B.C.A

SYLLABUS
FOR
ALAGAPPA UNIVERSITY AFFILIATED COLLEGES

FROM THE ACADEMIC YEAR - 2023 – 2024

By

TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION, CHENNAI – 600 005

ALAGAPPA UNIVERSITY

(A State University Accredited with "A+" Grade by NAAC (CGPA: 3.64) in the third Cycle and Graded as Category-I University by MHRD-UGC)

KARAIKUDI - 630 003, TAMIL NADU.

Introduction

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 every one 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.

1. Programme Outcomes (PO) of BCA

- Scientific aptitude will be developed in Students
- Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the Computer Science & humanities stream.
- Students will become employable; Students will be eligible for career opportunities in education field, Industry, or will be able to opt for entrepreneurship.
- Students will possess basic subject knowledge required for higher studies, professional and applied courses.
- Students will be aware of and able to develop solution oriented approach towards various Social and Environmental issues.
- Ability to acquire in-depth knowledge of several branches of Computer Science and aligned areas. This Programme helps learners in building a solid foundation for higher studies in Computer Science and applications.
- The skills and knowledge gained leads to proficiency in analytical reasoning, which can be utilized in modeling and solving real life problems.
- Utilize computer programming skills to solve theoretical and applied problems by critical understanding, analysis and synthesis.
- To recognize patterns and to identify essential and relevant aspects of problems.
- Ability to share ideas and insights while seeking and benefitting from knowledge and insight of others.
- Mold the students in to responsible citizens in a rapidly changing interdependent society. The above expectations generally can be pooled into 6 broad categories and can be modified according to institutional requirements:

  PO1: Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct investigations of complex problems

PO5: Modern tool usage

PO6: Applying to society

2. Programme Specific Outcomes of B.Sc. Degree Programme in Computer Science

PSO1: Think in a critical and logical based manner

PSO2:Familiarizethestudents with suitable software tools of computer science and industrial applications to handle issues and solve problems in mathematics or statistics and real time application related sciences.

PSO3: Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.

PSO4: Understand, formulate, develop programming model with logical approaches to an Address issues arising in social science, business and other contexts.

PSO5: Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of Computer science and Industrial statistics.

PO6: Provide students / learners sufficient knowledge and skills enabling them to undertake further studies in Computer Science or Applications or Information Technology and its allied areas on multiple disciplines linked with Computer Science.

PO7: Equip with Computer science technical ability, problem solving skills, creative talent and power of communication necessary for various forms of employment.

PO8: Develop a range of generic skills helpful in employment, internships & societal activities.

PO9:Get adequate exposure to global and local concerns that provides platform for further exploration into multi-dimensional aspects of computing sciences. Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) can be carried out accordingly, assigning the appropriate level in the grids: (put tick mark in each row)

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

3. 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 corecomponentsandincorporatingapplicationorientedcontentwhereverrequired.
- 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 so facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Computer Science 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 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 interdisciplinary nature are incorporated as Elective courses, covering conventional topics to the latest – Statistics with R Programming, Data Science, Machine learning. Internet of Things and Artificial Intelligence etc..

4. 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 overview of the pedagogy of learning abstract Mathematics and simulating mathematical Concepts to real world.	• In still 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 Computing / Computational skills Enable the students gain knowledge and exposure on latest computational aspects
		• Data analytical skills will enable students gain internships,apprenticeships,fieldworkinvolvingdatacollection,compilation,analysisetc.
		• Entrepreneurial skill training will provide an opportunity for independent livelihood. • Generates self–employment. • Create small scale entrepreneurs. • Training to girls leads to women empowerment.
		• Discipline centric skill will improve the Technical. knowhow of solving real life problems using ICT Tools.
III,IV, V&VI	Elective papers-An open choice of topics categorized under Generic and Discipline Centric	• Strengthening the domain knowledge. • Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and interdisciplinary nature. • Students are exposed to Latest topics on Computer Science/IT, that require strong mathematical back ground. • Emerging topics in higher education/industry /communication network/health sector etc. are introduced with hands-on-training, facilitates designing of mathematical models in the respective sectors

IV	Industrial Statistics	• Exposure to industry moulds students in to solution providers • Generates Industry ready graduates • Employment opportunities enhanced
II year Vacation activity	Internship/Industrial Training	• Practical training at the Industry/ Banking Sector /Private/ Public sector organizations / Educational institutions, enable the students gain professional Experience and also become responsible citizens.
V	Project with Viva–voce	• Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
VI	Introduction of Professional Competency component	• Curriculum design accommodates all category of learners; Mathematics for Advanced Explain component will comprise of advanced topics in Mathematics and allied fields, for those in the peer group/aspiring researchers; • Training for Competitive Examinations' –caters to the needs of the aspirants towards most sought-after services of the nation viz, UPSC, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.
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

Credit Distribution for UG Programmes

Sem I	Credit	Sem II	Credit	Sem III	Credit	Sem IV	Credit	Sem V	Credit	Sem VI	Credit
Part 1. Language – Tamil	3	Part..1. Language – Tamil	3	Part..1. Language – Tamil	3	Part..1. Language – Tamil	3	5.1 Core Course –\ CC IX	4	6.1 Core Course – CC XIII	4
Part 2 English	3	Part..2 English	3	Part..2 English	3	Part..2 English	3	5.2 Core Course – CC X	4	6.2 Core Course – CC XIV	4
1.3 Core Course – CC I	5	2..3 Core Course – CC III	5	3.3 Core Course – CC V	5	4.3 Core Course – CC VII Core Industry Module	5	5. 3.Core Course CC -XI	4	6.3 Core Course – CC XV	4
1.4 Core Course – CC II	5	2.4 Core Course – CC IV	5	3.4 Core Course – CC VI	5	4.4 Core Course – CC VIII	5	5. 4.Core Course –/ Project with viva- voce CC -XII	4	6.4 Elective -VII Generic/ Discipline Specific	3
1.5 Elective I Generic/ Discipline Specific	3	2.5 Elective II Generic/ Discipline Specific	3	3.5 Elective III Generic/ Discipline Specific	3	4.5 Elective IV Generic/ Discipline Specific	3	5.5 Elective V Generic/ Discipline Specific	3	6.5 Elective VIII Generic/ Discipline Specific	3
1.6 Skill Enhancement Course SEC-1	2	2.6 Skill Enhancement Course SEC-2	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	4.6 Skill Enhancement Course SEC-6	2	5.6 Elective VI Generic/ Discipline Specific	3	6.6 Extension Activity	1
1.7 Skill Enhancement - (Foundation Course)	2	2.7 Skill Enhancement Course – SEC-3	2	3.7 Skill Enhancement Course SEC-5	2	4.7 Skill Enhancement Course SEC-7	2	5.7 Value Education	2	6.7 Professional Competency Skill	2
				3.8 E.V.S.	-	4.8 E.V.S	2	5.8 Summer Internship /Industrial Training	2		
	23		**23**		**22**		**25**		**26**		**21**
Total – 140 Credits											

Consolidated Semester wise and Component wise Credit distribution

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

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

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

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

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

Practical Subjects:

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

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

For Internal Marks:

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

Total	**:**	**25**

For External Marks:

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

Total	**:**	**75**

Annexure I

Suggested topics in Core component

1. Microprocessor and Microcontroller
2. Microprocessor and Microcontroller Lab
3. RDBMS with PL/SQL
4. PL/SQL Lab
5. Software Engineering
6. Machine Learning
7. Machine Learning Lab
8. Network Security
9. Data Mining and Warehousing
10. Mobile Application Development
11. Mobile Application Development Lab
12. Introduction to Data Science and more.

Suggested topics in Elective Course

Generic Specific

1. Discrete Mathematics–I
2. Discrete Mathematics-II
3. Statistical Methods and its Application-I
4. Statistical Methods and its Application-II
5. Optimization Techniques
6. Nano Technology
7. Introduction to Linear Algebra
8. Graph Theory and its Application
9. Financial Accounting
10. Cost and Management Accounting
11. Digital Logic Fundamentals
12. Numerical Methods
13. Resource Management Techniques and more.

Elective course–(EC1-EC8)-Discipline Specific

1. Software Metrics
2. Natural Language Processing
3. Analytics for Service Industry
4. Cryptography
5. Database Management System
6. Big Data Analytics
7. IOT and its Applications
8. Software Project Management
9. Image Processing
10. Information Security
11. Human Computer Interaction
12. Fuzzy Logic
13. Artificial Intelligence
14. Mobile Adhoc Network
15. Computational Intelligence
16. Grid Computing
17. Cloud Computing
18. Artificial Neural Network
19. Agile Project Management and more..

[Pl.Note:InSemester-VI-ForEC7andEC8subjects Instructionalhoursmaybeusedas:5per cycle]

Annexure II

Suggested topics in Skill Enhancement (SEC 1-SEC 8) Course

Skill Enhancement Course

1. Fundamentals of Information Technology
2. Introduction to HTML
3. Web Designing
4. PHP Programming
5. Software Testing
6. Problem Solving Techniques
7. Understanding Internet
8. Office Automation
9. Quantitative Aptitude
10. Open Source Technologies
11. Multimedia Systems
12. Advanced Excel
13. Biometrics
14. Cyber Forensics
15. Pattern Recognition
16. Enterprise Resource Planning
17. Robotics and Applications
18. Simulation and Modeling
19. Organization Behavior and more.

Illustration for B.C.A. Curriculum Design

Sem.	Part	Course Code	Courses	List of Courses	T/P	Credit	Hours per week (L/T/P)	Max. Marks		
								Int.	Ext.	Total
I	Part-I	2311T	T/OL	தமிழ் இலக்கிய வரலாறு –I/ other Language	T	3	6	25	75	100
	Part-II	2312E	E	General English I	T	3	6	25	75	100
	Part-III	23BCA1C1	CC-1	Python Programming	T	5	5	25	75	100
		23BCA1P1	CC-2	Python Programming Lab	P	3	4	25	75	100
		-	Generic Elective (Allied)	B.Sc.IT/B.Sc.,CS/ B.Sc.Mathematics/ B.Sc.Physics	T	3	3	25	75	100
				Respective Allied Theory Practical	P	2	2	25	75	100
	Part IV	23BCA1S1	SEC-I	Web Designing	T	2	2	25	75	100
		23BCA1FC	FC	Structured programming in C	T	2	2	25	75	100
				TOTAL		**23**	**30**	**175**	**525**	**700**
II	Part-I	2321T	T/OL	தமிழ் இலக்கிய வரலாறு-2 /Other Languages-II	T	3	6	25	75	100
	Part-II	2322E	E	General English-II	T	3	6	25	75	100
	Part-III	23BCA2C1	CC- 3	Object Oriented Programming Concepts using C++	T	5	5	25	75	100
		23BCA2P1	CC- 4	C++ Programming Lab	P	3	4	25	75	100
		--	Generic Elective (Allied)	B.Sc. IT/B.Sc., CS/B.Sc. Mathematics/B.Sc. Physics	T	3	3	25	75	100
		--		Respective Allied Theory Practical	P	2	2	25	75	100
	Part-IV	23BCA2S1	SEC-II	Fundamentals of Information Technology	T	2	2	25	75	100
		23BCA2S2	SEC-III	Multimedia Systems	T	2	2	25	75	100
				Naan Mudhalvan Course	T	2	2			
				TOTAL	**-**	**23**	**30**	**200**	**600**	**800**
III	Part-I	2331T	T/OL	தமிழக வரலாறும் பண்பாடும் /Other Languages-III	T	3	6	25	75	100
	Part-II	2332E	E	General English - III	T	3	6	25	75	100
	Part-III	23BCA3C1	CC -5	Data Structures and Algorithms	T	4	5	25	75	100
		23BCA3P1	CC -6	Data Structures and Algorithms Lab using C++	P	4	4	25	75	100
		--	Generic Elective (Allied)	B.Sc. IT/B.Sc., CS/B.Sc. Mathematics/B.Sc. Physics	T	3	3	25	75	100
		--		Respective Allied Theory Practical	P	2	2	25	75	100
	Part-IV	23BCA3S1	SEC-IV	Software Testing	T	2	2	25	75	100
		233AT/ 23BCA3S2	SEC-V	Adipadai Tamil/ Biometrics	T	2	2	25	75	100
				TOTAL		**23**	**30**	**300**	**600**	**900**

Sem.	Part	Course Code	Courses	List of Courses	T/P	Credit	Hours per week (L/T/P)	Max. Marks		
								Int.	Ext.	Total
IV	Part-I	2341T	T/OL	தமிழும் அறிவியலும் /Other Languages -IV	T	3	6	25	75	100
	Part-II	2342E	E	General English - IV	T	3	6	25	75	100
	Part-III	23BCA4C1	CC- 7	Programming in Java	T	4	4	25	75	100
		23BCA4P1	CC- 8	Programming in Java Lab	P	3	3	25	75	100
		--	Generic Elective (Allied)	B.Sc. IT/B.Sc., CS/B.Sc. Mathematics/B.Sc. Physics	T	3	3	25	75	100
		--		Respective Allied Theory Practical	P	2	2	25	75	100
	Part-IV	23BCA4S1	SEC-VI	PHP Programming	T	2	2	25	75	100
		234AT/ 23BCA4S2	SEC-VII	Adipadai Tamil/ Cyber Forensics	T	2	2	25	75	100
		23BES4		Environmental Studies	T	2	2	25	75	100
				TOTAL	**-**	**24**	**30**	**300**	**600**	**900**
V	Part-III	23BCA5C1	CC -9	Operating Systems	T	4	5	25	75	100
		23BCA5C2	CC -10	ASP .Net Programming	T	4	5	25	75	100
		23BCA5P1	CC- 11	ASP. Net Programming Lab	P	4	5	25	75	100
		23BCA5E1/ 23BCA5E2	DSE-I	Database Management System / Natural Language Processing	P	3	4	25	75	100
		23BCA5E3/ 23BCA5E4	DSE-II	Internet of Things and its Applications / Image Processing	T	3	4	25	75	100
		23BCA5PR	CC -12	Project with Viva voce (Individual)	T	4	5	25	75	100
	Part-IV	23BVE5		Value Education	T	2	2	25	75	100
		23BCA5I		Internship/Industrial Training (Summer vacation at the end of IV semester activity)	T	2	-	25	75	100
				TOTAL		**26**	**30**	**200**	**600**	**800**
VI	Part -III	23BCA6C1	CC- 13	Computer Networks	T	4	6	25	75	100
		23BCA6C2	CC 14	Data Analytics using R Programming	T	4	6	25	75	100
		23BCA6P1	CC- 15	R Programming Lab	P	4	6	25	75	100
		23BCA6E1/ 23BCA6E2	DSE-III	Artificial Intelligence / Fuzzy Logic	T	3	5	25	75	100
		23BCA6E3/ 23BCA6E4	DSE-IV	Cloud Computing / Artificial Neural Networks	T	3	5	25	75	100
	Part-IV	23BCA6S1	PCS	Essential Reasoning and Quantitative Aptitude	T	2	2	25	75	100
	Part V			Extension Activity		1				
				TOTAL		**21**	**30**	**175**	**425**	**600**

- T/OL–Tamil/Other Languages
- E–English
- CC –Core course – Core competency, critical thinking, analytical reasoning, research skill & teamwork
- Generic Elective (Allied)
- FC-Foundation Course
- EC – Elective Course
- SEC – Skill Enhancement Course
- T/P-T-Theory, P-Practical

Chairperson details: Dr.P.Eswaran, Alagappa University, Karaikudi. Mobile No: 9865022233

COREPAPER

FIRST YEAR - SEMESTER-I

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BCA1C1	PYTHON PROGRAMMING	Core 1	5	-	-	-	5	25	75	100

Course Objective	
CO1	To make students understand the concepts of Python programming.
CO2	To apply the OOPs concept in PYTHON programming.
CO3	To impart knowledge on demand and supply concepts
CO4	To make the students learn best practices in PYTHON programming
CO5	To know the costs and profit maximization

	Contents	No. of Hours
UNIT 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
UNIT II	**Control Statements:** Selection/Conditional Branching statements: if, if-else, nested if and if-elif-else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops. **Jump Statements:** break, continue and pass statements**.**	15
UNIT 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 Name space - Defining our own modules.	15
UNIT IV	**Lists:** Creating a list-Access value 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
UNIT 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		ProgrammeOutcomes
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	ReemaThareja,PythonProgrammingusingproblemsolvingapproach,FirstEdition, 2017,Oxford UniversityPress.	
2	Dr.R.NageswaraRao,CorePythonProgramming,FirstEdition,2017,Dreamtech Publishers.	
ReferenceBooks		
1	VamsiKurama,–PythonProgramming:AModernApproach,PearsonEducation.	
2	MarkLutz,LearningPython,Orielly.	
3	AdamStewarts,PythonProgramming,Online.	
4	FabioNelli,PythonDataAnalytics,APress.	
5	Kenneth A.Lambert,Fundamentals of Python–First Programs,CENGAGE Publication.	

WebResources	
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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**2**	**2**	**3**	**2**	**3**
CO3	**3**	**2**	**2**	**3**	**2**	**2**
CO4	**3**	**2**	**2**	**3**	**2**	**3**
CO5	**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
23BCA1P1	PYTHON PROGRAMMING LAB	Core 2	-	-	5	-	3	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.	**60**

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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**2**	**2**	**2**	**3**	**2**
CO2	**2**	**1**	**3**	**2**	**-**	**2**
CO3	**3**	**3**	**1**	**1**	**1**	**2**
CO4	**2**	**3**	**3**	**1**	**-**	**1**
CO5	**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.	Marks		
									CIA	External	Total
23BCA1S1	**WEB DESIGNING**	SEC-I	2	-	-	-	2	2	25	75	100

Course Objective	
CO1	Understand the basics of HTML and its components
CO2	To study about the Graphics in HTML
CO3	Understand and apply the concepts of XML and DHTML
CO4	Understand the concept of Java Script
CO5	To identify and understand the goals and objectives of the Ajax

	Details	**No. of Hours**
UNIT I	**HTML:** HTML- Introduction-tag basics–page structure–adding comments working with texts, paragraphs and line break. Emphasizing test-heading and horizontal rules-list-font size, face and color-Alignment links-tables-frames.	6
UNIT II	**Forms & Images using Html:** Graphics: Introduction-How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia, data collection with html forms text box, password, list box, combo box, text area, tools for Building web page front page.	6
UNIT III	**XML & DHTML:** Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your webpages-Grouping styles-extensible markup language (XML).	6
UNIT IV	**Dynamic HTML:** Document object model (DCOM)-Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding. **JavaScript:** Client-side scripting, What is Java Script, How to develop Java Script, simple Java Script, variables, functions, conditions, loops and repetition,	6
UNIT V	Advance script, Java Script and objects, Java Script own objects, the DOM and web browser environments, forms and validations.	6
	Total	**30**

	Course Outcomes	**Programme Outcome**
CO	Oncompletionofthiscourse,studentswill	
1	DevelopworkingknowledgeofHTML	PO1, PO3,PO6, PO8
2	AbilitytoDevelopandpublishWebpagesusingHypertextMarkupLanguage(HTML).	PO1,PO2,PO3, PO6
3	Abilitytooptimizepagestylesandlayoutwith CascadingStyleSheets(CSS).	PO3,PO5
4	Abilitytodevelopajavascript	PO1,PO2,PO3, PO7
5	AnabilitytodevelopwebapplicationusingAjax.	P02,PO6,PO7

	TextBook
1	PankajSharma,–WebTechnology,SkKataria&SonsBangalore2011.
2	MikeMcgrath,–JavaScript,DreamTechPress2006,1st Edition.
3	AchyutSGodbole&AtulKahate,–WebTechnologies,2002,2nd Edition.
	Reference Books
1.	LauraLemay,RafeColburn,JenniferKyrnin,–MasteringHTML,CSS&JavaScriptWeb Publishing,2016.
2.	DTEditorialServices(Author),–HTML5BlackBook(CoversCSS3,JavaScript,XML, XHTML,AJAX,PHP,jQuery),Paperback2016,2nd Edition.
1.	NPTEL&MOOCcoursestitledWebDesign and Development.
2.	https://www.geeksforgeeks.org

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**3**	**-**	**2**	**1**	**1**
CO2	**3**	**3**	**-**	**2**	**-**	**1**
CO3	**3**	**3**	**-**	**2**	**2**	**1**
CO4	**3**	**3**	**-**	**2**	**-**	**1**
CO5	**3**	**3**	**3**	**2**	**-**	**1**
Weightage of course contributed to each PSO	15	15	3	10	3	4

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BCA1FC	**Structured Programming in C**	Found. Course	2	-	-	-	2	2	25	75	100

Course Objective	
CO1	To familiarize the students with the Programming basics and the fundamentals of C, Data types in C, Mathematical and logical operations.
CO2	To understand the concept using if statements and loops
CO3	This unit covers the concept of Arrays
CO4	This unit covers the concept of Functions
CO5	To understand the concept of implementing pointers.

	Details	**No. of Hours**	**Course Objectives**
UNIT 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, key words and identifiers, constants, variables, data types, declaration of variables, Assigning values to variables-Assignment statement, declaring a variables constant, as volatile. Operators and Expression.	6	CO1
UNIT II	**Decision Making and Branching**: Decision making with If, simple IF, IF ELSE, nested IF ELSE, ELSE IF ladder, switch, GO TO statement. **Decision Making and Looping**: While, Do-While, For, Jumps in loops.	6	CO2
UNIT III	**Arrays**: Declaration and accessing of one & two-dimensional arrays, initializing two-dimensional arrays, multi-dimensional arrays.	6	CO3
UNIT 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
UNIT 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 functions, pointers and structures.	6	CO5
	Total	**30**	

	Course Outcome	**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, PO8
Text Book		
1	E.Balagurusamy, Programming in ANSIC, 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, 1998	
3.	YashavantKanetkar, Let Us C, Eighteenth Edition, BPB Publications, 2021	
Web Resources		
1.	https://codeforwin.org/	
2.	https://www.geeksforgeeks.org/c-programming-language/	
3.	http://en.cppreference.com/w/c	
4.	http://learn-c.org/	
5.	https://www.cprogramming.com/	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**1**	**2**	**2**	**2**	**2**	**-**
CO2	**2**	**2**	**2**	**2**	**-**	**2**
CO3	**3**	**2**	**2**	**1**	**1**	**-**
CO4	**3**	**2**	**2**	**1**	**-**	**1**
CO5	**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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BCA2C1	**OBJECT ORIENTED PROGRAMMING CONCEPTS USING C++**	**Core Course 3**	5	-	-	-	5	5	25	75	100

Course Objective	
CO1	Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects
CO2	Understand dynamic memory management techniques using pointers, constructors, destructors, etc
CO3	Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
CO4	Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
CO5	Demonstrate the use of various OOPs concepts with the help of programs

	Details	**No. of Hours**
UNIT 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
UNIT 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
UNIT 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
UNIT 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, Polymorphism and Virtual Functions.	15
UNIT V	**Files** –File stream classes –file modes –Sequential Read /Write operations–Binary and ASCII Files–Random Access Operation–Templates –Exception Handling-String –Declaring and Initializingstringobjects–StringAttributes–Miscellaneousfunctions.	15
	Total	**75**

	Course Outcomes	**Programme Outcome**
CO	Upon completion of the course the students would be Able to:	

CO 1	Remember the program structure of C with its syntax and semantics	PO1, PO6
CO 2	Understand the programming principles in C(data types, operators, branching and looping, arrays, functions, structures, pointers and files)	PO2
CO 3	Apply the programming principles learnt in real- Time problems	PO4, PO7
CO 4	Analyze the various methods of solving a problem and choose the best method	PO6
CO 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	

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

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**1**	**-**	**-**	**1**
CO2	**2**	**2**	**2**	**1**	**-**	**-**
CO3	**3**	**1**	**1**	**-**	**1**	**-**
CO4	**1**	**2**	**1**	**2**	**2**	**1**
CO5	**3**	**2**	**1**	**2**	**3**	**2**
Weightage of course contributed to each PSO	12	9	6	5	6	4

Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BCA2P1	C++ PROGRAMMING LAB	Core Course 4	-	-	4	-	3	4	25	75	100

Course Objective	
CO1	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
CO2	Understand dynamic memory management techniques using pointers, constructors, destructors.
CO3	Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
CO4	Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
CO5	Demonstrate the use of various OOPs concepts with the help of programs

S. No	List of Lab Programs	No. of Hours
1	Write a C++ program to demonstrate function overloading, Default Arguments and Inline function.	60
2	Write a C++ program to demonstrate Class and Objects	
3	Write a C++ program to demonstrate the concept t 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 Outcomes		Programme Outcome
CO	Upon completion of the course the students would be able to:	
CO 1	Remember the program structure of C with its syntax and semantics.	PO1, PO6
CO 2	Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files).	PO2

CO 3	Apply the programming principles learn in real-time problems.	PO4, PO7
CO 4	Analyze the various methods of solving a problem and choose the best method.	PO6
CO 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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**3**	**3**	**3**	**1**	**2**
CO2	**2**	**3**	**3**	**3**	**1**	**2**
CO3	**2**	**3**	**3**	**3**	**1**	**2**
CO4	**2**	**3**	**3**	**3**	**1**	**2**
CO5	**2**	**3**	**3**	**3**	**1**	**2**
Weightage of course contributed to each PSO	11	15	15	15	5	10

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BCA2S1	FUNDAMENTALS OF INFORMATION TECHNOLOGY	S E Course 2	2	-	-	-	2	25	75	100

Learning Objectives	
CO1	Understand basic concepts and terminology of information technology.
CO2	Have a basic understanding of personal computers and their operation
CO3	Be able to identify data storage and its usage
CO4	Get great knowledge of software and its functionalities
CO5	Understand about operating system and their uses

	Contents	No. of. Hours
UNIT I	**Introduction to Computers**-Generations of Computer–Data and Information – Components of Computer – Software – Hardware – Input Devices-Output Devices—Types of Operating System.	6
UNIT II	**MS-Word**: Introduction–Element of Window–Files, Folders and Directories – Text Manipulating: Cut, Copy, Paste, Drag and Drop – Text Formatting: Font – Style, Size, Face and Colors (Both foreground and background)–Alignment-Bullets and Numbering-Header and footer- watermark–inserting objects (images, other application document) –Table creation – Mail merge.	6
UNIT III	**Ms Excel**: Introduction–Inserting rows and columns–Sizing rows and columns–Implementing formulas–Generating series-Functions in excel –Creation of Chart–Inserting objects–Filter–Sorting–Inserting worksheet.	6
UNIT IV	**MS Power Point**: Introduction– Slides Manipulation (Inserting new, Copy, paste, delete and duplicate slides) –Slide show– Types of Views – Types of Animations–Inserting Objects–Implementing multimedia (Video and Audio)–Templates (Built-in and User-Defined).	6
UNIT V	**Internet**: Introduction to Internet and Intranet–Services of Internet-Domain Name – URL – Browser – Types of Browsers – Search Engine -E-Mail – Basic Components of E-Mail –How to send group mail. **E-Commerce**: Digital Signature–Digital Currency–Online shopping and Transaction.	6
	Total	30

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Learn the basics of computer, Construct the structure of the required things in computer, learn how to use it.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Develop organizational structure using for the devices present currently under input or output unit.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Concept of storing data in computer using two headers namely RAM and ROM with different types of ROM with advancement in storage basis.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Work with different software, Write program in the software and Applications of software.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Usage of Operating system in information technology which really acts as a interpreter between software and hardware.	PO1,PO2, PO3, PO4, PO5, PO6

Text books	
1	Anoop Mathew, S.Kavitha Murugeshan (2009) "Fundamental of Information Technology‖, Majestic Books.
2	Alexis Leon, Mathews Leon, Fundamental of Information Technology‖, 2nd Edition.
3	S.K Bansal, Fundamental of Information Technology.
Reference Books	
1.	Bhardwaj Sushil Puneet Kumar,Fundamental of Information Technology‖
2.	G G WILKINSON, Fundamentals of Information Technology‖, Wiley-Blackwell
3.	A Ravichandran,—Fundamentals of Information Technology, Khanna Book Publishing
Web Resources	
1.	https://testbook.com/learn/computer-fundamentals
2.	https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html
3.	https://www.javatpoint.com/computer-fundamentals-tutorial
4.	https://www.tutorialspoint.com/computer_fundamentals/index.htm
5.	https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**3**	**2**	**2**	**1**	**1**
CO2	**3**	**2**	**3**	**2**	**3**	**3**
CO3	**3**	**2**	**2**	**2**	**2**	**3**
CO4	**2**	**3**	**3**	**3**	**3**	**1**
CO5	**3**	**3**	**3**	**3**	**3**	**2**
Weightage of course Contributed to each PSO	**13**	**13**	**13**	**12**	**12**	**10**

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BCA2S2	**Multimedia Systems**	**S E Course 3**	**2**	**-**	**-**	**-**	**2**	**2**	**25**	**75**	**100**

Course Objective	
CO1	Understand the definition of Multimedia
CO2	To study about the Image File Formats, Sounds Audio File Formats
CO3	Understand the concepts of Animation and Digital Video Containers
CO4	To study about the Stage of Multimedia Project
CO5	Understand the concept of Ownership of Content Created for Project Acquiring Talent

	Details	**No. of Hours**
UNIT I	Multimedia Definition-Use of Multimedia-Delivering Multimedia- Text: About Fonts and Faces-Using Text in Multimedia -Computers and Text Font Editing and Design Tools-Hypermedia and Hypertext.	6
UNIT II	**Images:** Plan Approach-Organize Tools-Configure Computer Workspace-Making Still Images-Color –Image File Formats. **Sound:** The Power of Sound-Digital Audio-Midi Audio- Midi vs. Digital Audio-Multimedia System Sounds Audio File Formats -Vaughan's Law of Multimedia Minimums-Adding Sound to Multimedia Project	6
UNIT III	**Animation:** The Power of Motion-Principles of Animation-Animation by Computer-Making Animations that Work. **Video:** Using Video –Working with Video and Displays-Digital Video Containers-Obtaining Video Clips-Shooting and Editing Video	6
UNIT IV	**Making Multimedia:** The Stage of Multimedia Project-The Intangible Needs -The Hardware Needs - The Software Needs-An Authoring Systems Needs-Multimedia Production Team.	6
UNIT V	**Planning and Costing:** The Process of Making Multimedia-Scheduling-Estimating-RFPs and Bid Proposals. Designing and Producing- Content and Talent: Acquiring Content-Ownership of Content Created for Project-Acquiring Talent	6
	Total	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	understand the concepts, importance, application and the process of developing multimedia	PO1
CO2	To have basic knowledge and understanding about image related processing	PO1,PO2
CO3	To understand the framework of frames and bit images to animations	PO4,PO6
CO4	Speaks about the multimedia projects and stages of requirement in phases of project.	PO4, PO5, PO6
CO5	Understanding the concept of cost involved in multimedia planning, designing, and producing	PO3, PO8

Text Book	
1	Tay Vaughan, "Multimedia: Making It Work", 8th Edition, Osborne/McGraw- Hill, 2001.
Reference Books	
1.	Ralf Steinmetz & Klara Nahrstedt" Multimedia Computing, Communication & Applications", Pearson Education, 2012.
Web Resources	
1.	https://www.geeksforgeeks.org/multimedia-systems-with-features-or-characteristics/

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**3**	**3**	**2**	**1**
CO2	**3**	**2**	**3**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**3**	**2**	**1**
CO4	**3**	**2**	**3**	**3**	**1**	**1**
CO5	**3**	**3**	**3**	**3**	**1**	**1**
Weightage of course contributed to each PSO	15	11	15	15	8	5

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

SECOND YEAR – SEMESTER III

Course Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BCA3C1	**DATA STRUCTURES AND ALGORITHMS**	**Core Course 5**	5	-	-	-	4	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 application of graphs
LO5	To understand various sorting and searching

UNIT	**Details**	**No. of Hours**
UNIT I	Abstract Data Types (ADTs)- List ADT-array-based implementation-linked list implementation singly linked lists-circular linked lists-doubly-linkedlists-applicationsoflists-PolynomialManipulation-Alloperations-Insertion-Deletion-Merge-Traversal	15
UNIT 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
UNIT 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
UNIT 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
UNIT 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	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", Mc Graw 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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**3**	**3**	**-**	**1**	**-**
CO2	**1**	**2**	**1**	**-**	**-**	**-**
CO3	**3**	**1**	**2**	**1**	**-**	**-**
CO4	**2**	**2**	**1**	**-**	**-**	**1**
CO5	**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

Course Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BCA3 P1	DATA STRUCTURES AND ALGORITHMS LAB using C++	Core Course 6	-	-	4	-	4	4	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 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 post fix form and then evaluates the post fix 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 programs for the implementation of BFS and DFS for a given graph.	
8	Write a programs for implementing the following searching methods: • Linear search • Binary search.	
9.	Write a programs for implementing the following sorting methods: • Bubble sort • Selection sort • Insertion sort • Radix sort.	

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", Mc Graw 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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**3**	**3**	**2**	**1**	**-**
CO2	**1**	**2**	**1**	**-**	**-**	**2**
CO3	**3**	**1**	**2**	**1**	**-**	**-**
CO4	**2**	**2**	**1**	**2**	**3**	**1**
CO5	**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
23BCA3S1	**Software Testing**	SEC - IV	2	-	-	-	2	2	25	75	100

Course Objective	
LO1	To study fundamental concepts in software testing
LO2	To discuss various software testing issues and solutions in software unit, integration and system testing.
LO3	To study the basic concept of Data flow testing and Domain testing.
LO4	To Acquire knowledge on path products and path expressions.
LO5	To learn about Logic based testing and decision tables

UNIT	**Details**	**No. of Hours**
UNIT I	Introduction: Purpose–Productivity and Quality in Software–Testing Vs Debugging–Modelfor Testing–Bugs–Types of Bugs–Testing and Design Style.	6
UNIT II	Flow/Graphs and Path Testing–Achievable paths–Path instrumentation Application Transaction Flow Testing Techniques.	6
UNIT III	Data Flow Testing Strategies-Domain Testing: Domains and Paths–Domains and Interface Testing.	6
UNIT IV	Linguistic–Metrics–Structural Metric–Path Products and Path Expressions. Syntax Testing–Formats–Test Cases	6
UNIT V	Logic Based Testing–Decision Tables–Transition Testing–States, State raph, State Testing.	6
	Total	**30**

Course Outcomes		**Program Outcomes**
CO	On completion of this course, students will	
1	Students learn to apply software testing knowledge and engineering methods	PO1
2	Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.	PO1,PO2
3	Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.	PO4, PO6
4	Have basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems	PO4, PO5, PO6
5	Have an ability to use software testing methods and modern software testing tools for their testing projects.	PO3, PO8

Text Book	
1	B.Beizer, Software Testing Techniques, II Edn., Dream Tech India, New Delhi, 2003.
2	K.V.K.Prasad, Software Testing Tools, Dream Tech. India, New Delhi, 2005

Reference Books	
1.	I.Burnstein, 2003, Practical Software Testing, Springer International Edn.
2.	E.Kit, Software Testing in the Real World: Improving the Process, Pearson Education, New Delhi, 1995.
3.	R.Rajani and P.P.Oak, Software Testing, Tata Mcgraw Hill, New Delhi, 2004.

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

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**3**	**2**	**2**	**2**	**-**
CO2	**3**	**2**	**2**	**3**	**3**	**2**
CO3	**2**	**3**	**3**	**2**	**2**	**3**
CO4	**2**	**1**	**2**	**2**	**2**	**1**
CO5	**2**	**2**	**3**	**2**	**2**	**2**
Weightage of course contributed to each PSO	11	10	12	11	11	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
23BCA3S2	**Biometrics**	SEC - V	2	-	-	-	2	2	25	75	100

Course Objectives	
LO1	Identify the various biometric technologies.
LO2	Design of biometric recognition.
LO3	Develop simple applications for privacy
LO4	Understand the need of biometric in the society
LO5	Understand the scope of biometric techniques

UNIT	Details	No. of Hours
UNIT I	**Introduction**: What is Biometrics, History, Types of biometric Traits, General architecture of biometric systems, Basic working of biometric matching, Biometric system error and performance measures, Design of biometric system, Applications of biometrics, Biometrics versus traditional authentication methods. **Face Biometrics:** Introduction, Background of Face Recognition, Design of Face Recognition System, Neural Network for Face Recognition, Face Detection in Video Sequences, Challenges in Face Biometrics. Face Recognition Methods, Advantages and Disadvantages.	6
UNIT II	**Retina and Iris Biometrics:** Introduction, Performance of Biometrics, Design of Retina Biometrics, Design of Iris Recognition System, Iris Segmentation Method, Determination of Iris Region, Determination of Iris Region, Applications of Iris Biometrics, Advantages and Disadvantages **Vein and Fingerprint Biometrics:** Introduction, Biometrics Using Vein Pattern of Palm, Fingerprint Biometrics, Fingerprint Recognition System, Minutiae Extraction, Fingerprint Indexing, Experimental Results, Advantages and Disadvantages.	6
UNIT III	**Privacy Enhancement Using Biometrics:** Introduction, Privacy Concerns Associated with Biometric Deployments, Identity and Privacy, Privacy Concerns, Biometrics with Privacy Enhancement, Comparison of Various Biometrics in Terms of Privacy, Soft Biometrics. **Multimodal Biometrics:** Introduction to Multimodal Biometrics, Basic Architecture of Multimodal Biometrics, Multimodal Biometrics Using Face and Ear, Characteristics and Advantages of Multimodal Biometrics, Characteristics and Advantages of Multimodal Biometrics.	6
UNIT IV	**Watermarking Techniques:** Introduction, Data Hiding Methods, Basic Framework of Watermarking, Classification of Watermarking, Applications of Watermarking, Attacks on Watermarks, Performance Evaluation, Characteristics of Watermarks, General Watermarking Process, Image Watermarking Techniques, Watermarking Algorithm, Experimental Results, Effect of Attacks on Watermarking Techniques, Attacks on Spatial Domain Watermarking.	6
UNIT V	**Scope and Future:** Scope and Future Market of Biometrics, Biometric Technologies, Applications of Biometrics, Biometrics and Information Technology Infrastructure, Role of Biometrics in Enterprise Security, Role of Biometrics in Border Security, Smart Card Technology and Biometrics, Radio Frequency Identification (RFID) Biometrics, DNA Biometrics, Comparative Study of Various Biometric Techniques. **Biometric Standards:** Introduction, Standard Development Organizations, Application Programming Interface (API), Information Security and Biometric Standards, Biometric Template Interoperability.	6
	Total	**30**

Course Outcomes		
CO	On completion of this course, students will;	
CO1	To understand the basic concepts and the functionality of the Biometrics, Face Biometrics, Types, Architecture and Applications.	PO1,PO3, PO6, PO8
CO2	To know the concepts Retina and Iris Biometrics and Vein and Fingerprint Biometrics.	PO1, PO2, PO3, PO6
CO3	To analyse the Privacy Enhancement and Multimodal Biometrics.	PO3, PO5
CO4	To get analytical idea on Watermarking Techniques	PO1, PO2, PO3, PO7
CO5	To Gain knowledge on Future scope of Biometrics, and Study of various Biometric Techniques.	PO2, PO6, PO7
Recommended Text		
1.	G.R Sinha and Sandeep B. Patil, Biometrics: Concepts and Applications, Wiley, 2013	
References Books		
1.	Ruud M. Bolle , Sharath Pankanti, Nalinik.Ratha, Andrew W.Senior, Jonathan H. Connell, Guide to Biometrics, Springer 2009	
2.	by Anilk.Jain, Arun A. Ross, Karthik Nandakumar, Introduction to Biometrics	
3.	Handbook of Biometrics, Anil K. Jain, Patrick Flynn, Arun A. Ross.	
Web Resources		
1.	https://www.tutorialspoint.com/biometrics/index.htm	
2.	https://www.javatpoint.com/biometrics-tutorial	
3.	https://www.thalesgroup.com/en/markets/digital-identity-and-security/government/inspired/biometrics	

SEMESTER - IV

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BCA 4C1	**Programming in JAVA**	Core Course - 7	5	-	-	-	4	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.
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.

UNIT	Details	No. of Hours
UNIT 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
UNIT II	**Inheritance**: Basic concepts - Types of inheritance -Member access rules- Usage of this and Super keyword – 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
UNIT III	**Multithreaded Programming**: Thread Class-Runnable interface– Synchronization–Using synchronized methods– Using synchronized statement – Inter thread Communication–Deadlock. **I/O Streams:** Concepts of streams-Stream classes-Byte and Character stream - Reading console Input and Writing Console output – File Handling.	15
UNIT 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
UNIT V	**Swing:** Introduction to Swing-Hierarchy of swing components. Containers – Top level containers-J Frame-J Window – J Dialog – J Panel – J Button – J toggle Button – J Check Box – J Radio Button-J Label, J Text Field – J Text Area – J List – J Combo Box – J Scroll Pane.	15
	Total	**75**

	Course Outcomes	Programme Outcome
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 Mc Graw 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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**-**	**2**	**2**	**2**
CO2	**3**	**1**	**2**	**1**	**2**	**2**
CO3	**1**	**-**	**2**	**2**	**2**	**2**
CO4	**2**	**2**	**2**	**2**	**2**	**2**
CO5	**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
23BCA4P1	**Programming in Java lab**	Core Course - 8	-	-	5	-	4	4	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.
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

Sl. No.	Details	No. of Hours
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	Writea Java program to multiply two given matrices.	
3	Writea 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 Character Array 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 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 every1 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 1 to10 using Thread 1and to print 90 to100 using Thread 2.	
10	Write a program to demonstrate the use of following exceptions. a. Arithmetic Exception b. Number Format Exception c. Array Index Out of Bound Exception 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 centre 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	Writea 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	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**2**	**1**	**3**	**2**	**3**
CO2	**3**	**2**	**1**	**3**	**1**	**3**
CO3	**3**	**2**	**1**	**3**	**2**	**3**
CO4	**3**	**2**	**1**	**3**	**2**	**3**
CO5	**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
23BCA4S1	**PHP PROGRAMMING**	SEC - 6	2				2	2	25	75	100

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

UNIT	**Details**	**No. of Hours**
UNIT I	Introduction to PHP-Basic Knowledge of websites-Introduction of Dynamic Website-Introduction to PHP-Scope of PHP-XAMPP and WAMP Installation	6
UNIT II	PHP Programming Basics-Syntax of PHP-Embedding PHP in HTML-Embedding HTML in PHP. Introduction to PHP Variable-Understanding Data Types –Using Operators -Using Conditional Statements -If(), else if() and else if condition Statement.	6
UNIT III	Switch() Statements-Using the while() Loop-Using the for() Loop PHP Functions. PHP Functions-Creating an Array-Modifying Array Elements-Processing Arrays with Loops-Grouping Form Selections with Arrays-Using Array Functions.	6
UNIT IV	PHP Advanced Concepts –Reading and Writing Files -Reading Data From a File.	6
UNIT V	Managing Sessions and Using Session Variables-Destroying a Session-Storing Data in Cookies-Setting Cookies.	6
	Total	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Write PHP scripts to handle HTML forms	PO1, PO4, PO6, PO8.
2	Write regular expressions including modifiers, operators, and meta characters.	PO2, PO5, PO7.
3	Create PHP Program using the concept of array.	PO3, PO6, PO8.
4	Create PHP programs that use various PHP	PO2, PO3, PO5, PO8.
	Library functions	
5	Manipulate files and directories.	PO3, PO5, PO6.

Text Book	
1	Head First PHP & MySQL: ABrain-Friendly Guide – 2009 - Lynnmighley and Michael Morrison.
2	The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL – Alan Forbes
Reference Books	
1.	PHP: The Complete Reference - Steven Holzner.
2.	DT Editorial Services (Author), *HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)*, Paper back 2016, 2nd Edition.
Web Resources	
1.	Refer MOOC Courses like NPTEL and SWAYAM
2.	https://www.w3schools.com/php/default.asp

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**3**	**1**	**1**	**-**	**1**
CO2	**2**	**-**	**1**	**1**	**2**	**1**
CO3	**3**	**3**	**1**	**1**	**-**	**1**
CO4	**1**	**3**	**2**	**1**	**-**	**1**
CO5	**3**	**2**	**1**	**1**	**-**	**1**
Weightage of course contributed to each PSO	12	11	6	5	2	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
23BCA4S2	**Cyber Forensics**	SEC - 7	2	-	-	-	2	2	25	75	100

Course Objective	
LO1	Understand the definition of computer forensics fundamentals.
LO2	To study about the Types of Computer Forensics Evidence
LO3	Understand and apply the concepts of Duplication and Preservation of Digital Evidence
LO4	Understand the concepts of Electronic Evidence and Identification of Data
LO5	To study about the Digital Detective, Network Forensics Scenario, Damaging Computer Evidence.

UNIT	Details	No. of Hours
UNIT I	**Overview of Computer Forensics Technology:** Computer Forensics Fundamentals: What is Computer Forensics Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of professional Forensics Methodology, Steps taken by Computer Forensics Specialists. Types of Computer. Forensics Technology: Types of Business Computer Forensic, Technology–Types of Military Computer Forensic Technology–Types of Law Enforcement–Computer Forensic. Technology–Types of Business Computer Forensic Technology.	6
UNIT II	**Computer Forensics Evidence and capture:** Data Recovery: Data Recovery Defined, Data Back–up and Recovery, The Role of Back –up in Data Recovery, The Data – Recovery Solution. Evidence Collection and Data Seizure: Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collections, Artefacts, Collection Steps, Controlling Contamination: The chain of custody.	6
UNIT III	**Duplication and Preservation of Digital Evidence:** Processing steps, Legal Aspects of collecting and Preserving Computer forensic Evidence. Computer image Verification and Authentication: Special needs of Evidential Authentication, Practical Consideration, Practical Implementation.	6
UNIT IV	**Computer Forensics Analysis:** Discovery of Electronic Evidence: Electronic Document Discovery: A Powerful New Litigation Tool. Identification of Data: Time Travel, Forensic Identification and Analysis of Technical Surveillance Devices.	6
UNIT V	**Reconstructing Past Events:** How to Become a Digital Detective, Useable File Formats, Unusable File Formats, Converting Files. Networks: Network Forensics Scenario, a technical approach, Destruction Of E–Mail, Damaging Computer Evidence, Documenting The Intrusion on Destruction of Data, System Testing.	6
	Total	**30**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
1	Understand the definition of computer forensics fundamentals.	PO1
2	Evaluate the different types of computer forensics technology.	PO1, PO2
3	Analyze various computer forensics systems.	PO4, PO6
4	Apply the methods for data recovery, evidence collection and data seizure.	PO4, PO5, PO6
5	Gain your knowledge of duplication and preservation of digital evidence.	PO3, PO8
Text B ook		
1	John R.Vacca, Computer Forensics: Computer Crime Investigation, 3/E, Firewall Media, New Delhi, 2002.	
Reference Books		
1	Nelson, Phillips Enfinger, Steuart,–Computer Forensics and Investigations, CENGAGE Learning, 2004.	
2	Anthony Sammes and Brian Jenkinson, Forensic Computing: A Practitioner & # 39; s Guide, Second Edition, Springer–Verlag London Limited, 2007.	
3	Robert M. Slade, Software Forensics Collecting Evidence from the Scene of a Digital Crime, TMH 2005.	
Web Resources		
1	https://www.vskills.in	
2	https://www.hackingarticles.in/best-of-computer-forensics-tutorials/	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**3**	**-**	**2**	**2**	**3**
CO2	**3**	**-**	**-**	**2**	**3**	**-**
CO3	**-**	**2**	**1**	**-**	**2**	**3**
CO4	**3**	**3**	**1**	**3**	**3**	**2**
CO5	**3**	**2**	**1**	**3**	**-**	**3**
Weightage of course contributed to each PSO	11	10	3	10	10	11

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
23BCA 5C1	**Operating Systems**	Core Course - 9	5	-	-	-	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 the concept of memory organization and multi programming

UNIT	**Details**	**No. of Hours**
UNIT I	**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
UNIT 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
UNIT III	**Deadlock and in definite postponement:** Resource concepts, four necessary conditions for deadlock, deadlock prevention, deadlock avoidance and Dijkstra‘s Banker‘s algorithm, deadlock detection, deadlock recovery.	15
UNIT 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
UNIT 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 concepts, multilevel storage organization, block mapping, paging basic concepts, segmentation, paging/ segmentation systems. **Virtual Memory Management:** Demand Paging, Page replacement strategies.	15
	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, Ninth Edition, John Wiley & Sons (ASIA) Pvt. Ltd.,2012	
Web Resources		
1.		
2.		

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**-**	**1**	**2**	**-**	**1**
CO2	**2**	**3**	**1**	**2**	**-**	**1**
CO3	**3**	**2**	**-**	**3**	**-**	**1**
CO4	**1**	**3**	**1**	**1**	**3**	**2**
CO5	**3**	**-**	**1**	**3**	**2**	**1**
Weightageofcoursecontributedtoeach 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
23BCA5C2	**ASP .Net Programming**	Core Course - 10	5	-	-	-	4	5	25	75	100

Course Objective	
LO1	To identify and understand the goals and objectives of the .NET frame work 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**
UNIT 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
UNIT 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
UNIT 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
UNIT IV	ADO .NET Overview – Database Connections–Commands –Data Reader – Data Adapter – Data Sets –Data Controls and Its Properties – Data Binding	15
UNIT V	**Grid View control:** Deleting, editing, Sorting and Paging. XML classes–Web form to manipulate XML files-Website Security-Authentication - Authorization–Creating Web application.	15
	Total	**75**

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 Microsoft ADO .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 Mc Graw-Hill, 2015.	
Reference Books		
1.	Herbert Schildt, The Complete Reference C# .NET, Tata McGraw-Hill, 2017.	
2.	Kogent Learning Solutions, C# 2012 Programming Covers .NET 4.5 Black Book, Dream tech press, 2013.	
3.	Anne Boehm, Joel Murach, Murach's C# 2015, Mike Murach & Associates Inc. 2016.	
4.	Denielle Otey, Michael Otey, ADO .NET: The Complete reference, Mc Graw Hill, 2008.	
5.	Matthew Mac Donald, Beginning ASP .NET4 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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**1**	**2**	**2**	**1**	3
CO2	**3**	**2**	**2**	**2**	**2**	3
CO3	**3**	**3**	**2**	**2**	**3**	3
CO4	**3**	**1**	**2**	**2**	**1**	3
CO5	**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 Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BCA5P1	**ASP .Net Programming LAB**	Core Course – 11	-	-	5	-	4	5	25	75	100

Course Objective	
LO1	To develop ASP .NET Web application using standard controls.
LO2	To create rich database applications using ADO .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**	
1.	Create an exposure of Web applications and tools	
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.	
7.	Web application using Data Controls.	
8.	Data binding with Web controls	
9.	Data binding with Data Controls.	
10.	Data base application to perform insert, update and delete operations.	
11.	Database application using Data Controls to Perform insert, delete, edit, paging and sorting operation.	
12.	Implement the Xml classes.	
13.	Implement Authentication–Authorization.	
14.	Ticket reservation using ASP.NET controls.	
15.	On line examination using ASP .NET controls	
	Total	**60**

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	Createa 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	Svetlin Nakov, Veselin Kolev & Co, Fundamentals of Computer Programming with C#, Faber publication, 2019.	
2	Mathew, MacDonald, The Complete Reference ASP .NET, Tata McGraw-Hill, 2015.	
Reference Books		
1.	Herbert Schildt, The Complete Reference C# .NET, TataMc Graw-Hill, 2017.	
2.	Kogent Learning Solutions, C# 2012 Programming Covers .NET 4.5 Black Book, Dream tech press, 2013.	
3.	Anne Boehm, Joel Murach, Murach‘s C# 2015, Mike Murach & Associates Inc. 2016.	
4.	Denielle Otey, Michael Otey, ADO .NET: The Complete reference, Tata McGraw Hill, 2008.	
5.	Matthew MacDonald, Beginning ASP .NET4 in C# 2010, A PRESS, 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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**2**	**2**	**1**	1
CO2	**3**	**2**	**3**	**2**	**2**	2
CO3	**3**	**3**	**2**	**2**	**1**	1
CO4	**3**	**2**	**3**	**2**	**1**	1
CO5	**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
23BCA5E1	**Database Management System**	EC- 8	4	-	-	-	3	4	25	75	100
Course Objective											
LO1	To enable the students to learn the designing of database systems, foundation on the Relational model of data and normal forms.										
LO2	To understood the concepts of database 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 database systems, foundation on the Relational model of data and normal forms.										
LO5	To understood the concepts of database management system, design simple Database models										

UNIT	Details	No. of Hours
UNIT I	**Database Concepts:** Database Systems-Data vs Information - Introducing the database - File system-Problems with file system – Database systems. Data models-Importance-Basic Building Blocks-Business rules - Evolution of Data models - Degrees of Data Abstraction	12
UNIT II	**Design Concepts:** Relational database model – logical view of data-keys-Integrity rules-relational set operators – data dictionary and the system catalog-relationships-data redundancy revisited-indexes-codd's rules. Entity relationship model-ER diagram.	12
UNIT III	**Normalization of Database Tables**: Database tables and Normalization – The Need for Normalization –The Normalization Process–Higher level Normal Form. **Introduction to SQL**: Data Definition Commands–Data Manipulation Commands–SELECT Queries–Additional Data Definition Commands–Additional SELECT Query Keywords–Joining Database Tables.	12
UNIT IV	**Advanced SQL**: Relational SET Operators: UNION –UNIONALL–INTERSECT-MINUS. SQL Join Operators: Cross Join – Natural Join – Join USING Clause – JOIN ON Clause – Outer Join. **Sub Queries and Correlated Queries**: WHERE – IN – HAVING –ANY and ALL – FROM. SQL Functions: Date and Time Function–Numeric Function–String Function–Conversion Function	12
UNIT V	**PL/SQL**: A Programming Language: History–Fundamentals – Block Structure – Comments – Data Types – Other Data Types – Variable Declaration –Assignment operation –Arithmetic operators. **Control Structures and Embedded SQL**: Control Structures –Nested Blocks–SQL in PL/SQL–Data Manipulation – Transaction Control statements. **PL/SQL Cursors and Exceptions**: Cursors – Implicit Cursors, Explicit Cursors and Attributes–Cursor FOR loops–SELECT…FOR UPDATE – WHERE CURRENT OF clause – Cursor with Parameters – Cursor Variables – Exceptions–Types of Exceptions.	12
	Total	**60**

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

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BCA5E2	**NATURAL LANGUAGE PROCESSING**	**EC - 8**	4	-	-	-	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 with in NLP.
LO4	To get acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, pragmatics etc.
LO5	Tounderstandcurrentmethodsforstatisticalapproachestomachinetranslation.

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

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 weaknesses of each Use 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
Text books		
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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**-**	**-**	**2**	**-**	**2**
CO2	**2**	**1**	**-**	**1**	**3**	**1**
CO3	**3**	**-**	**1**	**1**	**-**	**1**
CO4	**2**	**-**	**-**	**2**	**1**	**2**
CO5	**2**	**-**	**-**	**2**	**-**	2
Weightage of course Contributed to each PSO	11	1	1	8	4	8

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BCA5E3	**Internet of Things and its Applications**	EC - 9	4	-	-	-	3	4	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
UNIT I	IoT & Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.	12
UNIT II	M2M to IoT–A Basic Perspective–Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview–Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.	12
UNIT III	IoT Architecture -State of the Art–Introduction, State of the art, Architecture. Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture-Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views	12
UNIT IV	IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management.	12
UNIT V	Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.	12
	Total	**60**

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	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.	Francisda Costa, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, A press Publications 2013, 1st Edition,
3	Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice 4. Cuno P fister, 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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**-**	**-**	**2**	**-**	**2**
CO2	**2**	**1**	**-**	**1**	**3**	**1**
CO3	**3**	**-**	**1**	**1**	**-**	**1**
CO4	**2**	**-**	**-**	**2**	**1**	**2**
CO5	**2**	**-**	**-**	**2**	**-**	2
Weightage of course Contributed to each PSO	11	1	1	8	4	8

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BCA5E4	**Image Processing**	EC - 9	4	-	-	-	3	4	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
UNIT 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	**12**
UNIT II	**2D Image transforms:** Properties of 2D-DFT-Walsh transform-Hada mard transform-Haar transform- Discrete Cosine Transform- Karhunen-Loeve Transform-Singular Value Decomposition	**12**
UNIT 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.	**12**
UNIT 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.	**12**
UNIT V	**Image Compression:** Need for compression-Redundancy-Classification of image – Compression schemes-Huffman coding-Arithmetic coding- Dictionary based compression-Transform based compression,	**12**
	Total	**60**

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.	Jain Anil K, Fundamentals of digital image processing:, PHI,1988	
2.	Kenneth R Castleman, Digital image processing:, Pearson Education, 2/e, 2003	
3.	Pratt 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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	3	2	2	3	1
CO2	3	2	3	2	3	3
CO3	3	3	2	2	2	1
CO4	3	3	3	1	3	3
CO5	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
23BCA5PR	**Project with Viva Voce**	Core Course 12	5	-	-	-	4	5	25	75	100

SEMESTER VI

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BCA6C1	**Computer Networks**	Core Course - 13	6	-	-	-	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 internetworking devices
LO4	To study about Network communication.
LO5	To learn the concept of Transport layer

UNIT	**Details**	**No. of Hours**
UNIT 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
UNIT II	Wireless Transmission-Communication Satellites–Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues–Error Detection and Correction.	15
UNIT 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
UNIT IV	Network Layer – Design Issues – Routing Algorithms – Congestion Control Algorithms–IP Protocol–IP Addresses–Internet Control Protocols.	15
UNIT 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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**-**	**2**	**1**	**-**
CO2	**3**	**2**	**1**	**2**	**2**	**-**
CO3	**3**	**-**	**-**	**2**	**-**	**2**
CO4	**3**	**1**	**-**	**2**	**1**	**-**
CO5	**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
23BCA6C2	**DATA ANALYTICS USING R Programming**	Core Course - 14	6	-	-	-	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 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
UNIT I	**EVOLUTION OF BIG DATA**—Best Practices for Big data Analytics — Big data characteristics — Validating—The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications —Perception and Quantification of Value –Understanding Big Data Storage —A General Overview of High-Performance Architecture—HDFS—Map Reduce and YARN— Map Reduce Programming Model.	18
UNIT 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
UNIT 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
UNIT 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
UNIT V	**OBJECT-ORIENTED PROGRAMMINGS** Classes, SGeneric Functions, Writing SClasses, Using Inheritance, SClasses, Writing SClasses, Implementing a Generic Functionon an SClass, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation	18
	Total	**90**

Course Outcomes		Programme Outcomes
	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 SQL data bases and management.	PO3, PO8
Text Book		
1	Roger D.Peng, R Programming for Data Science, 2012	
2	Norman Matloff, The Art of R Programming-ATour 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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**-**	**3**	**1**	**-**
CO2	**3**	**3**	**2**	**2**	**-**	**2**
CO3	**1**	**2**	**3**	**1**	**2**	**1**
CO4	**2**	**2**	**1**	**-**	**2**	**1**
CO5	**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
23BCA6P1	R Programming-LAB	Core Course - 15	-	-	6	-	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 nusing 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 piechart and barchart 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		Programme 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 skil lof designing graphical-user Interfaces (GUI) in R Programming	PO1, PO3, PO6
4	Acquire R Programming skills to move into Specific branches	PO3, PO4
5	Develop the factoriual for the given numbare	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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO 6
CO1	**3**	**3**	**3**	**3**	**1**	**2**
CO2	**2**	**3**	**3**	**3**	**1**	**2**
CO3	**2**	**3**	**3**	**3**	**1**	**2**
CO4	**2**	**3**	**3**	**3**	**1**	**2**
CO5	**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	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BCA6E1	**Artificial Intelligence**	Elective Course - 10	5	-	-	-	3	5	25	75	100

Course Objective	
LO1	To learn various concepts of AI Techniques.
LO2	To learn various Search Algorithm in AI.
LO3	To learn probabilistic reasoning and models in AI.
LO4	To learn about Markov Decision Process.
LO5	To learn various type of Reinforcement learning.

UNIT	Details	No. of Hours
UNIT I	Introduction: Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree	12
UNIT II	Search Algorithms: Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A*algorithm, Game Search	12
UNIT III	Probabilistic Reasoning: Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.	12
UNIT IV	Markov Decision process : MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.	12
UNIT V	Reinforcement Learning: Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning-Q learning	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the various concepts of AI Techniques.	PO1
2	Understand various Search Algorithm in AI.	PO1, PO2
3	Understand probabilistic reasoning and models in AI.	PO4, PO6
4	Understand Markov Decision Process.	PO4, PO5, PO6
5	Understand various type of Reinforcement learning Techniques.	PO3, PO8

Text Book	
1	Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall.
2	Elaine Rich and Kevin Knight, –Artificial Intelligence, Tata McGraw Hill

Reference Books	
1.	Trivedi, M. C. –A Classical Approach to Artificial Intelligence, Khanna Publishing House, Delhi.
2.	Saroj Kaushik, –Artificial Intelligence, Cengage Learning India,2011
3.	David Poole and Alan Mackworth, Artificial Intelligence: Foundations for Computational Agents, Cambridge University Press 2010

Web Resources	
1.	NPTEL & MOOC courses titled Artificial Intelligence and Expert Systems
2.	https://nptel.ac.in/courses/106106140/
3.	https://nptel.ac.in/courses/106106126/

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**3**	**2**	**3**	**2**	**-**
CO2	**2**	**-**	**2**	**3**	**3**	**2**
CO3	**1**	**2**	**-**	**-**	**2**	**3**
CO4	**3**	**1**	**2**	**2**	**2**	**1**
CO5	**2**	**1**	**3**	**1**	**2**	**2**
Weightage of course contributed to each PSO	10	7	9	9	11	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
23BCA6E2	**Fuzzy Logic**	Elective Course - 10	5	-	-	-	3	5	25	75	100

Course Objective	
LO1	To understand the basic concept of Fuzzy logic
LO2	To learn the various operations on relation properties
LO3	To study about the membership functions
LO4	To learn about the Defuzzification and Fuzzy Rule-Based System
LO5	To learn the concepts of Applications of Fuzzy Logic

UNIT	**Details**	**No. of Hours**
UNIT I	Introduction to Fuzzy Logic- Fuzzy Sets - Fuzzy Set Operations, Properties of Fuzzy Sets, Classical and Fuzzy Relations: Introduction-Cartesian Product of Relation-Classical Relations-Cardinality of Crisp Relation.	12
UNIT II	Operations on Crisp Relation-Properties of Crisp Relations-Composition Fuzzy Relations, Cardinality of Fuzzy Relations-Operations on Fuzzy Relations-Properties of Fuzzy Relations-Fuzzy Cartesian Product and Composition-Tolerance and Equivalence Relations, Crisp Relation.	12
UNIT III	Membership Functions: Introduction, Features of Membership Function, Classification of Fuzzy Sets, Fuzzification, Membership Value Assignments, Intuition, Inference, Rank Ordering.	12
UNIT IV	Defuzzification: Introduction, Lambda Cuts for Fuzzy Sets, Lambda Cuts for Fuzzy Relations, Defuzzification Methods, Fuzzy Rule- Based System: Introduction, Formation of Rules, Decomposition of Rules, Aggregation of Fuzzy Rules, Properties of Set of Rules.	12
UNIT V	Applications of Fuzzy Logic: Fuzzy Logic in Automotive Applications, Fuzzy Antilock Brake System - Antilock-Braking System and Vehicle Speed-Estimation Using Fuzzy Logic.	12
	TOTAL	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Understand the basics of Fuzzy sets, operation and properties.	PO1
2	Apply Cartesian product and composition on Fuzzy relations and use the tolerance and Equivalence relations.	PO1, PO2
3	Analyze various fuzzification methods and features of membership Functions.	PO4, PO6
4	Evaluate defuzzification methods for real time applications.	PO4, PO5, PO6
5	Design an application using Fuzzy logic and its Relations.	PO3, PO8

Text Book	
1	S.N.Sivanandam, S.Sumathi and S.N.Deepa – Introduction to Fuzzy Logic using MATLAB, Springer-Verlag Berlin Heidelberg, 2007.
Reference Books	
1.	Guanrong Chen and Trung Tat Pham-Introduction to Fuzzy Sets, Fuzzy Logic and Fuzzy Control Systems
2.	Timothy J Ross, Fuzzy Logic with Engineering Applications
Web Resources	
1.	https://www.javatpoint.com/fuzzy-logic
2.	https://www.guru99.com/what-is-fuzzy-logic.html

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	2	1	1
CO2	3	2	3	2	3	3
CO3	3	3	2	2	2	3
CO4	2	3	1	1	3	3
CO5	3	2	3	3	3	3
Weightage of course Contributed to each PSO	13	13	11	10	12	13

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BCA6E3	**Cloud Computing**	Elective Course - 11	5	-	-	-	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 pit falls.
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
UNIT 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–Map Reduce–Identity and Access Management–Service Level Agreements–Billing.	12
UNIT 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 - Notification Services - Media Services. **Content Delivery Services:** Amazon Cloud Front – Windows Azure Content Delivery Network Analytics Services: Amazon Elastic Map Reduce - Google Map Reduce Service-Google Big Query - Windows Azure HD Insight Deployment and Management Services: Amazon Elastic Bean stack-Amazon Cloud Formation Identity and Access **Management Services:** Amazon Identity and Access Management-Windows Azure. Active Directory Open Source Private Cloud Software: Cloud Stack– Eucalyptus -Open Stack	12
UNIT 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 Methodologies: Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), RESTful Web Services –Data Storage Approaches: Relational Approach (SQL), Non-Relational Approach (NoSQL).	12
UNIT IV	**Cloud Application Benchmarking and Tuning:** Introduction to Benchmarking – Steps in Benchmarking – Workload Characteristics –Application Performance Metrics–Design Consideration for Benchmarking Methodology–Benchmarking Tools and Types of Tests – Deployment Prototyping. **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.	
UNIT 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.	12
	Total	**60**

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	PO4, PO6
	Application design.	
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	Arshdeep Bahga, Vijay Madisetti, Cloud Computing–A Hands On Approach, Universities Press (India) Pvt. Ltd., 2018	
Reference Books		
1.	Anthony T Velte, Toby J Velte, Robert Elsenpeter, Cloud Computing: A Practical 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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**2**	**2**	**3**	**3**	**1**
CO2	**3**	**1**	**2**	**3**	**3**	**-**
CO3	**3**	**2**	**1**	**2**	**1**	**3**
CO4	**3**	**3**	**2**	**3**	**2**	**-**
CO5	**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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BCA6E4	**Artificial Neural Networks**	Elective Course - 11	5	-	-	-	3	5	25	75	100

Course Objective	
LO1	Understand the basics of ANN, learning process, single layer and multi-layer perceptron networks.
LO2	Understand the Error Correction and various learning algorithms and tasks.
LO3	Identify the various Single Layer Perception Learning Algorithm.
LO4	Identify the various Multi-Layer Perception Network.
LO5	Analyze the Deep Learning of various Neural network and its Applications.

UNIT	**Details**	**No. of Hours**
UNIT I	Artificial Neural Model – Activation functions – Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem - Multilayer Networks. Learning Algorithms-Error correction-Gradient Descent Rules, Perception Learning Algorithm, Perception Convergence Theorem.	**12**
UNIT II	Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation.	**12**
UNIT III	Single layer Perception: Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, Learning in continuous perception. Limitation of Perception.	**12**
UNIT IV	Multi-Layer Perception Networks: Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm	**12**
UNIT V	Deep learning- Introduction- Neuro architectures building blocks for theDL techniques, Deep Learning and Neocognitron, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltz man Machines, Training of DNN And Applications	**12**
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Students will learn the basics of artificial neural networks with single layer and multi-layer Perception networks.	PO1
2	Learn about the Error Correction and various learning algorithms and tasks.	PO1, PO2
3	Learn the various Perception Learning Algorithm.	PO4, PO6
4	Learn about the various Multi-Layer Perception Network.	PO4, PO5, PO6
5	Understand the Deep Learning of various Neural Network and its Applications.	PO3, PO8

Text Book	
1	Neural Networks A Classroom Approach-Satish Kumar, McGraw Hill-Second Edition.
2.	Simon Haykins, Neural Network- A Comprehensive Foundation, Prentice Hall, 2nd Edition, 1999.
Reference Books	
1.	Artificial Neural Networks- B.Yegnanarayana, PHI, New Delhi, 1998.
Web Resources	
1.	https://www.w3schools.com/ai/ai_neural_networks.asp
2.	https://en.wikipedia.org/wiki/Artificial_neural_network
3.	https://link.springer.com/chapter/10.1007/978-3-642-21004-4_12

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	2	-	1
CO2	3	2	3	2	3	3
CO3	3	1	2	2	2	3
CO4	2	3	3	1	3	1
CO5	3	3	3	3	3	3
Weightage of course contributed to each PSO	13	12	13	10	11	11

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

Title of the Course		**ESSENTIAL REASONING AND QUANTITATIVE APTITUDE**					
Paper Number		**Professional Competency Skill**					
Category	PCS	**Year**	III	**Credits**	2	**Sub. Code**	**23BCA6S1**
		Semester	VI				

Instructional Hours per week	**Lecture**	**Tutorial**	**Lab Practice**	**Total**
	1	1	-	2

Objectives of the Course	• Develop Problem solving skills for competitative examinations • Understand the concepts of averages , simple interest , compound interest
UNIT-I:	**Quantitative Aptitude:** Simplifications=averages-Concepts –problem-Problems on numbers-Short cuts- concepts –Problems
UNIT-II:	Profit and Loss –short cuts-Concepts –Problems –Time and work -Short –uts -Concepts -Problems.
UNIT-III:	Simple interest –compound interest- Concepts- Prolems
UNIT-IV:	**Verbal Reasoning :** Analogy- coding and decoding –Directions and distance –Blood Relation
UNIT-V:	**Analytical Reasoning :**Data sufficiency Non-Verbal Reasoning : Analogy ,Classification and series
Skills acquired from this course	Studnets relating the concepts of compound interest and simple interest
Recommended Text	1.”Quantitative Aptitude” by R.S aggarwal ,S.Chand & Company Ltd 2007
Website and e-Learning Source	https://nptel.ac.in