a singly linked list. • Stack ADT • Queue ADT	
3.	Write a program that reads an infix expression, converts the expression to postfix form and then evaluates the postfix expression (use stack ADT).	
4.	Write a program to implement priority queue ADT.	
5.	Write a program to perform the following operations: • Insert an element into a binary search tree. • Delete an element from a binary search tree. • Search for a key element in a binary search tree.	
6.	Write a program to perform the following operations • Insertion into an AVL-tree • Deletion from an AVL-tree	
7.	Write a programs for the implementation of BFS and DFS for a given graph.	
	Write a programs for implementing the following searching methods: • Linear search • Binary search.	

8		
9.	Write a programs for implementing the following sorting methods: • Bubble sort • Selection sort • Insertion sort • Radix sort.	
	Total	

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation	PO1,PO4,PO5
2	Understand basic data structures such as arrays, linked lists, stacks and queues	PO1, PO4,PO8
3	Describe the hash function and concepts of collision and its resolution methods	PO1,PO3,PO6
4	Solve problem involving graphs, trees and heaps	PO3,PO4
5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	PO1,PO5,PO6

Text Book	
1	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education 2014, 4th Edition.
2	Reema Thareja, "Data Structures Using C", Oxford Universities Press 2014, 2nd Edition
Reference Books	
1	Thomas H.Cormen, Chales E.Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", McGraw Hill 2009, 3rd Edition
2.	Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education 2003
Web Resources	
1.	NPTEL & MOOC courses titled Data Structures
2.	https://nptel.ac.in/courses/106106127/

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**3**	**3**	**3**	**2**	**1**	**-**
CO 2	**1**	**2**	**1**	**-**	**-**	**2**
CO 3	**3**	**1**	**2**	**1**	**-**	**-**
CO 4	**2**	**2**	**1**	**2**	**3**	**1**
CO 5	**3**	**2**	**1**	**-**	**-**	**-**
Weightage of course contributed to each PSO	12	10	8	5	4	4

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
U23CAE33A	Accounting and Financial Management	Elective	Y	-	-	-	3	4	25	75	100

Course Objectives	
LO1	To know a brief of accounting procedures.
LO2	To know about the preparation of final Accounts.
LO3	To create knowledge of accessing the account information.
LO4	Understanding the need of Accounts of an organization for decision making.

UNIT I: ACCOUNTING INFORMATION AND DOUBLE ENRTY

Origin and Growth of accounting: Meaning – objectives & Classifications, uses of accounting information – Limitations. Double Entry System: Definitions – Rules, Merits & Demerits

UNIT II: **JOURNAL AND LEDGERS**

Journal – Ledger – Posting Journal to Ledger.

UNIT III: BALACE SHEET

Final accounts of Sole Trading Concerns: Trail Balance – Profit and Loss account – Balance Sheet.

UNIT IV: FINACIAL MANAGEMENT

Introduction to Financial Management – Origin – Scope – Types.

UNIT V: FINANCIAL STATEMENT ANALYSIS

Financial statement analysis & interpretation: Accounting ratio their significance, Utility & Limitations, Analysis for Inequality, Profitability & Solvency.

TEXT BOOK:

1. T.S.Grewal, "Double entry book keeping", 2019.
2. R.L.Gupta& M.Radhasamy, "Advanced Accountancy", 2013.
3. M.A.Arulanantham& S.Raman, "Advanced Accountancy" , 2016.
4. S.N.Maheswari, "Advanced Accountancy" - 2019

5. M.C.Shukhala&T.S.Grewal, "Advanced Accountancy", 2016.
REFERENCE BOOKS:
1. R.L.Gupta& Radha Swamy, "Accounting", Sultan Chand & Sons, 1993. 2. Khan & Jain, "Financial Management", McGraw Hill Companies, 2007.
WEB RESOURCES:
1. https://www.educba.com/accounting-vs-financial-management/ 2. https://talentedge.com/articles/difference-financial-management-financial-accounting/ 3. https://www.investopedia.com/ask/answers/041015/how-does-financial-accounting-differ-managerial-accounting.asp

CO	COURSE OUTCOMES	CL
1.	Know about the accounting information and double entry system.	**K2, K3,**
2.	Understand about how to enter the data in Journal and Ledgers	**K2, K3**
3	Understand about to prepare the balance sheet	**K2, K3**
4.	Gain more knowledge about financial management.	**K2, K3**
5.	Gain more knowledge about financial management and analyse it.	**K2, K3, K4**

MAPPING OF COS WITH POS AND PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	3	3	3	3	3	2	2	3
CO2	2	2	3	2	3	2	3	3	2	2	2
CO3	2	2	3	3	3	2	3	3	2	3	2
CO4	3	2	3	2	3	2	2	3	2	2	2
CO5	2	3	2	2	3	3	3	3	3	2	2

S – Strongly Correlating M- Moderately Correlating

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23CAS304	SEC4-Database Management System Lab	Core	Y	-	-	-	1	2	25	75	100

Course Objective			
LO1	To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.		
LO2	To understood the concepts of data base management system, design simple Database models		
LO3	To learn and understand to write queries using SQL, PL/SQL.		
LO4	To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.		
LO5	To understood the concepts of data base management system, design simple Database models		
	List of Exercises:	**No. of Hours**	**Course Objective**
II	***I. SQL*** 1. DDLCOMMANDS 2. DMLCOMMANDS 3. TCLCOMMANDS ***II. PL/SQL*** 4. FIBONACCI SERIES 5. FACTORIAL 6. STRING REVERSE 7. SUM OF SERIES 8. TRIGGER ***III. CURSOR*** 9. STUDENT MARK ANALYSIS USING CURSOR		

	IV. APPLICATION 10. LIBRARY MANAGEMENTSYSTEM 11. STUDENT MARK ANALYSIS		
	Total		

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models.	PO1
2	Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model.	PO1, PO2
3	Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML)	PO4, PO6
4	Classify the different functions and various join operations and enhance the knowledge of handling multiple tables.	PO4, PO5, PO6
5	Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions	PO3, PO8

Text Book	
1	Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition
2	Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016
Reference Books	
1.	Abraham Silberschatz, Henry F.Korth and S.Sudarshan,"Database System Concepts", McGraw Hill International Publication ,VI Edition
2.	Shio Kumar Singh , "Database Systems ",Pearson publications ,II Edition
Web Resources	

1.	Web resources from NDL Library, E-content from open-source libraries

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**3**	**3**	**3**	**3**	**1**	**2**
CO 2	**2**	**3**	**3**	**3**	**1**	**2**
CO 3	**2**	**3**	**3**	**3**	**1**	**2**
CO 4	**2**	**2**	**2**	**3**	**1**	**2**
CO 5	**2**	**3**	**3**	**3**	**1**	**2**
Weightage of course contributed to each PSO	11	14	14	15	5	10

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

SEMESTER IV

Subject Code	Subject Name	Category	L	T	P	S	Credit	Hr	Marks

									CIA	**External**	**Total**
U23CAT407 Core Theory4	**Programming IN JAVA**	Core	Y	-	-	-	5	5	25	75	100

Course Objectives	
LO1	To provide fundamental knowledge of object-oriented programming
LO2	To equip the student with programming knowledge in Core Java from the basics up.
LO3	To enable the students to use AWT controls, Event Handling and Swing for GUI.
LO4	To provide fundamental knowledge of object-oriented programming.
LO5	To equip the student with programming knowledge in Core Java from the basics up.

UNIT	**Details**	**No. of Hours**	**Course Objectives**
I	**Introduction:** Review of Object Oriented concepts – History of Java – Java buzzwords – JVM architecture – Data types - Variables - Scope and life time of variables - arrays - operators – control statements - type conversion and casting - simple java program - constructors - methods - Static block - Static Data – Static Method String and String Buffer Classes.	15	CO1
II	**Inheritance**: Basic concepts - Types of inheritance - Member access rules - Usage of this and Super key word - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final keyword. **Packages**: Definition-Access Protection –Importing Packages. **Interfaces**: Definition–Implementation–Extending Interfaces. **Exception Handling**: *try – catch - throw - throws – finally –* Built-in exceptions - Creating own Exception classes.	15	CO2
III	**Multithreaded Programming**: Thread Class - Runnable	15	CO3

	interface –Synchronization–Using synchronized methods– Using synchronized statement- Interthread Communication –Deadlock. **I/O Streams:** Concepts of streams - Stream classes- Byte and Character stream - Reading console Input and Writing Console output - File Handling.		
IV	**AWT Controls:** The AWT class hierarchy - user interface components- Labels - Button - Text Components - Check Box - Check Box Group - Choice - List Box - Panels – Scroll Pane - Menu - Scroll Bar. Working with Frame class - Colour - Fonts and layout managers. **Event Handling:** Events - Event sources - Event Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events - Adapter classes - Inner classes	15	CO4
V	**Swing:** Introduction to Swing - Hierarchy of swing components. Containers - Top level containers - JFrame - JWindow - JDialog - JPanel - JButton - JToggleButton - JCheckBox - JRadioButton - JLabel, JTextField - JTextArea - JList - JComboBox - JScrollPane.	15	CO5
	Total	**75**	

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic Object-oriented concepts. Implement the basic constructs of Core Java.	PO1, PO2, PO6
CO2	Implement inheritance, packages, interfaces and exception handling of Core Java.	PO2, PO3, PO8
CO3	Implement multi-threading and I/O Streams of Core Java	PO1, PO3, PO7
CO4	Implement AWT and Event handling.	PO2, PO6
CO5	Use Swing to create GUI.	PO1, PO3, PO8

Text Books:

1.	Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010
2.	Gary Cornell, *Core Java 2 Volume I – Fundamentals,* Addison Wesley, 1999

References :	
1.	Head First Java, O'Rielly Publications,
2.	Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010
Web Resources	
1.	https://javabeginnerstutorial.com/core-java-tutorial
2.	http://docs.oracle.com/javase/tutorial/
3.	https://www.coursera.org/

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	**3**	**2**	**-**	**2**	**2**	**2**
CO 2	**3**	**1**	**2**	**1**	**2**	**2**
CO 3	**1**	**-**	**2**	**2**	**2**	**2**
CO 4	**2**	**2**	**2**	**2**	**2**	**2**
CO 5	**1**	**2**	**-**	**2**	**2**	**2**
Weightage of course contributed to each PSO	10	7	6	9	10	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**
U23CAP408	**Programming in java lab**	Core	-	-	y	-	5	5	25	75	100
Course Objective											

LO1	To provide fundamental knowledge of object-oriented programming.	
LO2	To equip the student with programming knowledge in Core Java from the basics up.	
LO3	To enable the students to know about Event Handling .	
LO4	To enable the students to use String Concepts.	
LO5	To equip the student with programming knowledge in to creat GUI using AWT controls.	
UNIT	**Details**	
1	Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer	
2	Write a Java program to multiply two given matrices.	
3	Write a Java program that displays the number of characters, lines and words in a text	
4	Generate random numbers between two given limits using Random class and print messages according to the range of the value generated.	
5	Write a program to do String Manipulation using CharacterArray and perform the following string operations: a. String length b. Finding a character at a particular position c. Concatenating two strings	
6	Write a program to perform the following string operations using String class: a. String Concatenation b. Search a substring c. To extract substring from given string	
7	Write a program to perform string operations using String Buffer class: a. Length of a string	

	b. Reverse a string c. Delete a substring from the given string	
8	Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.	
9	Write a threading program which uses the same method asynchronously to print the numbers 1to10 using Thread1 and to print 90 to100 using Thread2.	
10	Write a program to demonstrate the use of following exceptions. a. Arithmetic Exception b. Number Format Exception c. Array Index Out of BoundException d. Negative Array Size Exception	
11	Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes	
12	Write a program to accept a text and change its size and font. Include bold italic options. Use frames and controls.	
13	Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes).	
14	Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions	

	like divide by zero.	
15	Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "stop" or "ready" or "go" should appear above the buttons in a selected color. Initially there is no message shown.	
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the basic Object-oriented concepts. Implement the basic constructs of Core Java.	PO1
2	Implement inheritance, packages, interfaces and exception handling of Core Java.	PO1, PO2
3	Implement multi-threading and I/O Streams of Core Java	PO4, PO6
4	Implement AWT and Event handling.	PO4, PO5, PO6
5	Use Swing to create GUI.	PO3, PO8

Text Book	
1	Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010.
2.	Gary Cornell, *Core Java 2 Volume I – Fundamentals*, Addison Wesley, 1999.
Reference Books	
1.	Head First Java, O'Rielly Publications,
2.	Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010.
Web Resources	
1.	https://www.w3schools.com/java/
2.	http://java.sun.com
3.	http://www.afu.com/javafaq.html

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**3**	**2**	**1**	**3**	**2**	**3**
CO 2	**3**	**2**	**1**	**3**	**1**	**3**
CO 3	**3**	**2**	**1**	**3**	**2**	**3**
CO 4	**3**	**2**	**1**	**3**	**2**	**3**
CO 5	**3**	**2**	**1**	**3**	**2**	**3**
Weightage of course contributed to each PSO	15	10	5	15	9	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
U23CAE44A	Statistical Methods & its applications	Elective	Y	-	-	-	3	3	25	75	100

Course Objectives	
LO1	To have a broad background in Statistics fundamentals and techniques.
LO2	To recognize the importance and value of mathematical and statistical thinking, training, and approach to problem solving, on a diverse variety of disciplines.
LO3	To become familiar with a variety of examples where mathematics or statistics helps accurately explain abstract or physical phenomena.

LO4	To understand the probability concept.

UNIT I: ORGANIZING DATA

Organizing data: Raw data-Frequency distribution-percentage- bar graph- pie graph-histogram-cumulative frequency distributions- Ogives.

UNIT II: **LINEAR PROGRAMMING PROBLEMS**

Frequency distribution: measure of central tendency - Arithmetic Mean – Median – Mode – Geometric Mean – Harmonic Mean.

UNIT III: SIMPLEX METHOD

Correlation- Regression – Rank Correlation- Binomial Distribution – Poison distribution

UNIT IV: ASSIGNMENT PROBLEM

Experiment – outcomes - sample space – compound events- probability- marginal and continuous probability- mutually exclusive events- Baye's Theorem – permutation and combination.

UNIT V: TRANSPOTATION PROBLEM

χ^2 – Distribution - χ^2 Test - χ^2 test to test the goodness of fit – Test for independence of attributes.

TEXT BOOK:

1. S.Arumugam Issac, "Statistics", New Gamma Publishing House, Palayamkottai, 2009.
2. Larry.J.Stephens, "Beginning statistics", Schaum's Outline Series, McGraw-Hill Education; 2nd edition, 2006

REFERENCE BOOKS:

1. S.C.Gupta, V.K.Kapoor, "Element of Mathematical Statistics", Sultan Chand & Sons, 2020.

WEB RESOURCES:

1. https://learn.g2.com/statistical-analysis-methods
2. https://www.analyticsvidhya.com/blog/2017/02/lintroductory-guide-on-linear-programming-explained-in-simple-english/
3. https://www.britannica.com/topic/simplex-method
4. https://www.geeksforgeeks.org/transportation-problem-set-1-introduction/

S.No.	COURSE OUTCOMES	CL
CO1	Understand the concepts of mean, median, mode	**K2, K3,**
CO2	Discuss about the Regression and Correlation to solve problems	**K2, K3**
CO3	Describe the solution methods using Bayes theorem.	**K2, K3**
CO4	Evaluate problems using various distributions	**K2, K3**
CO5	Understand the probability concepts	**K2, K3, K4**

MAPPING OF COS WITH POS AND PSOS :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	2	2	2	2	3	3	2
CO2	3	3	2	3	2	3	2	2	3	3	3
CO3	3	3	2	2	2	3	2	2	3	2	3
CO4	2	3	2	3	2	S	3	2	3	3	3
CO5	S	2	3	3	2	2	2	2	2	3	3

S – Strongly Correlating **M- Moderately Correlating**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23CAS405	Excel for Data Analytics Lab	Specific Elective	Y	-	-	-	2	2	25	75	100

Course Objective	
LO1	Handle large amounts of data
LO2	Aggregate numeric data and summarize into categories and subcategories
LO3	Filtering, sorting, and grouping data or subsets of data
LO4	Create pivot tables to consolidate data from multiple files
LO5	Presenting data in the form of charts and graphs

UNIT	Details	No. of Hours	Course Objective
I	Basics of Excel- Customizing common options- Absolute and relative cells- Protecting and un-protecting worksheets and cells- Working with Functions - Writing conditional expressions - logical functions - lookup and reference functions- VlookUP with Exact Match, Approximate Match- Nested VlookUP with Exact Match- VlookUP with Tables, Dynamic Ranges- Nested VlookUP with Exact Match- Using VLookUP to consolidate Data from Multiple Sheets	6	C1
II	Data Validations - Specifying a valid range of values - Specifying a list of valid values- Specifying custom validations based on formula - Working with Templates Designing the structure of a template- templates for standardization of worksheets - Sorting and Filtering Data - Sorting tables- multiple-level sorting- custom sorting- Filtering data for selected view - advanced filter options- Working with Reports Creating subtotals- Multiple-level subtotal.	6	C2
III	Creating Pivot tables Formatting and customizing Pivot tables-	6	C3

	advanced options of Pivot tables- Pivot charts- Consolidating data from multiple sheets and files using Pivot tables- external data sources- data consolidation feature to consolidate data- Show Value As % of Row, % of Column, Running Total, Compare with Specific Field- Viewing Subtotal under Pivot- Creating Slicers.		
IV	More Functions Date and time functions- Text functions- Database functions- Power Functions - Formatting Using auto formatting option for worksheets- Using conditional formatting option for rows, columns and cells- What If Analysis - Goal Seek- Data Tables- Scenario Manager.	6	C4
V	Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together- Secondary Axis in Graphs- Sharing Charts with PowerPoint / MS Word, Dynamically- New Features Of Excel Sparklines, Inline Charts, data Charts- Overview of all the new features.	6	C5
	Total	**30**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn No-SQL databases and management.	PO3, PO8

Text Book	
1	Data Analysis Using SQL and Excel," Gordon S. Linoff", 2008 by Wiley Publishing, Inc., Indianapolis, Indiana Published simultaneously in Canada.
2	Microsoft Excel Pivot Table Data Crunching (Office 2021 and Microsoft 365), " Bill Jelen" "Published with the authorization of Microsoft Corporation by: Pearson Education

Web Resources	
1.	https://www.simplilearn.com
2	https://www.javatpoint.com
3	https://www.w3schools.com

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**2**	**2**	**2**	**1**	**3**	**-**
CO 2	**3**	**2**	**2**	**1**	**1**	**3**
CO 3	**3**	**2**	**1**	**2**	**1**	**3**
CO 4	**3**	**3**	**2**	**2**	**2**	**1**
CO 5	**3**	**2**	**1**	**3**	**1**	**3**
Weightage of course contributed to each PSO	14	11	8	9	8	10

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

THIRD YEAR

SEMESTER V

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23CAT509	**Operating Systems**	Core	Y	-	-	-	4	5	25	75	100

Course Objective	
LO1	Understanding the design of the Operating System
LO2	Imparting knowledge on CPU scheduling, Process and Memory Management.
LO3	To code specialized programs for managing overall resources and operations of the computer.
LO4	To study about the concept of Job and processor scheduling
LO5	To learn about te concept of memory organization and multiprogramming

UNIT	Details	No. of	Course

		Hours	Objective
	Introduction: operating system, history (1990s to 2000 and beyond), distributed computing, parallel computation. **Process concepts:** definition of process, process states-Life cycle of a process, process management- process state transitions, process control block(PCB), process operations , suspend and resume, context switching, Interrupts -Interrupt processing, interrupt classes, Inter process communication-signals, message passing.	15	CO1
II	**Asynchronous concurrent processes:** mutual exclusion-critical section, mutual exclusion primitives, implementing mutual exclusion primitives, Peterson's algorithm, software solutions to the mutual Exclusion Problem-, n-thread mutual exclusion- Lamports Bakery Algorithm. Semaphores – Mutual exclusion with Semaphores, thread synchronization with semaphores, counting semaphores, implementing semaphores. **Concurrent programming:** monitors, message passing	15	CO2
III	**Deadlock and indefinite postponement:** Resource concepts, four necessary conditions for deadlock, deadlock prevention, deadlock avoidance and Dijkstra's Banker's algorithm, deadlock detection, deadlock recovery.	15	CO3
IV	**Job and processor scheduling:** scheduling levels, scheduling objectives, scheduling criteria, preemptive vs non-preemptive scheduling, interval timer or interrupting clock, priorities, scheduling algorithms- FIFO scheduling, RR scheduling, quantum size, SJF scheduling, SRT scheduling, HRN scheduling, multilevel feedback queues, Fair share scheduling.	15	CO4
V	**Real Memory organization and Management**:**:** Memory organization, Memory management, Memory hierarchy, Memory management strategies, contiguous vs non-contiguous memory allocation, single user contiguous memory allocation, fixed partition multiprogramming, variable partition multiprogramming, Memory swapping **Virtual Memory organization:** virtual memory basic	15	CO5

	concepts, multilevel storage organization, block mapping, paging basic concepts, segmentation, paging/segmentation systems. **Virtual Memory Management:** Demand Paging, Page replacement strategies		
	Total	**75**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Define the fundamentals of OS and identify the concepts relevant to process , process life cycle, Scheduling Algorithms, Deadlock and Memory management	PO1
2	know the critical analysis of process involving various algorithms, an exposure to threads and semaphores	PO1, PO2
3	Have a complete study about Deadlock and its impact over OS. Knowledge of handling Deadlock with respective algorithms and measures to retrieve from deadlock. .	PO4, PO6
4	Have complete knowledge of Scheduling Algorithms and its types.	PO4, PO5, PO6
5	understand memory organization and management	PO3, PO8

Text Book	
1	H.M. Deitel, Operating Systems, Third Edition, Pearson Education Asia, 2011
Reference Books	
1.	William Stallings, Operating System: Internals and Design Principles, Seventh Edition, Prentice-Hall of India, 2012.
2.	A. Silberschatz, and P.B. Galvin., Operating Systems Concepts, Nineth Edition, John Wiley &Sons(ASIA) Pte Ltd.,2012

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	**3**	**-**	**1**	**2**	**-**	**1**
CO 2	**2**	**3**	**1**	**2**	**-**	**1**

CO 3	**3**	**2**	**-**	**3**	**-**	**1**
CO 4	**1**	**3**	**1**	**1**	**3**	**2**
CO 5	**3**	**-**	**1**	**3**	**2**	**1**
Weightage of course contributed to each PSO	12	8	4	11	5	6

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**
U23CAT510	**ASP .Net Programming**	Core	Y	-	-	-	4	5	25	75	100

Course Objective	
LO1	To identify and understand the goals and objectives of the .NET framework and ASP.NET with C# language.
LO2	To develop ASP.NET Web application using standard controls.
LO3	To implement file handling operations.
LO4	To handles SQL Server Database using ADO.NET.
LO5	Understand the Grid view control and XML classes.

UNIT	**Details**	**No. of Hours**	**Course Objective**

I	Overview of .NET framework: Common Language Runtime (CLR), Framework Class Library- C# Fundamentals: Primitive types and Variables – Operators - Conditional statements -Looping statements – Creating and using Objects – Arrays – String operations.	15	C1
II	Introduction to ASP.NET - IDE-Languages supported Components -Working with Web Forms – Web form standard controls: Properties and its events – HTML controls -List Controls: Properties and its events.	15	C2
III	Rich Controls: Properties and its events – validation controls: Properties and its events– File Stream classes - File Modes – File Share – Reading and Writing to files – Creating, Moving, Copying and Deleting files – File uploading.	15	C3
IV	ADO.NET Overview – Database Connections – Commands – Data Reader - Data Adapter - Data Sets - Data Controls and its Properties – Data Binding	15	C4
V	Grid View control: Deleting, editing, Sorting and Paging. XML classes – Web form to manipulate XML files - Website Security - Authentication - Authorization – Creating a Web application.	15	C5
	Total	**60**	

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Develop working knowledge of C# programming constructs and the .NET Framework	PO1, PO2, PO6
2	To develop a software to solve real-world problems using ASP.NET	PO2, PO3, PO8
3	To Work On Various Controls Files	PO1, PO3, PO7
4	To create a web application using MicrosoftADO.NET.	PO2, PO6
5	To develop web applications using XML	PO1, PO3, PO8

Text Book	
1	Svetlin Nakov,Veselin Kolev& Co, Fundamentals of Computer Programming with C#,Faber publication,2019.
2	Mathew, Mac Donald, The Complete Reference ASP.NET, Tata McGraw-Hill,2015.
Reference Books	
1.	Herbert Schildt, The Complete Reference C#.NET, TataMcGraw-Hill,2017.
2.	Kogent Learning Solutions, C# 2012 Programming Covers .NET 4.5 Black Book, Dreamtech pres,2013.
3.	Anne Boehm, Joel Murach, Murach's C# 2015, Mike Murach& Associates Inc.2016.
4.	DenielleOtey, Michael Otey, ADO.NET: The Complete reference, McGrawHill,2008.
5.	Matthew MacDonald, Beginning ASP.NET 4 in C# 2010,APRESS,2010.
Web Resources	
1.	https://www.geeksforgeeks.org/introduction-to-net-framework/
2.	https://www.javatpoint.com/net-framework

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**3**	**1**	**2**	**2**	**1**	3
CO 2	**3**	**2**	**2**	**2**	**2**	3
CO 3	**3**	**3**	**2**	**2**	**3**	3
CO 4	**3**	**1**	**2**	**2**	**1**	3
CO 5	**3**	**1**	**2**	**2**	**1**	2
Weightage of course contributed to each PSO	15	8	10	10	8	14

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

Subject	Subject Name	Category	L	T	P	S	Credit	Marks

Code									**CIA**	**External**	**Total**
Core Practical5 U23CAP511	**ASP.Net Programming LAB**	Core	-	-	Y	-	4	5	25	75	100

Course Objective	
LO1	To develop ASP.NET Web application using standard controls.
LO2	To create rich database applications usingADO.NET.
LO3	To implement file handling operations.
LO4	To implement XML classes.
LO5	To utilize ASP.NET security features for authenticating the website

Sl. No	**Programs**		**Course Objectvie**
1.	Create an exposure of Web applications and tools		C1
2.	Implement the Html Controls		
3.	Implement the Server Controls		
4.	Web application using Web controls.		
5.	Web application using List controls.		
6.	Web Page design using Rich control. Validate user input using Validation controls. Working with File concepts.		C2
7.	Web application using Data Controls.		
8.	Data binding with Web controls		
9.	Data binding with Data Controls.		
10.	Database application to perform insert, update and delete operations.		C3
11.	Database application using Data Controls to perform insert, delete, edit, paging and sorting operation.		
12.	Implement the Xml classes.		C4

13.	Implement Authentication – Authorization.		C5
14.	Ticket reservation using ASP.NET controls.		
15.	Online examination using ASP.NET controls		
	Total		

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	To create web applications and implement various controls	PO1, PO2, PO6
2	Create a web pages in Rich control.	PO3, PO8
3	Develop knowledge about file handling operations	PO1, PO4, PO8
4	An ability to design XML classes	PO2, PO6, PO7
5	To develop a software to solve real-world problems using ASP.NET	PO1,PO3, PO5, PO8

Text Book	
1	SvetlinNakov,VeselinKolev& Co, Fundamentals of Computer Programming with C#,Faber publication,2019.
2	Mathew, Mac Donald, The Complete Reference ASP.NET, Tata McGraw-Hill,2015.

Reference Books	
1.	Herbert Schildt, The Complete Reference C#.NET, TataMcGraw-Hill,2017.
2.	Kogent Learning Solutions, C# 2012 Programming Covers .NET 4.5 Black Book, Dreamtech pres,2013.
3.	Anne Boehm, Joel Murach, Murach's C# 2015, Mike Murach& Associates Inc.2016.
4.	DenielleOtey, Michael Otey, ADO.NET: The Complete reference, McGrawHill,2008.
5.	Matthew MacDonald, Beginning ASP.NET 4 in C# 2010,APRESS,2010.

Web Resources	
1.	https://www.geeksforgeeks.org/introduction-to-net-framework/
2.	https://www.javatpoint.com/net-framework

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**

CO 1	**3**	**2**	**2**	**2**	**1**	1
CO 2	**3**	**2**	**3**	**2**	**2**	2
CO 3	**3**	**3**	**2**	**2**	**1**	1
CO 4	**3**	**2**	**3**	**2**	**1**	1
CO 5	**3**	**2**	**2**	**2**	**1**	2
Weightage of course contributed to each PSO	**15**	11	12	10	6	7

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**
U23CAT512	**Data Mining and Warehousing**		Y	-	-	-	4	5	25	75	100

Course Objectives	
LO1	To provide the knowledge on Data Mining and Warehousing concepts and techniques
LO2	To study the basic concepts of Data Mining, Architecture and Comparison.
LO3	To study a set of Mining Association Rules, Data Warehouses.
LO4	To study about Classification and Prediction, Classifier Accuracy
LO5	To study the basic concepts of cluster analysis, Cluster Methods

UNIT	**Details**	**No. of Hours**	**Course Objectives**
I	Introduction: Data mining – Functionalities – Classification – Introduction to Data Warehousing – Data Preprocessing: Preprocessing the Data – Data cleaning –	15	CO1

	Data Integration and Transformation – Data Reduction		
II	Data Mining, Primitives, Languages and System Architecture: Data Mining – Primitives – Data Mining Query Language, Architecture of Data mining Systems. Concept Description, Characterization and Comparison: Concept Description, Data Generalization and Summarization, Analytical Characterization, Mining Class Comparison – Statistical Measures.	15	CO2
III	Mining Association Rules: Basic Concepts – Single Dimensional Boolean Association Rules From Transaction Databases, Multilevel Association Rules from transaction databases – Multi dimension Association Rules from Relational Database and Data Warehouses.	15	CO3
IV	Classification and Prediction: Introduction – Issues – Decision Tree Induction – Bayesian Classification – Classification of Back Propagation. Classification based on Concepts from Association Rule Mining – Other Methods. Prediction – Introduction – Classifier Accuracy	15	CO4
V	Cluster Analysis: Introduction – Types of Data in Cluster Analysis, Petitioning Methods – Hierarchical Methods-Density Based Methods – GRID Based Method – Model based Clustering Method	15	CO5
	Total	**75**	

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	To understand the basic concepts and the functionality of the various data mining and data warehousing component	PO1, PO3, PO6, PO8
CO2	To know the concepts of Data mining system architectures	PO1,PO2,PO3,PO6
CO3	To analyze the principles of association rules	PO3, PO5
CO4	To get analytical idea on Classification and prediction methods	PO1, PO2, PO3, PO7
CO5	To Gain knowledge on Cluster analysis and its methods.	PO2, PO6, PO7

Text Books

(Latest Editions)	
1.	Han and M. Kamber, "Data Mining Concepts and Techniques", 2001, Harcourt India Pvt. Ltd, New Delhi.
References Books **(Latest editions)**	
1.	K.P. Soman, ShyamDiwakar, V. Ajay "Insight into Data Mining Theory and Practice ",Prentice Hall of India Pvt. Ltd, New Delhi
2.	Parteek Bhatia, 'Data Mining and Data Warehousing: Principles and Practical Techniques', Cambridge University Press, 2019
Web Resources	
1.	https://www.topcoder.com/thrive/articles/data-warehousing-and-data-mining#:~:text=Data%20warehousing%20is%20a%20method,compiled%20in%20the%20data%20warehouse.
2.	https://www.javatpoint.com/data-mining-cluster-vs-data-warehousing
3.	https://www.tutorialspoint.com/Data-Warehousing-and-Data-Mining

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	2	3	2	2
CO 3	2	2	-	3	-	3
CO 4	3	3	2	3	1	1
CO 5	1	3	3	3	3	2
Weightage of course contributed to each PSO	12	14	10	15	9	11

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
U23CAE55A	NATURAL LANGUAGE PROCESSING	Elective	Y	-	-	3	3	25	75	100

Learning Objectives		
LO1	To understand approaches to syntax and semantics in NLP.	
LO2	To learn natural language processing and to learn how to apply basic algorithms in this field.	
LO3	To understand approaches to discourse, generation, dialogue and summarization within NLP.	
LO4	Toget acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, pragmatics etc.	
LO5	To understand current methods for statistical approaches to machine translation.	
UNIT	**Contents**	**No. Of. Hours**
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.	**15**
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.	**15**
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.	**15**
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.	**15**
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 Net Stemmers- POS Tagger- Research Corpora SSAS.	**15**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Describe the fundamental concepts and techniques of natural language processing. Explain the advantages and disadvantages of different NLP technologies and their applicability in different business situations.	PO1, PO2, PO3, PO4, PO5, PO6

CO2	Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknes NLP technologies to explore and gain a broad understanding of text data.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions. Use NLP methods to analyse sentiment of a text document.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Analyze large volume text data generated from a range of real-world applications. Use NLP methods to perform topic modelling.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Develop robotic process automation to manage business processes and to increase and monitor their efficiency and effectiveness. Determine the framework in which artificial intelligence and the Internet of things may function, including interactions with people, enterprise functions, and environments.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	Daniel Jurafsky, James H. Martin, "Speech & language processing", Pearson publications.	
2	Allen, James. Natural language understanding. Pearson, 1995.	
Reference Books		
1.	Pierre M. Nugues, "An Introduction to Language Processing with Perl and Prolog",Springer	
Web Resources		
1.	https://en.wikipedia.org/wiki/Natural_language_processing	
2.	https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing-NLP	

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	3	3	1
CO 2	2	3	3	3	2	3
CO 3	1	3	3	3	1	3
CO 4	3	2	1	3	2	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	12	14	13	15	11	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
U23CAE55B	**Image Processing**	Elective	-	Y	-	-	3	3	25	75	100
Course Objective											
LO1	To learn fundamentals of digital image processing.										
LO2	To learn about various 2D Image transformations										
LO3	To learn about various image enhancement processing methods and filters										
LO4	To learn about various classification of Image segmentation techniques										
LO5	To learn about various image compression techniques										

UNIT	Details	No. of Hours
I	**Digital Image Fundamentals:** Image representation - Basic relationship between pixels, Elements of DIP system -Applications of Digital Image Processing - 2D Systems - Classification of 2D Systems - Mathematical Morphology- Structuring Elements- Morphological Image Processing - 2D Convolution - 2D Convolution Through Graphical Method -2D Convolution Through Matrix Analysis	15
II	2D Image transforms: Properties of 2D-DFT - Walsh transform - Hadamard transform- Haar transform- Discrete Cosine Transform- Karhunen - Loeve Transform -Singular Value Decomposition	15
III	Image Enhancement: Spatial domain methods- Point processing- Intensity transformations - Histogram processing- Spatial filtering- smoothing filter- Sharpening filters - Frequency domain methods: low pass filtering, high pass Filtering- Homomorphic filter.	15
IV	Image segmentation: Classification of Image segmentation techniques - Region approach – Clustering techniques - Segmentation based on thresholding - Edge based segmentation - Classification of edges- Edge detection - Hough transform- Active contour.	15
V	Image Compression: Need for compression -Redundancy- Classification	15

	of image- Compression schemes- Huffman coding- Arithmetic coding- Dictionary based compression -Transform based compression,	
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the fundamental concepts of digital image processing.	PO1
2	Understand various 2D Image transformations	PO1, PO2
3	Understand image enhancement processing techniques and filters	PO4, PO6
4	Understand the classification of Image segmentation techniques	PO4, PO5, PO6
5	Understand various image compression techniques	PO3, PO8

Text Book	
1	S Jayaraman, S Esakkirajan, T Veerakumar, Digital image processing ,Tata McGraw Hill, 2015
2	Gonzalez Rafel C, Digital Image Processing, Pearson Education, 2009

Reference Books	
1.	1. Jain Anil K , Fundamentals of digital image processing: , PHI,1988
2.	nneth R Castleman , Digital image processing:, Pearson Education,2/e,2003
3.	att William K , Digital Image Processing: , John Wiley,4/e,2007

Web Resources	
1.	https://kanchiuniv.ac.in/coursematerials/Digital%20image%20processing%20-Vijaya%20Raghavan.pdf
2.	http://sdeuoc.ac.in/sites/default/files/sde_videos/Digital%20Image%20Processing%203rd%20ed.%20-%20R.%20Gonzalez%2C%20R.%20Woods-ilovepdf-compressed.pdf
3.	https://dl.acm.org/doi/10.5555/559707
4.	https://www.ijert.org/image-processing-using-web-2-0-2

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	1	3	2	2	3	1
CO 2	3	2	3	2	3	3
CO 3	3	3	2	2	2	1

CO 4	3	3	3	1	3	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	13	13	13	10	14	11

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**
U23CAE56A	Digital Principles & Computer Organization	Elective	-	Y	-	-	3	3	25	75	100

Course Objectives	
	To learn the operation of latches, flip-flops, counters, registers, and register transfers in the Computer organization.
LO2	To design two-level logic functions with AND, OR, NAND, NOR and XOR gates with minimum number of gate delays or literals
LO3	To be trained and design the combinational circuits and sequential circuits
LO4	Gaining background knowledge as well as core expertise in computer organization.

UNIT I: NUMBER REPRESENTATION & BOOLEAN ALGEBRA

Number Representation-Number System: Binary, Hexadecimal-Octal Codes-BCD-Excess-3-Gray Code - ASCII - EBCDIC - Binary Arithmetic-1's Complement-2's Complement Representation-Error Detecting Codes-Hamming Codes.

Introduction-Boolean Algebra- De Morgan's Theorem-Sum Of Product method-Product of Sum method - Karnaugh Map.

UNIT II: **LOGIC GATES & FLIPFLOPS**

Introduction - Logic Gates – Universal Gates – Decoder – Encoder – Multiplexer - Demultiplexer - Half Adder - Full Adder - Half Subtractor - Full Subtractor. Flip-Flops - S-R Flip-flop - J-K Flip Flops

UNIT III: COMPUTER LANGUAGE AND ORGANIZATION

Introduction: Machine Language - Assembly language – Assembler - Programming Arithmetic & Logic Operations – Input - Output Programming.

Basic Computer Organization and Design Instruction Codes - Computer Registers -Computer Instruction - Timing & Control Instruction Cycles-Memory Reference Instruction.

UNIT IV: I/O ORGANIZATION

I/O Organization - Peripheral Devices - I/O Interface - Mode of Transfers - DMA.

UNIT V: MEMORY ORGANIZATION

Memory Organization - Memory Hierarchy - Main Memory - Auxiliary Memory -Associative Memory - Cache Memory - Virtual Memory.
TEXT BOOK:
1. Albert Paul Malvino & Donald P.Leach, Digital Principles and Applications, IV Edition - Tata McGraw Hill Company Limited, 2015. 2. Morris Mano, **Computer System Architecture**, Pearson Publication, Third Edition, 2003.
REFERENCE BOOKS:
1. P. K. Sinha & Priti Sinha , "Computer Fundamentals", 6th Edition, BPB Publications, 2019 2. Dr.Anita Goel, Computer Fundamentals", Pearson Education, 2010. 3. Alexis Leon, "Fundamentals of Information Technology", Vikas Publication, 2009 4. P.S.Manoharan, "F Digital Principles & System Design", Revised Edition - Charulatha Publication, 2013.
WEB RESOURCES:
1. https://lecturenotes.in/subject/419/digital-logic-design-and-computer-organisation-dldco/note 2. https://www.javatpoint.com/digital-computers 3. https://www.yumpu.com/en/document/view/16977783/digital-principles-and-computer-organisation-npr-arts-and-science-

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	**3**	**2**	**-**	**3**	**1**	**-**
CO 2	**3**	**3**	**2**	**2**	**-**	**2**
CO 3	**1**	**2**	**3**	**1**	**2**	**1**
CO 4	**2**	**2**	**1**	**-**	**2**	**1**
CO 5	**2**	**2**	**2**	**1**	**3**	**1**
Weightage of course contributed to each PSO	11	11	8	7	8	5

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
U23CAE56B	NUMERICALMETHODS	Elective	-	Y	-	-	3	3	25	75	100

Course Objective		
LO1	To familiarize the students with the understanding of various techniques	
LO2	To improve the problem solving skills	
LO3	Learning the basic numerical methods used frequently.	
Unit	**Details**	**No.of Hours**
I	Algebraic and transcendental equations: Errors in numerical computations – iteration methods– bisection methods– regular false methods–Newton Rapson method.	**15**
II	Simultaneous equations–back substitutions–gauss elimination method –gauss seidal iteration method–comparison of direct and iterative method.	**15**
III	Interpolation–Newton's Formulae–gauss interpolation formulae Language's Interpolation formula–inverse interpolation.	**15**
IV	Numerical Differentiation: Newton]s formulae– Numerical integration–Simpson's Rule–Gaussian Quadrature.	**15**
V	Numerical solution of differential equations: Euler's method -Taylor series method–Runge Kutta methods –Predictor Corrector methods.	**15**
		75

CO	**Course Outcomes**
CO1	Describes about Numerical Computations
CO2	Describes comparison of direct and iterative method
CO3	Understanding about Newton‟s Formulae.
CO4	Understanding Gaussian Quadrature.
CO5	Understanding Euler‟s method.

Textbook

□	Numerical methods byS.Arumugam and, S.Thangapandi Issac,A.Somasundaram,Scitech publications LINU

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	2	2
CO2	3	3	2	3	2	2
CO3	3	3	3	3	2	2
CO4	3	3	2	3	2	2
CO5	3	3	2	3	2	2
Weightage of course contributed to each PSO	15	14	11	15	10	10

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

SEMESTER VI

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23CAT613	**Computer Networks**	CORE/ Elective	-	Y	-	-	4	6	25	75	100

Course Objective	
LO1	To understand the concept of Data communication and Computer network
LO2	To get a knowledge on routing algorithms.
LO3	To impart knowledge about networking and inter networking devices
LO4	To study about Network communication.
LO5	To learn the concept of Transport layer

UNIT	Details	No. of Hours
I	Introduction – Network Hardware – Software – Reference Models – OSI and TCP/IP Models – Example Networks: Internet, ATM, Ethernet and Wireless LANs - Physical Layer – Theoretical Basis for Data Communication - Guided Transmission Media	15
II	Wireless Transmission - Communication Satellites – Telephone System:	15

	Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues – Error Detection and Correction.	
III	Elementary Data Link Protocols - Sliding Window Protocols – Data Link Layer in the Internet - Medium Access Layer – Channel Allocation Problem – Multiple Access Protocols – Bluetooth	15
IV	Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms – IP Protocol – IP Addresses – Internet Control Protocols.	15
V	Transport Layer - Services - Connection Management - Addressing, Establishing and Releasing a Connection – Simple Transport Protocol – Internet Transport Protocols (ITP) - Network Security: Cryptography.	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	To Understand the basics of Computer Network architecture, OSI and TCP/IP reference model	PO1
2	To gain knowledge on Telephone systems using wireless network	PO1, PO2
3	To understand the concept of MAC	PO4, PO6
4	To analyze the characteristics of Routing and Congestion control algorithms	PO4, PO5, PO6
5	To understand network security and define various protocols such as FTP, HTTP, Telnet, DNS	PO3, PO8

Text Book

1	A. S. Tanenbaum, "Computer Networks", 4th Edition, Prentice-Hall of India, 2008.

Reference Books

1.	B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition, 2017
2.	F. Halsall, "Data Communications, Computer Networks and Open Systems", Pearson Education, 2008
3.	D. Bertsekas and R. Gallagher, "Data Networks", 2nd Edition, PHI, 2008.
4.	Lamarca, "Communication Networks", Tata McGraw- Hill, 2002

Web Resources

1.	https://en.wikipedia.org/wiki/Computer_network

2.	https://citationsy.com/styles/computer-networks

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**3**	**2**	**-**	**2**	**1**	**-**
CO 2	**3**	**2**	**1**	**2**	**2**	**-**
CO 3	**3**	**-**	**-**	**2**	**-**	**2**
CO 4	**3**	**1**	**-**	**2**	**1**	**-**
CO 5	**3**	**3**	**-**	**2**	**1**	**-**
Weightage of course contributed to each PSO	15	8	1	10	5	2

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
U23CAT614	**Data Analytics Using R Programming**	Core	Y	-	-	-	4	6	25	75	100

LO1	To understand the problem solving approaches
LO2	To learn the basic programming constructs in R Programming
LO3	To learn the basic programming constructs in R Programming
LO4	To use R Programming data structures - lists, tuples, and dictionaries.
LO5	To do input/output with files in R Programming.

UNIT	Details	No. of Hours	Course Objective
I	Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating —	18	C1

	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		
II	CONTROL STRUCTURES AND VECTORS -Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations	18	C2
III	LISTS- Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations	18	C3

IV	FACTORS AND TABLES - Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions R PROGRAMMING .	18	C4
V	OBJECT-ORIENTED PROGRAMMING S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation	18	C5
	Total	**90**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO8

Text Book

1	Roger D. Peng," R Programming for Data Science, Learn Publisher, 2012 http://leanpub.com/rprogramming
2	Norman Matloff,"The Art of R Programming- A Tour of Statistical Software Design", 2011, Publisher William Pollock, ISBN-10: 1-59327-384-3 ISBN-13: 978-1-59327-384-2.

Reference Books

1.	Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations" , 1st Edition, 2014.

2.	Venables , W.N.,and Ripley,"S programming", Springer, 2000.
Web Resources	
1.	https://www.simplilearn.com

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**3**	**2**	**-**	**3**	**1**	**-**
CO 2	**3**	**3**	**2**	**2**	**-**	**2**
CO 3	**1**	**2**	**3**	**1**	**2**	**1**
CO 4	**2**	**2**	**1**	**-**	**2**	**1**
CO 5	**2**	**2**	**2**	**1**	**3**	**1**
Weightage of course contributed to each PSO	11	11	8	7	8	5

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
U23CAP615	**R Programming - LAB**	Core	-	-	Y	-	4	6	25	75	100

Course Objective	
LO1	To understand the problem solving approaches
LO2	To learn the basic programming constructs in R Programming
LO3	To practice various computing strategies for R Programming -based solutions to real world problems
LO4	To use R Programming data structures - lists, tuples, and dictionaries.
LO5	To do input/output with files in R Programming.

Sl. No	**Details**	
1.	Program to convert the given temperature from Fahrenheit to Celsius	

	and vice versa depending upon user's choice.	
2.	Program, to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.	
3.	Write a program to find list of even numbers from 1 to n using R-Loops.	
4.	Create a function to print squares of numbers in sequence.	
5.	Write a program to join columns and rows in a data frame using cbind() and rbind() in R.	
6.	Implement different String Manipulation functions in R.	
7.	Implement different data structures in R (Vectors, Lists, Data Frames)	
8	Write a program to read a csv file and analyze the data in the file in R.	
9	Create pie chart and bar chart using R.	
10	Create a data set and do statistical analysis on the data using R.	
11	Program to find factorial of the given number using recursive function	
12	Write a R program to count the number of even and odd numbers from array of N numbers.	
	Total	

Course Outcomes		**Programe Outcome**
CO	On completion of this course, students will	
1	Acquire programming skills in core R Programming	PO1,PO4,PO5
2	Acquire Object-oriented programming skills in R Programming.	PO1, PO4,PO8
3	Develop the skill of designing graphical-user interfaces (GUI) in R Programming	PO1,PO3,PO6
4	Acquire R Programming skills to move into specific branches	PO3,PO4
5		PO1,PO5,PO6
Text Book		
1	Roger D. Peng," R Programming for Data Science ", 2012	

2	Norman Matloff,"The Art of R Programming- A Tour of Statistical Software Design", 2011
Reference Books	
1	Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations" , 1st Edition, 2014
2.	Venables , W.N.,and Ripley,"S programming", Springer, 2000.
Web Resources	
1.	https://www.simplilearn.com

Mapping with Programme Outcomes:

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

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

Subject Code	Subject Name	Date	L	T	P	S	C	I	Marks

									CIA	**External**	**Total**
U23CAE67A	**Robotics and Its Applications**	Specific Elective	Y	-	-	-	3	5	25	75	100

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

UNIT	**Details**	**No. of Hours**	**Course Objective**
I	Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics.	6	CO1
II	Actuators and sensors :Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot	6	CO2
III	Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.	6	CO3
IV	Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations	6	CO4

V	Application: Ariel robots-collision avoidance robots for agriculture-mining-exploration-underwater-civilian- and military applications-nuclear applications-space Applications-Industrial robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot welding-spray painting-assembly operation-cleaning-etc.	6	CO5
	Total		

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Describe the different physical forms of robot architectures.	PO1
2	Kinematically model simple manipulator and mobile robots.	PO1, PO2
3	Mathematically describe a kinematic robot system	PO4, PO6
4	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	PO4, PO5, PO6
5	Program robotics algorithms related to kinematics, control, optimization, and uncertainty.	PO3, PO8

Text Book

1	RicharedD.Klafter. Thomas Achmielewski and MickaelNegin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001
2	Saeed B.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2 nd edition 2011

Reference Books

1.	Industrial robotic technology-programming and application by M.P.Groover et.al, McGrawhill2008
2.	Robotics technology and flexible automation by S.R.Deb, THH-2009

Web Resources

1.	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm
2.	https://www.geeksforgeeks.org/robotics-introduction/

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	**2**	**2**	**2**	**1**	**3**	**-**

CO 2	**2**	**2**	**2**	**3**	**1**	**3**
CO 3	**3**	**2**	**3**	**2**	**1**	**3**
CO 4	**3**	**3**	**2**	**2**	**2**	**1**
CO 5	**3**	**2**	**1**	**3**	**3**	**3**
Weightage of course contributed to each PSO	13	11	10	11	10	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**
U23CAE67B	**Information Security**	**Elective**	Y	-	-	-	3	5	25	75	100

Course Objectives	
LO1	To know the objectives of information security
LO2	Understand the importance and application of each of confidentiality, integrity, authentication and availability
LO3	Understand various cryptographic algorithms
LO4	Understand the basic categories of threats to computers and networks
LO5	To study about the concepts of security in networks, web security

UNIT	**Details**	**No. of Hours**	**Course Objectives**
I	Introduction to Information Security : Security mindset, Computer Security Concepts (CIA), Attacks, Vulnerabilities and protections, Security Goals, Security Services, Threats, Attacks, Assets, malware, program analysis and mechanisms	15	CO1
II	The Security Problem in Computing: The meaning of computer Security, Computer Criminals, Methods of Defense. Cryptography: Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption	15	CO2

III	Symmetric and Asymmetric Cryptographic Techniques : DES, AES, RSA algorithms .Authentication and Digital Signatures : Use of Cryptography for authentication, Secure Hash function, Key management – Kerberos	15	CO3
IV	Program Security : Non-malicious Program errors – Buffer overflow, Incomplete mediation, Time-of-check to Time-of- use Errors, Viruses, Trapdoors, Salami attack, Man-in-the- middle attacks, Covert channels. File protection Mechanisms, User Authentication Designing Trusted O.S: Security polices, models of security, trusted O.S design, Assurance in trusted O.S. Implementation examples	15	CO4
V	Security in Networks : Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security. Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction	15	CO5
	Total	**75**	

Course Outcomes

Course Outcomes	On completion of this course, students will;	**Programme Outcomes**
CO1	Understand network security threats, security services, and countermeasures	PO1
CO2	Understand vulnerability analysis of network security	PO1, PO2
CO3	Acquire background on hash functions; authentication; firewalls; intrusion detection techniques	PO4, PO6
CO4	Gain hands-on experience with programming and simulation techniques for security protocols.	PO4, PO5, PO6
CO5	Apply methods for authentication, access control, intrusion detection and prevention	PO3, PO8

Text Books (Latest Editions)

1.	Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education
2.	Cryptography And Network Security Principles And Practice, Fourth or Fifth Edition, William Stallings, Pearson
References Books **(Latest editions, and the style as given below must be strictly adhered to)**	
1.	Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, lst Edition
2.	Cryptography and Network Security : Forouzan Mukhopadhyay, Mc Graw Hill, 2"d Edition
3.	Information Security, Principles and Practice: Mark Stamp, Wiley India
4.	Principles of Computer Sceurity: WM.Arthur Conklin, Greg White, TMH
Web Resources	
1.	https://www.geeksforgeeks.org/what-is-information-security/
2.	https://www.tutorialspoint.com/what-is-information-security#:~:text=Information%20security%20is%20designed%20and,destruction%2C%20alteration%2C%20and%20disruption.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**2**	**3**	**1**	**2**	**3**	**2**
CO 2	**2**	**-**	**1**	**-**	**3**	**2**
CO 3	**-**	**3**	**1**	**3**	**-**	**-**
CO 4	**2**	**3**	**1**	**3**	**3**	**-**
CO 5	**2**	**3**	**1**	**3**	**3**	**2**
Weightage of course contributed to each PSO	8	12	5	11	12	6

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

Subject	Subject Name	Category	L	T	P	S	C	I	Marks

Code									CIA	External	Total
U23CAE68A	**Internet of Things and its applications**		Y	-	-	-	3	5	25	75	100
Course Objective											
LO1	Use of Devices, Gateways and Data Management in IoT.										
LO2	Design IoT applications in different domain and be able to analyze their performance										
LO3	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										

UNIT	Details	No. of Hours	Course Objective
I	IoT & Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.	15	C1
II	M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.	15	C2
III	IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views	15	C3

IV	IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and GasIndustry, Opinions on IoT Application and Value for Industry, Home Management	15	C4
V	Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	15	C5
	Total	**75**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO8

Text Book

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

Reference Books

1. Michael Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World", kindle version.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications 2013, 1st Edition,.

3	WaltenegusDargie, ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice" 4..CunoPfister, "Getting Started with the Internet of Things", O"Reilly Media 2011
Web Resources	
1.	https://www.simplilearn.com
2.	https://www.javatpoint.com
3.	https://www.w3schools.com

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**2**	**-**	**-**	**2**	**-**	**2**
CO 2	**2**	**1**	**-**	**1**	**3**	**1**
CO 3	**3**	**-**	**1**	**1**	**-**	**1**
CO 4	**2**	**-**	**-**	**2**	**1**	**2**
CO 5	**2**	**-**	**-**	**2**	**-**	2
Weightage of course contributed to each PSO	11	1	1	8	4	8

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
U23CAE68B	**Cloud Computing**	Elective	-	Y	-	-	3	5	25	75	100
Course Objective											
LO1	Learning fundamental concepts and Technologies of Cloud Computing.										
LO2	Learning various cloud service types and their uses and pitfalls.										
LO3	To learn about Cloud Architecture and Application design.										
LO4	To know the various aspects of application design, benchmarking and security on the Cloud.										

LO5	To learn the various Case Studies in Cloud Computing.	
UNIT	**Details**	**No. of Hours**
I	Introduction to Cloud Computing: Definition of Cloud Computing – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples – Cloud-based Services and Applications. Cloud Concepts and Technologies: Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring – Software Defined Networking – Network Function Virtualization – MapReduce – Identity and Access Management – Service Level Agreements – Billing.	15
II	Cloud Services Compute Services: Amazon Elastic Computer Cloud - Google Compute Engine - Windows Azure Virtual Machines Storage Services: Amazon Simple Storage Service - Google Cloud Storage - Windows Azure Storage Database Services: Amazon Relational Data Store - Amazon Dynamo DB - Google Cloud SQL - Google Cloud Data Store - Windows Azure SQL Database - Windows Azure Table Service Application Services: Application Runtimes and Frameworks - Queuing Services - Email Services - Notifiction Services - Media Services Content Delivery Services: Amazon CloudFront - Windows Azure Content Delivery Network Analytics Services: Amazon Elastic MapReduce - Google MapReduce Service - Google BigQuery - Windows Azure HDInsight Deployment and Management Services: Amazon Elastic Beanstack - Amazon Cloud Formation Identity and Access Management Services: Amazon Identiy and Access Management - Windows Azure Active Directory Open Source Private Cloud Software: CloudStack – Eucalyptus – OpenStack	15

III	**Cloud Application Design:** Introduction – Design Consideration for Cloud Applications – Scalability – Reliability and Availability – Security – Maintenance and Upgradation – Performance – Reference Architectures for Cloud Applications – Cloud Application Design Méthodologies: Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), RESTful Web Services – Data Storage Approaches: Relational Approach (SQL), Non-Relational Approach (NoSQL).	15
IV	**Cloud Application Benchmarking and Tuning:** Introduction to Benchmarking – Steps in Benchmarking – Workload Characteristics – Application Performance Metrics – Design Considération for Benchmarking Methodology – Benchmarking Tools and Types of Tests – Deployment Prototyping. **Cloud Security:** Introduction – CSA Cloud Security Architecture – Authentication (SSO) – Authorization – Identity and Access Management – Data Security : Securing data at rest, securing data in motion – Key Management – Auditing.	15
V	**Case Studies:** Cloud Computing for Healthcare – Cloud Computing for Energy Systems - Cloud Computing for Transportation Systems - Cloud Computing for Manufacturing Industry - Cloud Computing for Education.	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the fundamental concepts and Technologies in Cloud Computing.	PO1
2	Able to understand various cloud service types and their uses and pitfalls.	PO1, PO2
3	Able to understand Cloud Architecture and Application design.	PO4, PO6
4	Understand the various aspects of application design, benchmarking and security in the Cloud.	PO4, PO5, PO6
5	Understand various Case Studies in Cloud Computing.	PO3, PO8
Text Book		
1	ArshdeepBahga, Vijay Madisetti, *Cloud Computing – A Hands On Approach*,	

	Universities Press (India) Pvt. Ltd., 2018
Reference Books	
1.	Anthony T Velte, Toby J Velte, Robert Elsenpeter, *Cloud Computing: A Practical Approach*, Tata McGraw-Hill, 2013.
2.	Barrie Sosinsky, *Cloud Computing Bible*, Wiley India Pvt. Ltd., 2013.
3.	David Crookes, *Cloud Computing in Easy Steps*, Tata McGraw Hill, 2015.
4.	Dr. Kumar Saurabh, *Cloud Computing*, Wiley India, Second Edition 2012.
Web Resources	
1.	https://en.wikipedia.org/wiki/Cloud_computing
2.	https://link.springer.com/chapter/10.1007/978-3-030-34957-8_7
3.	https://webobjects.cdw.com/webobjects/media/pdf/solutions/cloud-computing/121838-CDW-Cloud-Computing-Reference-Guide.pdf

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**2**	**2**	**2**	**3**	**3**	**1**
CO 2	**3**	**1**	**2**	**3**	**3**	**-**
CO 3	**3**	**2**	**1**	**2**	**1**	**3**
CO 4	**3**	**3**	**2**	**3**	**2**	**-**
CO 5	**2**	**2**	**1**	**3**	**3**	**3**
Weightage of course contributed to each PSO	13	10	8	14	12	7

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