DEPARTMENT OF COMPUTER SCIENCE

Minutes of the meeting of Board of Studies in Computer Science for PG Programs ie., M.C.A, M.Sc(Computer Science) and M.Sc(Computational Data Science) held on 07th October 2023 (Saturday) at 11 A.M. in the Department of Computer Science.

Name of the Member	Role
Dr.T.S.Ravi Kiran, HOD, Dept of CS, P.B. Siddhartha College of Arts & Science. Mobile: 9441176980, Email: tsravikiran@pbsiddhartha.ac.in, kirantsr1@gmail.com	Chairman
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PG

AGENDA

1. To discuss and approve the ***Programme Structure and Syllabi of Third Semester*** **of** ***M.Sc.(Computer Science), M.C.A*** **and** ***M.Sc.(Computational Data Science) Programmes*** for the batch of students admitted from the Academic Year **2022-2023(R22)** and onwards**.**

2. To discuss and approve the *Structure, Syllabi* and *Model Question Papers* of Open Electives titled **"R-Programming", "Mobile Networks", "UNIX Programming", "Office Tools"** and **"Python Programming".**

RECOMMENDATIONS FOR M.Sc.(COMPUTR SCIENCE) PROGRAMME

Percentage of change of syllabus between the Regulation 2021-2022 (R20) & 2022-2023 (R22) for M.Sc.(Computer Science) Programme

SEMESTER I

Academic Year: 2021-2022				Academic Year: 2022-2023				
S.No	Course Code	Title of Course	Credits	S.No	Course Code	Title of Course	Credits	Percentage of Change
1	20CS1T1	Problem Solving Using Python Programming	4	1	22CS1T1	Programming and Problem Solving Using Python	4	10%
2	20CS1T2	Computer Organization	4	2	22CS1T4	Operating Systems	4	100%
3	20CS1T3	Software Engineering	4	3	22CS1T5	Personality Development through Life Enlightenment Skills	3	Introduced
4	20CS1T4	Database Management Systems	4	4	22CS1T2	Database Management Systems	4	10%
5	20CS1T5	Theory of Computation	4	5	22CS1T3	Formal Languages and Automata Theory	4	20%
6	20CS1L1	Problem Solving Using Python Programming Lab	4	6	22CS1L1	Programming and Problem solving using Python Lab	3	Nil
7	20CS1L2	DBMS Lab	4	7	22CS1L2	Database Management Systems Lab	3	Nil
8	20CS1S1	Seminar	1					
			29				25	

Percentage of change in First Semester: **23.33%**

Percentage of change of syllabus between the Regulation 2022-2023 (R22) & 2023-2024 (R22) for M.Sc.(Computer Science) Programme

SEMESTER III

Academic Year: 2022-2023				Academic Year: 2023-2024				
S.No	Course Code	Title of Course	Credits	S.No	Course Code	Title of Course	Credits	Percentage of Change
				1	22CS3T1	Data Science	4	100%
1	20CS3T3	Design & Analysis of Algorithms	4	**DOMAIN SPECIFIC ELECTIVES (CHOOSE ANY THREE)**				
				2	22CS3E1	Design & Analysis of Algorithms	4	Nil
2	20CS3T2	Cryptography & Network Security	4	3	22CS3E2	Cryptography & Network Security	4	Nil
3	20CS3T4	Data Mining Techniques	4	4	22CS3E3	Machine Leaning	4	100%
4	21OEO7	Personal Finance	4	5	22CS3E4	Applied Data Analytics	4	100%
5	20CS3T1	Internet of Things (IoT)	4	6	22CS3E5	Internet of Things	4	Nil
				7	22CS3E6	Block Chain Technologies	4	100%
LAB PRACTICALS								

6	20CS3L1	Web Technologies Lab	3	8	22CS3L1	Data Science Lab	3	100%
7	20CS3L2	Data Mining Lab	3	9	22CS3L2	Machine Leaning Lab	3	100%
OPEN ELECTIVE (INTERDISCIPLINARY/MULTIDISCIPLINARY) COURSES (CHOOSE ANY ONE)								
Nil				10	22OE301	R-Programming	3	Introduced
Nil				11	22OE302	Mobile Networks	3	Introduced
Nil				12	22OE303	UNIX Programming	3	Introduced
Nil				13	22OE304	Office Tools	3	Introduced
Nil				14	22OE305	Python Programming	3	Introduced
			30				25	
Percentage of change in Third Semester: 66%								

- As per the new regulations recommended by the Krishna University with effect from 2022-2023(R22), new structure is formulated for *M.Sc.(Computer Science)* Programme. The *Program Structure* and *Syllabi of Third Semester* may be approved for the batch of students admitted in the academic year 2022-2023.

1. It is resolved and recommend to introduce the course "Data Science" with course code "22CS3T1" in III semester of M.Sc. (Computer Science) programme from the batch of students admitted in 2023-24 and onwards. For the syllabus and model question paper vide page number from Page Numbers17-20.

1. It is resolved and recommend to revise the syllabus & model question paper of the course "Design & Analysis of Algorithms" with course code "20CS3T3" as "Design & Analysis of Algorithms" with course code "22CS3E1" in III semester of M.Sc.(Computer Science) programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide Page Numbers from 21-23.

2. It is resolved and recommend to revise the syllabus & model question paper of the course "Cryptography & Network Security" with course code "20CS3T2" as "Cryptography & Network Security" with course code "22CS3E2" in III semester of M.Sc.(Computer Science) programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide page number from Page Numbers 24-26.

3. It is resolved and recommend to introduce the syllabus & model question paper of the course "Machine Learning" with course code "22CS3E3" in lieu of "Data Mining Techniques" with course code "20CS3T4" in III semester of M.Sc.(Computer Science) programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide page number from Page Numbers 28-30.

4. It is resolved and recommend to introduce the syllabus & model question paper of the course "Applied Data Analytics" with course code "22CS3E4" in place of "Personal Finance " with course code "21OE07" in III semester of M.Sc.(Computer Science) programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide page number from Page Numbers 31-34.

5. It is resolved and recommended to revise the syllabus & model question paper of the course "Internet of Things" with course code "20CS3T1" as "Internet of Things" with course code "22CS3E5" in III semester of M.Sc.(Computer Science) programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide page number from Page Numbers 35-37.

6. It is resolved and recommended to introduce the course "Block Chain Technologies" with course code "22CA3E6" in III semester of M.Sc.(Computer Science) programme from the batch of students admitted in 2023-24 and onwards. For the syllabus and model question paper vide page number from Page Numbers 38-40.

7. It is resolved and recommend to revise the syllabus & model question paper of the course "Web Technologies Lab" with course code "20CS3L1" as "Data Science Lab" with course code "22CA3L1" in III semester of M.Sc.(Computer Science) programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide page number from Page Numbers 41-43.

8. It is resolved and recommend to adopt the syllabus & model question paper of the course "Data Mining Lab" with course code "20CS3L2" as "Machine Learning Lab" with course code "22CA3L2" in III semester of M.Sc.(Computer Science) programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide page number from Page Number 44.

RECOMMENDATIONS FOR OPEN ELECTIVES

1. It is resolved and recommended to adopt the course "R Programming" with course code "22OE301" from the batch of students admitted in 2023-24 and onwards as open elective. For the syllabus and model question paper vide page number from Page Numbers106-108.

2. It is resolved and recommended to adopt the course "Mobile Networks" with course code "22OE302" from the batch of students admitted in 2023-24 and onwards as open elective. For the syllabus and model question paper vide page number from Page Numbers 109-111.

3. It is resolved and recommended to adopt the course "UNIX Programming" with course code "22OE303" from the batch of students admitted in 2023-24 and onwards as open elective. For the syllabus and model question paper vide page number from Page Numbers112-114.

4. It is resolved and recommended to adopt the course "Office Tools" with course code "22OE304" from the batch of students admitted in 2023-24 and onwards as open elective. For the syllabus and model question paper vide from Page Numbers 115-117.

5. It is resolved and recommended to adopt the course "Python Programming" with course code "22OE305" from the batch of students admitted in 2023-24 and onwards as open elective. For the syllabus and model question paper vide page number from Page Numbers 118-120.

Percentage of change of syllabus between the Regulation 2021-2022 (R20) & 2022-2023 (R22) for M.C.A Programme								
SEMESTER I								
Academic Year: 2021-2022				Academic Year: 2022-2023				
S.No	Course Code	Title of Course	Credits	S.No	Course Code	Title of Course	Credits	Percentage of Change
1	20CA1T1	Problem Solving Using Python Programming	4	1	22CA1T1	Programming and Problem Solving Using Python	4	10%
2	20CA1T2	Computer Organization	4	2	22PG101	Personality Development through Life Enlightenment Skills	3	Introduced
3	20CA1T3	Software Engineering	4	3	22CA1T4	Operating Systems	4	100%
4	20CA1T4	Database Management Systems	4	4	22CA1T2	Database Management Systems	4	10%
5	20CA1T5	Discrete Mathematical Structures	4	5	22CA1T3	Mathematical and Statistical Foundations	4	100%

6	20CAIT6	Probability and Statistics	4	6	22CA1L1	Programming and Problem solving using Python Lab	3	Nil
7	20CA1L1	Problem Solving Using Python Programming Lab	4	7	22CA1L2	Database Management Systems Lab	3	Nil
8	20CA1L2	DBMS Lab	4					
9	20CA1S1	Seminar	1					
			33				25	
Percentage of change in First Semester: 36.66%								

RECOMMENDATIONS FOR M.C.A PROGRAMME

Percentage of change of syllabus between the Regulation 2021-2022 (R20) & 2023-2024 (R22) for M.C.A Programme								
SEMESTER III								
Academic Year: 2022-2023				Academic Year: 2023-2024				
S.No	Course Code	Title of Course	Credits	S.No	Course Code	Title of Course	Credits	Percentage of Change
1	20CA3T1	Big Data Analytics	4	1	22CA3T1	Data Science	4	100%
2	20CA3T3	Design & Analysis of Algorithms	4	**DOMAIN SPECIFIC ELECTIVES (CHOOSE ANY THREE)**				
				2	22CA3E1	Design & Analysis of Algorithms	4	Nil
3	20CA3T5	Cryptography & Network Security	4	3	22CA3E2	Cryptography & Network Security	4	Nil
4	20CA3T2	Artificial Intelligence and Machine Learning	4	4	22CA3E3	Machine Leaning	4	100%
CORE ELECTIVES				5	22CA3E4	Applied Data Analytics	4	100%
5	20CA3T5i	Internet of Things (IoT)	4	6	22CA3E5	Internet of Things	4	Nil
6	20CA3T4i	Block Chain Technologies	4	7	22CA3E6	Block Chain Technologies	4	Nil
LAB PRACTICALS								
7	20CA3L1	Big Data and Analytics Lab	3	8	22CA3L1	Data Science Lab	3	100%
8	20CA3L2	Data Mining Lab	3	9	22CA3L2	Machine Leaning Lab	3	100%
OPEN ELECTIVE (INTERDISCIPLINARY/MULTIDISCIPLINARY) COURSES (CHOOSE ANY ONE)								
Nil				10	22OE301	R-Programming	3	Introduced
Nil				11	22OE302	Mobile Networks	3	Introduced
Nil				12	22OE303	UNIX Programming	3	Introduced
Nil				13	22OE304	Office Tools	3	Introduced
Nil				14	22OE305	Python Programming	3	Introduced
			30				25	
Percentage of change in Third Semester: 55.55%								

- As per the new regulations recommended by the Krishna University with effect from 2022-2023(R22), new structure is formulated for *M.C.A.* Programme. The *Program Structure* and *Syllabi of Third Semester* may be approved for the batch of students admitted in the academic year 2022-2023.

1. It is resolved and recommend to revise the syllabus & model question paper of the course "Big Data Analytics" with course code "20CA3T1" as "Data Science" with course code "22CA3T1" in III semester of M.C.A programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide page number from Page Numbers 47-50.

2. It is resolved and recommend to revise the syllabus & model question paper of the course "Design & Analysis of Algorithms" with course code "20CA3T3" as "Design & Analysis of Algorithm" with course code "22CA3E1" in III semester of M.C.A programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide page number from Page Numbers 51-53.

3. It is resolved and recommend to revise the syllabus & model question paper of the course "Cryptography & Network Security" with course code "20CA3T5" as "Cryptography & Network Security" with course code

"22CA3E2" in III semester of M.C.A programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide Page Number 54-57.

4. It is resolved and recommend to introduce the syllabus & model question paper of the course "Machine Learning " with course code "22CA3E3" in lieu of "Artificial Intelligence and Machine Learning" with course code "20CA3T2" in III semester of M.C.A programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide Page Numbers from 58-60.

5. It is resolved and recommend to introduce the syllabus & model question paper of the course "Applied Data Analytics" with course code "22CA3E4" in III semester of M.C.A programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide Page Numbers from 61-64.

6. It is resolved and recommend to revise the syllabus & model question paper of the course "Internet of Things" with course code "20CA3T5i" as "Internet of Things" with course code "22CA3E5" in III semester of M.C.A programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide Page Numbers from 65-67.

7. It is resolved and recommend to revise the syllabus & model question paper of the course "Block Chain Technologies" with course code "20CA3T4i" as "Block Chain Technologies" with course code "22CA3E6" in III semester of M.C.A programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide Page Numbers from 68-70.

8. It is resolved and recommend to revise the syllabus & model question paper of the course "Big Data Analytics Lab" with course code "20CA3L1" as "Data Science Lab" with course code "22CA3L1" in III semester of M.C.A programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide Page Numbers from 71-72.

9. It is resolved and recommend to adopt the syllabus & model question paper of the course "Data Mining Lab" with course code "20CA3L2" as "Machine Learning Lab" with course code "22CA3L2" in III semester of M.C.A programme from the batch of students admitted in 2022-23 and onwards. For the syllabus and model question paper vide Page Number 73.

RECOMMENDATIONS FOR OPEN ELECTIVES

1. It is resolved and recommended to adopt the course "R Programming" with course code "22OE301" from the batch of students admitted in 2023-24 and onwards as open elective. For the syllabus and model question paper vide Page Numbers from 106-108.

2. It is resolved and recommended to adopt the course "Mobile Networks" with course code "22OE302" from the batch of students admitted in 2023-24 and onwards as open elective. For the syllabus and model question paper vide Page Numbers from 109-111.

3. It is resolved and recommended to adopt the course "UNIX Programming" with course code "22OE303" from the batch of students admitted in 2023-24 and onwards as open elective. For the syllabus and model question paper vide Page Numbers from 112-114.

4. It is resolved and recommended to adopt the course "Office Tools" with course code "22OE304" from the batch of students admitted in 2023-24 and onwards as open elective. For the syllabus and model question paper vide Page Numbers from 115-117.

5. It is resolved and recommended to adopt the course "Python Programming" with course code "22OE305" from the batch of students admitted in 2023-24 and onwards as open elective. For the syllabus and model question paper vide Page Numbers from 118-120.

RECOMMENDATIONS FOR M.Sc.(COMPUTATIONAL DATA SCIENCE) PROGRAMME

Percentage of change of syllabus between the Regulation 2021-2022 (R20) & 2022-2023 (R22) for M.Sc.(Computational Data Science) Programme								
SEMESTER I								
Academic Year: 2022-2023				Academic Year: 2023-2024				
S.No	Course Code	Title of Course	Credits	S.No	Course Code	Title of Course	Credits	Percentage of Change
1	22PG101	Personality Development through Life Enlightenment Skills	4	1	22PG101	Personality Development through Life Enlightenment Skills	3	Nil
2	22DS1T1	Data Structures	4	2	22DS1T1	Data Structures	4	Nil
3	22DS1T2	Object Oriented Programming	4	3	22DS1T2	Object Oriented Programming	4	Nil
4	22DS1T3	Advanced Database Management Systems	4	4	22DS1T3	Advanced Database Management Systems	4	Nil
5	22DS1T4	Data Mining Techniques	4	5	22DS1T4	Data Mining Techniques	4	Nil
6	22DS1L1	Data Structures Lab	3	6	22DS1L1	Data Structures Lab	3	Nil
7	22DS1L2	Object Oriented Programming Lab	3	7	22DS1L2	Object Oriented Programming Lab	3	Nil
			27				25	
Percentage of change in First Semester: Nil								

Percentage of change of syllabus between the Regulation 2021-2022 (R20) & 2023-2024 (R22) for M.Sc.(Computational Data Science) Programme								
SEMESTER III								
Academic Year: 2022-2023				Academic Year: 2023-2024				
S.No	Course Code	Title of Course	Credits	S.No	Course Code	Title of Course	Credits	Percentage of Change
1	21DS3T2	Cyber Security	4	1	22DS3T1	Data Science	4	100%
2	21DS3T1	Cloud Computing	4	**DOMAIN SPECIFIC ELECTIVES (CHOOSE ANY THREE)**				
				2	22DS3E1	Cloud Computing	4	Nil
3	21DS2T3	Internet of Things	4	3	22DS3E2	Internet of Things	4	70%
4	21DS3T3	Big Data and Analytics	4	4	22DS3E3	Big Data and Analytics	4	7%
5	21OE10	Deep Learning	4	5	22DS3E4	Deep Learning	4	Nil
	21DS3P1	Mini Project	1	6	22DS3E5	Software Engineering	4	100%
7	21DS3T4	Block Chain Technology	4	7	22DS3E6	Block Chain Technology	4	Nil
LAB PRACTICALS								
8	21DS3L1	Deep Learning Lab	3	8	22DS3L1	Deep Learning Lab	3	Nil
9	21DS3L2	Big Data and Analytics Lab	3	9	22DS3L2	Big Data and Analytics Lab	3	7%
OPEN ELECTIVE (INTERDISCIPLINARY/MULTIDISCIPLINARY) COURSES (CHOOSE ANY ONE)								
Nil					22OE301	R-Programming	3	Introduced
Nil					22OE302	Mobile Networks	3	Introduced
Nil					22OE303	UNIX Programming	3	Introduced
Nil					22OE304	Office Tools	3	Introduced

Nil			22OE305	Python Programming	3	Introduced
	31				25	
Percentage of change in Third Semester: 27%						

As per the new regulations recommended by the Krishna University with effect from 2022-2023(R22), new structure is formulated for *M.Sc.(Computational Data Science)* Programme. The *Program Structure* and *Syllabi of Third Semester* may be approved for the batch of students admitted in the academic year 2022

1. It is resolved and recommended to introduce the course "Data Science" with course code "22DS3T1" in lieu of cyber security with course code 21DS3T2 in III semester of M.Sc. (Computational Data Science) programme from the batch of students admitted in 2023-24 and onwards. For the syllabus and model question paper vide page number from 77-80.

1. It is resolved and recommended to adopt the syllabus & model question paper of the course "Cloud Computing" with course code "21DS3T1" as "Cloud Computing" with course code "22DS3E1" in III semester of M.Sc. (Computational Data Science) programme from the batch of students admitted in 2023-24 and onwards. For the syllabus and model question paper vide Page Numbers from 81-84.

2. It is resolved and recommended to revise the syllabus & model question paper of the course "Internet of Things" with course code "21DS2T3" as "Internet of Things" with course code "22DS3E2" in III semester of M.Sc. (Computational Data Science) programme from the batch of students admitted in 2023-24 and onwards. For the syllabus and model question paper vide Page Numbers from 85-87.

3. It is resolved and recommended to revise the syllabus & model question paper of the course "Big Data and Analytics" with course code "21DS3T3" as "Big Data and Analytics" with course code "22DS3E2" in III semester of M.Sc. (Computational Data Science) programme from the batch of students admitted in 2023-24 and onwards. For the syllabus and model question paper vide Page Numbers from 88-91.

4. It is resolved and recommended to adopt the syllabus & model question paper of the course "Deep Learning" with course code "21OE10" as "Deep Learning" with course code "22DS3E4" in III semester of M.Sc. (Computational Data Science) programme from the batch of students admitted in 2023-24 and onwards. For the syllabus and model question paper vide Page Numbers from 92-94.

5. It is resolved and recommended to introduce the syllabus & model question paper of the course "Software Engineering" with course code "22DS3E5" in lieu of mini project with course code 21DS3P1 in III semester of M.Sc. (Computational Data Science) programme from the batch of students admitted in 2023-24 and onwards. For the syllabus and model question paper vide Page Numbers from 95-99.

6. It is resolved and recommended to adopt the syllabus & model question paper of the course "Deep Learning" with course code "21OE10" as "Deep Learning" with course code "22DS3E4" in III semester of M.Sc. (Computational Data Science) programme from the batch of students admitted in 2023-24 and onwards. For the syllabus and model question paper vide Page Numbers from 100-102.

7. It is resolved and recommended to adopt the syllabus & model question paper of the course "Deep Learning Lab" with course code "21DS3L1" as "Deep Learning Lab" with course code "22DS3L1" in III semester of M.Sc. (Computational Data Science) programme from the batch of students admitted in 2023-24 and onwards. For the syllabus and model question paper vide Page Number from 103.

8. It is resolved and recommended to adopt the syllabus & model question paper of the course "Big Data and Analytics Lab " with course code "21DS3L2" as "Big Data and Analytics Lab" with course code "22DS3L2" in III semester of M.Sc. (Computational Data Science) programme from the batch of students admitted in 2023-24 and onwards. For the syllabus and model question paper vide Page Numbers from 104-105.

RECOMMENDATIONS FOR OPEN ELECTIVES

1. It is resolved and recommended to adopt the course "R Programming" with course code "22OE301" from the batch of students admitted in 2023-24 and onwards as open elective. For the syllabus and model question paper vide Page Numbers from 106-108.

2. It is resolved and recommended to adopt the course "Mobile Networks" with course code "22OE302" from the batch of students admitted in 2023-24 and onwards as open elective. For the syllabus and model question paper vide Page Numbers from 109-111.

3. It is resolved and recommended to adopt the course "UNIX Programming" with course code "22OE303" from the batch of students admitted in 2023-24 and onwards as open elective. For the syllabus and model question paper vide Page Numbers from 112-114.

4. It is resolved and recommended to adopt the course "Office Tools" with course code "22OE304" from the batch of students admitted in 2023-24 and onwards as open elective. For the syllabus and model question paper vide Page Numbers from 115-117.

5. It is resolved and recommended to adopt the course "Python Programming" with course code "22OE305" from the batch of students admitted in 2023-24 and onwards as open elective. For the syllabus and model question paper vide Page Numbers from 118-120.

PROGRAMME OUTCOMES & PROGRAMME SPECIFIC OUTCOMES

PROGRAMME OUTCOMES FOR M.Sc.(COMPUTER SCIENCE) PROGRAMME

PO1. Technical Expertise and Knowledge in Multiple Domains: Ability to develop an understanding of modern computing concepts and architectures from a design and performance perspective of various domains.

PO2. Assessment from System Level Perspective: Able to analyze and appreciate the structure of computer systems and the processes involved in their construction at various levels of detail and abstraction.

PO3. Critical Thinking, Business Analytics & Problem Solving and Innovation: An ability to apply knowledge of mathematics and computer science practices to build Innovative Public & Private Sector Applications involving complex computing problem solving and in research.

PO4. Professional Ethics & Social Responsibility: Ability to apply and commit to professional ethics following cyber regulations in a global economic environment. Create and design innovative applications to solve complex problems using established practices for the betterment of the society.

PO5. Apposite to Industry: Gain exposure to multiple programming languages, tools, paradigms, and technologies as well as the fundamental underlying principles throughout their education there by making them the right choice for industry positions.

PO6. Effective Communication & Leadership: Ability to communicate effectively and present technical & project management information using audio visual tools as well as in oral and written reports. Rise up to the need and be able to lead teams of individuals.

PO7. Life-long Learning and Research: Understand the importance of, and possess pre-requisite skill set to undertake life-long independent learning and research in the context of contemporary technological advancements.

PROGRAMME SPECIFIC OUTCOMES FOR M.SC.(COMPUTER SCIENCE) PROGRAMME

PSO1. To make the students industry ready as far as possible to enhance their employability in the industries.

PSO2. Create an ambience of education through *faculty training, self learning, sound academic practices* and *research endeavors*.

PROGRAMME OUTCOMES FOR M.C.A PROGRAMME

PO1. Technical Expertise and Knowledge in Multiple Domains: Ability to develop an understanding of modern computing concepts and architectures from a design and performance perspective of various domains.

PO2. Assessment from System level perspective: Able to analyze and appreciate the structure of computer systems and the processes involved in their construction at various levels of detail and abstraction.

PO3. Critical Thinking, Business Analytics & Problem Solving and Innovation: An ability to apply knowledge of mathematics and computer science practices to build Innovative Public & Private Sector Applications involving complex computing problem solving and in research.

PO4. Professional Ethics & Social Responsibility: Ability to apply and commit to professional ethics following cyber regulations in a global economic environment. Create and design innovative applications to solve complex problems using established practices for the betterment of the society.

PO5. Apposite to Industry: Gain exposure to multiple programming languages, tools, paradigms, and technologies as well as the fundamental underlying principles throughout their education there by making them the right choice for industry positions.

PO6. Effective Communication & Leadership: Ability to communicate effectively and present technical & project management information using audio visual tools as well as in oral and written reports. Rise up to the need and be able to lead teams of individuals.

PO7. Life-long Learning: Understand the importance of, and possess pre-requisite skill set to undertake life-long independent learning in the context of contemporary technological advancements.

PROGRAMME SPECIFIC OUTCOMES FOR M.C.A PROGRAMME

PSO1. To make the students industry ready as far as possible to enhance their employability in the industries.

PSO2. Create an ambience of education through *faculty training, self-learning, sound academic practices* and *research endeavors*.

PROGRAMME OUTCOMES FOR M.SC.(COMPUTATIONAL DATA SCIENCE) PROGRAMME

PO1. Technical Expertise and Knowledge in Multiple Domains: Ability to develop an understanding of modern computing concepts and architectures from a design and performance perspective of various domains.

PO2. Assessment from System level perspective: Able to analyze and appreciate the structure of computer systems and the processes involved in their construction at various levels of detail and abstraction.

PO3. Critical Thinking, Business Analytics & Problem Solving and Innovation: An ability to apply knowledge of mathematics and computer science practices to build Innovative Public & Private Sector Applications involving complex computing problem solving and in research.

PO4. Professional Ethics & Social Responsibility: Ability to apply and commit to professional ethics following cyber regulations in a global economic environment. Create and design innovative applications to solve complex problems using established practices for the betterment of the society.

PO5. Apposite to Industry: Gain exposure to multiple programming languages, tools, paradigms, and technologies as well as the fundamental underlying principles throughout their education there by making them the right choice for industry positions.

PO6. Effective Communication & Leadership: Ability to communicate effectively and present technical & project management information using audio visual tools as well as in oral and written reports. Rise up to the need and be able to lead teams of individuals.

PO7. Life-long Learning: Understand the importance of, and possess pre-requisite skill set to undertake life-long independent learning in the context of contemporary technological advancements.

PROGRAM SPECIFIC OUTCOMES FOR M.SC.(COMPUTATIONAL DATA SCIENCE)

PSO1: Take leading roles in *Industry*, *Academia*, and *Entrepreneurship* to develop robust application that solve real world problems and contributing to research with a professional context pertaining to ethics, social, cultural and cyber regulations.

PSO2: Implement the concepts of *Statistics*, *Optimization Techniques*, *Data Repository*, *Data Analytics* on real world problems, and to take a decision on the problem and Handle the projects related to *Electronic Commerce*, *Software Development* related to online applications and can achieve *Organizational Goals* and *Objectives*.

APPENDIX-I
PROGRAM STRUCTURE & SYLLABI FOR M.Sc.(COMPUTER SCIENCE) PROGRAMME

P.B.Siddhartha College of Arts & Science, Vijayawada
Programme Structure for M.Sc.(Computer Science)
Under Choice Based Credit System (CBCS)
W.E.F 2022-23 (R22 Regulations)

I SEMESTER (For the batch of students admitted during 2023-2024)					M.Sc.(Computer Science)			
Course Code	**Course Name**	**Teaching Hours / Week**			**CORE/IDC/ DSE/SEC/OEC/MOOCS**	**CIA**	**SEE**	**No. of Credits**
		Lecture	**Practical**	**Tutorial**				
22CS1T1	Programming and Problem Solving Using Python	4	0	0	Core	30	70	4
22CS1T2	Database Management Systems	4	0	0	Core	30	70	4
22CS1T3	Formal Languages and Automata Theory	4	0	0	Core	30	70	4
22CS1T4	Operating Systems	4	0	0	Core	30	70	4
22PG101	Personality Development through Life Enlightenment Skills	3	1	0	Core	30	70	3
22CS1L1	Programming and Problem solving using Python Lab	0	6	0	Core	30	70	3
22CS1L2	Database Management Systems Lab	0	6	0	Core	30	70	3
TOTAL FOR FIRST SEMESTER						**210**	**490**	**25**

II SEMESTER (For the batch of students admitted during 2023-2024)					M.Sc.(Computer Science)			
Course Code	**Course Name**	**Teaching Hours/ Week**			**CORE/IDC/ DSE/SEC/OEC/MOOCS**	**CIA**	**SEE**	**No. of Credits**
		Lecture	**Practical**	**Tutorial**				
22CS2T1	Computer Networks	4	0	0	Core	30	70	4
22CS2T2	Data Structures	4	0	0	Core	30	70	4
22CS2T3	Web Technologies	4	0	0	Core	30	70	4
22PG201	Research Methodology & IPR	3	1	0	SEC	30	70	3
DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY ONE)								
22CS2E1	Software Engineering	4	0	0	DSE	30	70	4
22CS2E2	Mobile Applications	4	0	0	DSE	30	70	4
22CS2E3	Unix Programming	4	0	0	DSE	30	70	4
LAB PRACTICALS								
22CS2L1	Data Structures Lab	0	6	0	Core	30	70	3
22CS2L2	Web Technologies Lab	0	6	0	Core	30	70	3
TOTAL FOR SECOND SEMESTER						**210**	**490**	**25**
At the end of 2nd semester, every student must undergo Summer Internship/Apprenticeship/Project Work/Industrial Training/Research based Project Work for Six Weeks and must prepare a report concerned as per approved project guidelines, and submit the same to the University 14 days before the commencement of third semester end examinations.								

Note: Students may be allowed to register and appear for MOOCS from the third semester itself. However, students are to complete the MOOCS successfully and submit pass certificate of the same to the University through the

Principal of the College concerned for approval and endorsement of the same on grade cards and PCs and ODs as per the regulations of the University.

III SEMESTER (For the batch of students admitted during 2022-2023)						M.Sc.(Computer Science)		
Course Code	**Course Name**	**Teaching Hours/ Week**			**CORE/IDC/DSE/ SEC/OEC/MOOCS**	**CIA**	**SEE**	**No. of Credits**
		Lecture	**Practical**	**Tutorial**				
22CS3T1	Data Science	4	0	0	Core	30	70	4
DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY THREE)								
22CS3E1	Design & Analysis of Algorithms	4	0	0	DSE	30	70	4
22CS3E2	Cryptography & Network Security	4	0	0	DSE	30	70	4
22CS3E3	Machine Learning	4	0	0	DSE	30	70	4
22CS3E4	Applied Data Analytics	4	0	0	DSE	30	70	4
22CS3E5	Internet of Things	4	0	0	DSE	30	70	4
22CS3E6	Block Chain Technologies	4	0	0	DSE	30	70	4
LAB PRACTICALS								
22CS3L1	Data Science Lab	0	6	0	Core	30	70	3
22CS3L2	Machine Leaning Lab	0	6	0	Core	30	70	3
OPEN ELECTIVE (INTERDISCIPLINARY/MULTIDISCIPLINARY) COURSES (CHOOSE ANY ONE)								
22OE301	R-Programming	3	0	0	OEC	30	70	3
22OE302	Mobile Networks	3	0	0	OEC	30	70	3
22OE303	UNIX Programming	3	0	0	OEC	30	70	3
22OE304	Power BI	3	0	0	OEC	30	70	3
22OE305	Python Programming	3	0	0	OEC	30	70	3
						210	**490**	**25**

IV SEMESTER (For the batch of students admitted during 2022-2023)						M.Sc.(Computer Science)		
Course Code	**Course Name**	**Teaching Hours/ Week**			**CORE/IDC/DSE/ SEC/OEC/MOOCS**	**CIA**	**SEE**	**No. of Credits**
		Lecture	**Practical**	**Tutorial**				
22CS4T1	Cloud Computing	4	0	0	Core	30	70	4
DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY THREE)								
22CS4E1	Big Data Analytics	4	0	0	DSE	30	70	4
22CS4E2	Deep Learning	4	0	0	DSE	30	70	4
22CS4E3	Artificial Intelligence	4	0	0	DSE	30	70	4
22CS4E4	Data Mining	4	0	0	DSE	30	70	4
22CS4E5	Cyber Security	4	0	0	DSE	30	70	4
22CS4E6	Information Security	4	0	0	DSE	30	70	4
LAB PRACTICALS								
22CA4L1	Cloud Computing Lab	0	6	0	Core	30	70	3
ENTREPRENURAL & INNOVATION/IT SKILL RELATED TO DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY ONE)								
22CS4E7	Social Media Analytics	3	0	0	SEC	30	70	3
22CS4E8	Dynamic Web Programming using Python	3	0	0	SEC	30	70	3
22CS4E9	Software Testing and Project Management	3	0	0	SEC	30	70	3
*** CHOOSE MOOCS FROM SWAYAM/NPTEL SOURCES**								
MOOCS								4
PROJECT WORK EVALUATION AND VIVA-VOCE						Nil	100	4

22CS3T1: DATA SCIENCE

Course Name	Data Science		L	T	P	C	CIA	SEE	TM
Course Code	22CS3T1		4	0	0	4	30	70	100
Year of Introduction: 2021	**Year of Offering:** 2022	**Year of Revision**: 2023			**Percentage of Revision:** 100				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose: The course is intended to cover, Introduction to Tableau, Basic Visualization Design, Connecting to Data, Top 10 Chart Types (Uni-variate/Bi-Variate & Multi-variate Charts), Interacting with the Viewer, Tableau Maps, Creating Dashboards and Stories, Introduction to Power Bi, Power Pivot Model and Power BI Environment.

Course Objective: The course aims to equip participants with comprehensive skills in Tableau and Power BI, covering fundamental concepts, visualization design, data connection, diverse chart types, viewer interaction, mapping, dashboard and story creation, as well as Power Pivot modeling, empowering them to proficiently analyze and visualize data for insightful decision-making.

Course Objectives:

- To understand *Basics of Tableau, Visual Design and Connecting various Data Sources*.
- To know *Uni-variate Charts***,** *Bi-variate Charts***,** *Multi-variate Charts, Interacting with the Viewer.*
- To create *Tableau Maps* and *Creating Dashboards and Stories*.
- To implement *Data Operations* of *Power BI.*
- To implement *Power Pivot Model* and *Power BI Environment.*

Specific Objectives include:

CO1: Upon completing this Tableau course, participants will master the fundamentals of Tableau, including workbook management, basic visualization design, and advanced data connection techniques, enabling them to create visually compelling and interactive data visualizations, analyze complex datasets, and make data-driven decisions effectively.

CO2: Upon completing this course, participants will gain expertise in a wide range of chart types for univariate, bivariate, and multivariate data analysis, enabling them to effectively visualize and interpret complex datasets; additionally, they will acquire advanced skills in viewer interaction through various filtering techniques and actions, empowering them to create dynamic and insightful Tableau visualizations.

CO3: Upon completing this course, participants will master Tableau's mapping capabilities, including geocoding, custom geocoding, and advanced mapping techniques, allowing them to create visually appealing and insightful maps; furthermore, they will gain proficiency in crafting interactive and visually cohesive dashboards and stories, integrating various elements and actions for effective data communication and analysis.

CO4: Upon completion of this Power BI course, participants will acquire comprehensive knowledge and practical skills in utilizing Power BI, including data acquisition from diverse sources, implementing natural language queries, advanced data manipulation using functions, merging and transforming queries effectively, enabling them to create insightful data visualizations and analytics for informed decision-making and enhanced business intelligence.

CO5: Upon completing this course, participants will master Power Pivot and Power BI, enabling them to create robust data models, establish relationships, implement advanced querying and merging techniques, design compelling visualizations, and effectively utilize calculations and measures, empowering them to analyze complex data sets, create interactive dashboards, and perform in-depth data modeling for diverse applications, including detailed analysis of Corona Cases.

UNIT-I (12 Hours)

Introduction to Tableau: What is Tableau? - Opening Existing Workbooks - Creating New Workbooks.
Basic Visualization Design: Using Show Me - Choosing Mark Types - Color - Size - Shape and Label Options- Choosing Color Options - Setting Mark Size - Choosing Shapes - Text Tables and Mark Labels - Formatting Options - Evaluating Multiple Measures - Shared Axis Charts - Measure Names and Measure Values - Dual Axis Charts.
Connecting to Data: Connecting to Various Data Sources - The Data Source Page - Customizing Your View of the Data: Changing Data Type - Modifying Dimension / Measure Assignment - Hiding -Renaming and Combining Fields - Splitting Fields - Changing the Default Field Appearance - Organizing Dimensions in Hierarchies Using Table or Folder View - Saving and Sharing Metadata Extracting Data -Data Blending - Moving from Test to Production Database.

UNIT-II (12 Hours)

Top 10 Chart Types (Uni-variate/Bi-Variate & Multi-variate Charts): Bar Chart - Line/Area Chart - Pie Chart - Text Table / Crosstab - Scatter Plot - Bubble Chart - Bullet Graph - Box Plot - Tree Map - Word Cloud.
Interacting with the Viewer: Filtering Data - Include or Exclude from the Worksheet - Basic Filtering -Quick Filters - Parameters - Creating a Parameter - Displaying a Parameter - Using a Parameter in a Worksheet - Worksheet Actions - Filter Actions - Highlight Actions - URL Actions.

UNIT-III (12 Hours)

Tableau Maps: Geocoded Fields - Geographic Hierarchies and Ambiguity - Custom Geocoding - Background Maps and Layers - Navigating Maps and Selecting Marks - Map Options - Web Map Services - Mapping and Mark Types - Custom Background Images - Generating Your Own Coordinate System - Adding a Custom Background Image.
Creating Dashboards and Stories: Creating a Simple Dashboard - Setting Dashboard - Size - Adding Sheets - Associated Worksheet Elements - Supplementary Dashboard Features - Layout Container - Blank Text - Image - Webpage - Setting Dashboard and Element - Sizes - Dashboard Actions - Highlight Action - Filter Action - URL Action.

UNIT-IV (12 Hours)

Power Bi: Get Knowing Power Bi - Getting Data from Existing Systems - Data Sources of Power Bi - Natural Language Queries - Getting data from web - Importing Data from Northwind ODATA feed T3_IMF - Functions & list Dates in Power Bi - Group By and unpivot in Power Bi - Merging Queries in Power Bi - IPL Statistics in Power Bi

UNIT-V (12 Hours)

Power Pivot Model: Creating Data Model - Explain what a Data Model is, Create Relationships between Tables in the Model, Create and use a Star Schema - Merging Queries in Power Bi - Data Compute in Power Bi - Append Query in Power Bi - Charts in Power Bi - Data Modeling in Power Bi - Charts in Power Bi - Data Modeling in Power Bi.
Power BI:
Power BI Environment: Adding Calculations and Measures - Importing Graphs - User Graphs, Dash boards - Dashboard for Corona Cases analysis.

Prescribed Text Books			
	Author	Title	Publisher
1	George Peck	Tableau 9 - The Official Guide	McGraw Hill, 2016
2	Dan Clark	Beginning Power BI: A Practical Guide to Self Service Data Analytics with Excel 2016 and Power BI Desktop	O'Reilley, Second Edition

Reference Text Books			
	Author	Title	Publisher
1	Ashutosh Nandeshwar	Tableau Data Visualization Cookbook	Packt Publishing Ltd, 2013
2	Rob Collie & Avi Singh	Power Pivot and Power BI : The Excel User's Guide to DAX Power Query, Power BI & Power Pivot in Excel 2010-2016	Holy Macro! Books, 2016
3	Daniel G. Murray	Tableau Your Data! Fast and Easy Visual Analysis with Tableau Software Second Edition	John Wiley & Sons

M.Sc.(Computer Science) DEGREE EXAMINATIONS
THIRD SEMESTER
DATA SCIENCE
SYLLABUS W.E.F 2022-2023

Time 3 Hours **Max.Marks: 70**

SECTION-A

Answer ALL questions **(5×4 = 20 Marks)**

1. (a) What is *Tableau*? Explain its role in Industry (CO1,L1)
(or)
(b) How do you change *Data Type* in Tableau. (CO1,L1)

2. (a) What is *Tree Map*? (CO2,L1)
(or)
(b) What is *Quick Filter*? (CO2,L1)

3. (a) Name any two *Web Map Services*. (CO3,L1)
(or)
(b) Name any two features of *Supplementary Dashboard*. (CO3,L1)

4. (a) Explain Natural Language Processing. (CO4,L2)
(or)
(b) Explain Functions used in Power Bi. (CO4,L2)

5. (a) What is *Star Schema*? Explain (CO5,L1)
(or)
(b) What are the advantages of *Dashboard*? (CO5,L1)

Answer Five Questions Choosing One Question from Each Unit.
All Questions Carry Equal Marks. **(5×10 = 50 Marks)**

6. (a) Explain *Shape and Label Options* and *Formatting Options* in *Tableau*. (CO1,L2)
(or)
(b) Illustrate how data sources connected to *Tableau*. (CO1,L2)

7. (a) Build Uni-variate Charts. (CO2,L3)
(or)
(b) Experiment with *Basic Filters* and *Quick Filters*. (CO2,L3)

8. (a) Compare any two types of *Tableau Maps*. (CO3,L4)
(or)
(b) Examine the procedure to create Simple Dashboard. (CO3,L4)

9. (a) Explain how import data from various existing data sources. (CO4,L5)
(or)
(b) Explain how to merge queries and operations on IPL dataset. (CO4,L5)

10. (a) Create Relationships between Tables in the Model (CO5,L6)
(or)
(b) Discuss how to import Graphs in Power BI. (CO5,L6)
(c) Discuss creating Measures in Power BI. (CO5,L6)

22CS3E1: DESIGN & ANALYSIS OF ALGORITHMS

Course Name	Design & Analysis of Algorithms		L	T	P	C	CIA	SEE	TM
Course Code	20CS3E1		4	0	0	4	30	70	100
Year of Introduction: 2005	Year of Offering: 2022	Year of Revision: 2022			Percentage of Revision: NIL				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose: The course is intended to develop proficiency in *Problem Solving and Programming*, perform *Analysis of various Algorithms in regard to Time and Space Complexity*, gain of *good understanding of Applications of Data Structures*, develop base for *Advanced Study* in *Computer Science*, apply *Design Techniques* to solve different types of problems as per their *Complexity* and develop *ability to segregate NP-Hard and NP-Complete problems.*

Course Objective: This course will help the students t o understand and learn basic ideas about *Analysis of Algorithms*, *Divide-and-Conquer* and *Greedy Method*, *Dynamic Programing* & *Basic Traversal and Search Techniques*, *Backtracking* and *Branch and Bound* Techniques and *NP-Hard* and *NP-Complete* Problems.

Specific Objectives include:

- To understand Basic Ideas about *Analysis of Algorithms* and the *Concept of Data Structures*.
- To know *Divide and Conquer*, *Greedy Methods* and *Solving Various Problems* by applying them.
- To apply *Dynamic Programming Method* and *Basic Traversal* and *Search Techniques* to solve various Problems.
- To understand *Backtracking and Branch and Bound* Techniques to Design Algorithms.
- To categorize *NP-Har*d and *NP-Complete* Problems.

Course Leaning Outcomes: On successful completion of this course

CO1: The course imparts a foundational understanding of algorithms, data structures, performance analysis, randomized algorithms, and graph theory, enabling students to analyze, design, and implement efficient solutions to a wide array of computational problems.

CO2: Students will have a comprehensive understanding of advanced algorithmic paradigms, including Divide-and-Conquer and Greedy methods, enabling them to apply these techniques to solve a wide range of computational problems efficiently and effectively.

CO3: The course empowers students with a comprehensive understanding of dynamic programming techniques, traversal and search algorithms for binary trees and graphs, equipping them with the skills to solve complex optimization problems efficiently and effectively in diverse domains.

CO4: The course provides students with a comprehensive understanding of backtracking and branch-and-bound algorithms, enabling them to efficiently solve complex combinatorial and optimization problems, such as the 8-Queens problem, graph coloring, and the traveling salesman problem, across various application domains.

CO5: The course equips students with a profound understanding of NP-Hard and NP-Complete problems, enabling them to recognize, analyze, and address computationally challenging problems across various domains, including graph theory, scheduling, code generation, and decision problem solving, while comprehending the theoretical underpinnings and implications of these complexities.

UNIT-I (12 Hours)

Introduction: What is Algorithm, Algorithm Specification Pseudo code Conventions, Recursive Algorithms, Performance Analysis: Space Complexity Time Complexity, Asymptotic Notation, Performance Measurement, Randomized Algorithms: Basics of Probability Theory, Randomized Algorithms Identifying the Repeated Element, Primality Testing: Advantages and Disadvantages.

Elementary Data Structures: Stacks and Queues, Trees: Terminology, Binary Trees, Dictionaries: Binary Search Trees, Priority Queues, Heaps , Heapsort , Sets and Disjoint Set Union: Introduction-Union and Find Operations, Graphs: Introduction, Definitions, Graph Representations.

UNIT-II (12 Hours)

Divide-and-Conquer: General Method, Defective Chess Board, Binary Search, Finding Maximum and Minimum, Merge Sort, Quick Sort, Selection Problem, Strassen's Matrix Multiplication, Convex Hull: Some Geometric Primitives, The Quick Hull Algorithm, Graham's Scan, An O(nlogn) Divide and Conquer Algorithm.
The Greedy Method: The General Method, Container Loading, Knapsack Problem, Tree Vertex Splitting, Job Sequencing with Deadlines, Minimum Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm, Optimal Storage on Tapes, Optimal Merge Patterns, Single Source Shortest Paths.

UNIT-III (12 Hours)

Dynamic Programming: The General Method, Multi Stage Graphs, All Pairs Shortest Paths, Single Source Shortest Paths, Optimal Binary Search Trees, String Editing -0/1 Knapsack, Reliability Design, The Traveling Sales Person Problem, Flow Shop Scheduling.
Basic Traversal and Search Techniques: Techniques for Binary Trees, Techniques for Graphs: Breadth First Search and Traversal-Depth First Search, Connected Components and Spanning Trees, Bi-Connected Components and DFS.

UNIT-IV (12 Hours)

Backtracking: The General Method, The 8-Queens Problem, Sum of Subsets, Graph Coloring, Hamiltonian Cycles, Knapsack Problem.
Branch and Bound: The Method: Least Cost Search, The 15 Puzzle Control Abstractions for LC Search, Bounding, FIFO Branch and Bound , LC Branch and Bound, 0/1 Knapsack Problem, LC Branch and Bound Solution, FIFO Branch and Bound Solution, Traveling Sales person.

UNIT-V (12 Hours)

NP-Hard and NP-Complete Problems: Basic Concepts: Non Deterministic Algorithms, The Classes NP Hard and NP Complex, Cook's Theorem, NP Hard Graph Problems, Clique Decision Problem, Node Cover Decision Problem Chromatic Number Decision Problem, Directed Hamiltonian Cycle, Traveling Sales Person Decision Problem, AND/OR Graph Decision Problem, NP-Hard Scheduling Problems, Scheduling Identical Processors, Flow Shop Scheduling, Job Scheduling, NP-Hard Code Generation Problems, Code Generation With Common Sub Expressions, Implementing Parallel Assignment Instructions, Some Simplified NP-Hard Problems.

Prescribed Text Book:

1. Sartaj Sahni, Fundamentals of Computer Algorithms, Second Edition, Universities Press, 2nd Edition, 2008.

Reference Text Books:

1. Anany Levitin, Introduction to the Design & Analysis of Algorithms, 2nd Edition, Pearson Education, 2007.
1. I.Chandra Mohan, Design and Analysis of Algorithms, PHI, 2nd Edition, 2012.
2. Prabhakar Gupta, Vineet Agrawal, Design and Analysis of Algorithms, PHI, 2nd Edition 2012.
3. Parag Himanshu, Dave, Design and Analysis of Algorithms, Pearson Education, 1st Edition 2008.

Course Focus: Foundation / Skill Development.

Reference Websites:

1. https://epgp.inflibnet.ac.in/Home
1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/lecture-notes/
2. https://www.cukashmir.ac.in/cukashmir/User_Files/imagefile/DIT/StudyMaterial/DAA/DAA_UNIT I_6th-Sem_StudyMaterial.pdf

P.B.SIDDHARTHA COLLEGE OF ARTS & SCIENCE (AUTONOMOUS), VIJAYAWADA-520010

(An Autonomous College in the Jurisdiction of Krishna University, A.P., India.)

M.Sc.(COMPUTER SCIENCE) DEGREE EXAMINATIONS

THIRD SEMESTER

DESIGN & ANALYSIS OF ALGORITHMS

SYLLABUS W.E.F 2022-2023

Time 3 Hours **Max.Marks: 70**

SECTION-A

Answer ALL questions **(5×4 = 20 Marks)**

1.(a) Define *Algorithm*. Explain the algorithm specification briefly.(CO1,L1)

(or)

(b) What are the operations in a *Priority Queue*? (CO1, L1)

2. (a) Explain the Divide and Conquer Algorithms to solve *Convex Hull Problem.* (CO2,L1)

(or)

(b) What is *Tree Vertex Splitting?* (CO2,L1)

3. (a) What is *String Editing?* (CO3,L1)

(or)

(b) Differentiate *DFS and BFS*. (CO3,L1)

4. (a) What is *Graph Colouring?* (CO4,L1)

(or)

(b) What is *Branch and Bound* technique*?*(CO4,L1)

5. (a) Compare *NP hard and NP Complete Classes.* (CO5,L1)

(or)

(b) Explain *flow shop scheduling* in *NP Hard Scheduling Problems.* (CO5,L1)

SECTION - B

Answer all questions. All question carry equal marks. **5 × 10 = 50 Marks**

6. (a) Define Algorithm. Discuss *Performance Analysis of Algorithms* briefly. (CO1,L2)

(or)

(b) Explain *Disjoint Sets, Disjoint Set Union* & *Find Operations* with Algorithms. (CO1,L2)

7. (a) Discuss the method for *Divide and Conquer* approach and write algorithm for Quick Sort with an example. (CO2,L6)

(or)

(b) Discuss the general method for *Greedy Method.* Apply it on *Single Source Shortest Path* by writing an algorithm with suitable example. (CO2,L6)

8. (a) Examine algorithm and procedure of finding *Optimal Binary Search Tree* using Dynamic Programming with example. (CO3,L4)

(or)

(b) Examine *Traversal Techniques for Graphs* with an example. (CO3,L4)

9. (a) Explain *Control Abstraction for LC Search*. Solve *0/1-Knapsack Problem* using *Branch and Bound Technique*. (CO4,L5)

(or)

(b) Explain the *Sum of Subsets Problem* using *Back Tracking Technique.* (CO4,L5)

10. (a) Make use of different formulae prove *COOKs Theorem.*. (CO5,L3)

(or)

(b) Choose *NP-Hard Graph Problems* and explain. (CO5,L3)

22CS3E2: CRYPTOGRAPHY & NETWORK SECURITY

Course Name	Cryptography & Network Security		L	T	P	C	CIA	SEE	TM
Course Code	22CS3E2		4	0	0	4	30	70	100
Year of Introduction: 2005	Year of Offering: 2021	Year of Revision: 2022			Percentage of Revision: 30%				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose: The course is intended to understand and gain knowledge on Computer & Network Security, Number Theory, Classical Encryption Techniques, Advanced Encryption Standard and Random Bit Generation and Stream Ciphers, Number Theory, Public Key Cryptography and RSA, Other Public-Key Crypto Systems and Message Authentication Codes, Digital Signatures, Key Management and Distribution and User Authentication, Transport Level Security, Electronic Mail Security and IP Security and Intruders and Firewalls.

Course Objective: The course aims to provide a comprehensive understanding of computer and network security, covering topics such as number theory, classical and advanced encryption techniques, public-key cryptography, digital signatures, key management, user authentication, transport level security, email and IP security, and intrusion detection, enabling students to secure digital communication and defend against cyber threats.

Specific Objectives include:

- To understand Basic Ideas about *Analysis of Algorithms* and the *Concept of Data Structures*.
- To know *Divide and Conquer*, *Greedy Methods* and *Solving Various Problems* by applying them.
- To apply *Dynamic Programming Method* and *Basic Traversal* and *Search Techniques* to solve various Problems.
- To understand *Backtracking and Branch and Bound* Techniques to Design Algorithms.
- To categorize *NP-Har*d and *NP-Complete* Problems.

Course Outcomes:

CO1: Upon completion of this course, students will master fundamental computer and network security concepts, classical encryption techniques (symmetric ciphers, substitutions, transpositions), Advanced Encryption Standard (AES) implementation, and random bit generation principles, equipping them with essential skills for securing digital systems and data against various threats.

CO2: Upon completion of this course, students will have a comprehensive understanding of fundamental number theory concepts, public key cryptography principles (including RSA, Diffie-Hellman, and elliptic curve cryptography), message authentication codes, and security protocols, enabling them to apply advanced cryptographic techniques in secure communication and data protection.

CO3: Upon completion of this course, students will possess in-depth knowledge of digital signatures, key management, and user authentication techniques, including the NIST Digital Signature Algorithm, symmetric key distribution using asymmetric encryption, distribution of public keys, Kerberos, and remote user authentication using asymmetric encryption, empowering them to design and implement robust security protocols for digital communication systems.

CO4: Upon completion of this course, students will be proficient in implementing Transport Layer Security, securing electronic mail using techniques like S/MIME and Pretty Good Privacy, and ensuring IP Security through comprehensive understanding of IP Security policy, Encapsulating Security Payload, and Combining Security Associations, enabling them to safeguard digital communication at the transport and network levels effectively.

CO5: Upon completion of this course, students will possess expertise in identifying and defending against intruders through intrusion detection techniques, implementing robust password management strategies, understanding the necessity of firewalls, grasping firewall characteristics and access policies, and recognizing

different types of firewalls, enabling them to design and deploy effective security measures against unauthorized access and cyber threats.

Syllabus

UNIT-I (12 Hours)

Computer & Network Security Concepts: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security.
Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques
Advanced Encryption Standard: AES Structure, An AES Example, AES Implementation.
Random Bit Generation and Stream Ciphers: Principles of Pseudo Random Number Generation, Pseudo Random Number Generators.

UNIT-II (12 Hours)

Introduction to Number Theory: Divisibility and the Division Algorithm, The Euclidean Algorithm, Modular Arithmetic, Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms.
Public Key Cryptography and RSA: Principles of Public Key Crypto Systems, The RSA Algorithm.
Other Public-Key Crypto Systems: Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.
Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs, MACs Based on Hash Functions: HMAC.

UNIT-III (12 Hours)

Digital Signatures: Digital Signatures, NIST Digital Signature Algorithm.
Key Management and Distribution: Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys.
User Authentication: Kerberos, Remote User-Authentication Using Asymmetric Encryption.

UNIT-IV (12 Hours)

Transport Level Security: Transport Layer Security.
Electronic Mail Security: S/MIME, Pretty Good Privacy.
IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations.

UNIT-V (12 Hours)

Intruders: Intruders, Intrusion Detection, Password Management.
Firewalls: The Need for Firewalls, Firewall Characteristics and Access Policy, Types of Firewalls.

Prescribed Text Book			
	Author	Title	Publisher
1	William Stallings	Cryptography and Network Security	Pearson, Seventh Edition, 2017

Reference Text Book			
	Author	Title	Publisher
1	William Stallings	Cryptography and Network Security	Pearson, Sixth Edition, 2014
2	William Stallings	Network Essentials - Security Applications and Standards	Pearson Education (2007), Third Edition.
3	Chris McNab	Network Security Assessment	OReilly (2007), 2nd Edition
4	Jon Erickson	Hacking-The Art of Exploitation	Press (2006),SPD
5	Neal Krawety	Introduction to Network Security	Thomson (2007).
6	Ankit Fadia	Network Security-A Hackers Perspective	Macmillan (2008)
7	Behrouz A Forouzan, Debdeep Mukhopadhyay	Cryptography and Network Security	MCGraw-Hill, Indian Special Edition, Third Edition, 2015

Course has focus on: Employability

Websites of Interest:

1. https://www.pearsonhighered.com/assets/hip/us/hip_us_pearsonhighere d/preface/0132775069.pdf
2. http://faculty.mu.edu.sa/public/uploads/1360993259.0858Cryptography%20and%20Network%20Security%20Principles%20and%20Practice,%205th %20Edition.pd

Co-curricular Activities: Programming Contests, Hackathons & Quiz.

PARVATHANENI BRAHMAYYA SIDDHARTHA COLLEGE OF ARTS & SCIENCE

(An Autonomous College in the jurisdiction of Krishna University)

M.Sc.(Computer Science Science), Third Semester

Course Name: Cryptography & Network Security

Course Code: 22CS3E2

(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70**

SECTION-A

AnswerALLquestions **(5×4=20Marks)**

1. (a) Explain Caesar Cipher.(CO1,L2)

(or)

(b) Explain TRNGs, PRNGs. (CO1,L2)

2. (a) What is Modular Arithmetic? Explain. (CO2,L1)

(or)

(b) Explain RSA Algorithm. (CO2,L1)

3. (a) What is Digital Signatures? (CO3,L1)

(or)

(b) List the Distribution of Public Keys. (CO3,L1)

4. (a) Explain Handshake Protocol in TLS. (CO4,L2)

(or)

(b) Explain Pretty Good Privacy. (CO4,L2)

5. (a) Explain Password Management Briefly. (CO5,L2)

(or)

(b) Explain Firewall Characteristics? (CO5,L2)

SECTION-B

Answer Five Questions Choosing One Question from each unit.

All Questions Carry Equal Marks. **(5×10=50Marks)**

6. (a) Explain various Security Attacks and Security Services. (CO1,L2)

(or)

(b) Explain AES Encryption and Decryption Process. (CO1,L2)

7. (a) Illustrate Diffie-Hellman Key Exchange. (CO2,L2)

(or)

(b) Explain Internal and External Error Control in Message Authentication Functions. (CO2,L2)

8. (a) Explain NIST Digital Signature Algorithm with diagram. (CO3,L5)

(or)

(b) Explain Kerberos in detail. (CO3,L5)

9. (a) Explain Confidentiality and Authentication in S/MIME (CO5,L5)

(or)

(b) Illustrate Overview of IP Security. (CO4,L5)

10. (a) Discuss what are the problems that may intruder create and explain how to overcome those problem? (CO5,L6)

(or)

(b) Discuss Various Types of Firewalls. (CO5,L6)

22CS3E3: MACHINE LEARNING

Course Name	Machine Learning			L	T	P	C	CIA	SEE	TM
Course Code	22CS3E3			4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2021	Year of Revision: 2022		Percentage of Revision: 100						
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks										

Course Description and Purpose: Machine Learning is a course that illustrates *concepts* of *Machine Learning, Basics* of *Data Preprocessing* and *Feature Engineering, Supervised Learning Algorithms, Regression Algorithms, Unsupervised Learning Algorithms, concepts* of *Neural Networks*.

Course Objectives: This course will help enable the students t o understand and learn various *Concepts* of *Machine Learning, Basics* of *Data Preprocessing* and *Feature Engineering, Supervised Learning Algorithms, Regression Algorithms, Unsupervised Learning Algorithms, Concepts* of *Neural Networks.*

Specific Objectives include:
- To know the concepts of *Machine Leaning*.
- To understand basics of *Data Pre-processing* and *Feature Selection.*
- To learn *Supervised Learning* and *Regression Algorithms*.
- To learn the concepts of *Unsupervised Learning.*
- To understand the concepts of *Neural Networks*.

Course Outcomes:

CO1: In this course, students will explore the foundations of machine learning, including human learning principles, various types of machine learning, programming languages and tools, and a comprehensive framework for developing and evaluating machine learning models, equipping them with the skills to build and assess sophisticated machine learning applications.

CO2: In this course, students will master the fundamentals of data pre-processing and feature engineering, encompassing techniques such as feature transformation, scaling, construction, subset selection, dimensionality reduction, explorative data analysis, and hyper parameter tuning, with a comprehensive introduction to the SK Learn package, empowering them to proficiently manipulate data and optimize machine learning models.

CO3: In this course, students will gain a deep understanding of supervised learning, covering a range of classification algorithms including Naïve Bayes, KNN, Decision Trees, Random Forest, Support Vector Machines, and XG Boost, as well as regression techniques like Simple Linear Regression, Multiple Linear Regression, Polynomial Regression, and Logistic Regression with Regularization (Lasso and Ridge), enabling them to build accurate predictive models for diverse real-world applications.

CO4: In this course, students will explore the principles of unsupervised learning, differentiating it from supervised learning, and delve into unsupervised learning models, dimensionality reduction techniques, clustering methods, association rule mining, and practical applications, enabling them to analyse complex, unstructured data and derive valuable insights for various domains.

CO5: In this course, students will master the fundamentals of neural networks, covering artificial neural networks, convolutional neural networks for tasks like hand digit and image classification, hyper parameter tuning techniques, and advanced topics including recurrent neural networks and Long Short-Term Memory networks, empowering them to design and optimize sophisticated deep learning models for diverse applications in computer vision and sequential data analysis.

UNIT-I (12 Hours)

Introduction to Machine Learning: Human Learning and Machine Learning - Types of Machine Learning - Languages and Tools in Machine Learning - Framework for Developing Machine Learning Models - Preparing to Model - Modeling and Evaluation Metrics.

UNIT-II (12 Hours)

Basics of Data Preprocessing and Feature Engineering: Feature Transformation - Feature Scaling- Feature Construction and Feature Subset Selection - Dimensionality Reduction - Explorative Data Analysis - Hyper Parameter Tuning - Introduction to SK Learn Package.

UNIT-III (12 Hours)

Supervised Learning: Introduction - Classification (Common Cassification Algorithms):Naïve Bayes,KNN, Decision Trees, Random Forest, Support Vector Machines, XGBoost.
Regression(Common Regression Algorithms): Simple Linear Regression and Multiple Linear Regression - Polynomial Regression - Logistic Regression-Regularisation:Lasso and Ridge.

UNIT-IV (12 Hours)

Unsupervised Learning: Introduction - Unsupervised Vs Supervised Learning - Unsupervised Learning Models - Dimensionality Reduction - Clustering: Association Rule Mining - Applications of Unsupervised Learning.

UNIT-V (12 Hours)

Introduction to Neural Networks: Artificial Neural Networks - Hand Digit Classification - Convolution Neural Networks - Image Classification - Hyper Parameter Tuning - Recurrent Neural Networks - Building Recurrent NN - Long Short Term Memory.

Reference Text Books:

1. Hastie, T., R. Tibshirani, and J. H. Friedman. , The Elements of Statistical Learning: Data Mining, Inference and Prediction, New York, NY: Springer, 2011, ISBN: 97803879
1. EthemAlphaydin, An introduction to Machine Learning, PHI Learning Private Limited, 2020
2. AurelienGeron, Hands-On Machine Learning with Scikit Learn, Keras and Tensor Flow, O'REILY -2019
3. Tom Mitchell, Machine Learning, Tata McGraw Hill, 2013
4. Francois Chollet, Deep Learning with Python, Manning , 2019

PARVATHANENI BRAHMAYYA SIDDHARTHA COLLEGE OF ARTS & SCIENCE

(An Autonomous College in the jurisdiction of Krishna University)

M.Sc.(Computer Science), Third Semester

Course Name: Machine Learning

Course Code: 22CS3E3

(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70 Marks**

SECTION-A

Answer ALL questions. All Questions Carry Equal Marks. (5×4 = 20 Marks)

1. (a) Define *Machine Learning* and list different *Machine Learning Techniques*. (CO1,L1)

(or)

(b) What are the *different tools* used in Machine Learning? (CO1,L1)

2. (a) What are the techniques of *Feature Scaling*? (CO2,L1)

(or)

(b) Define *Dimensionality Reduction* and explain its Techniques. (CO2,L1)

3. (a) What are the various algorithms used for *Classification*? (CO3,L1)

(or)

(b) Define *Logistic Regression*. (CO3,L1)

4. (a) Explain *Clustering* and list out different *Clustering Algorithms*? (CO4, L2)

(or)

(b) Explain the Applications of *Unsupervised Learning*? (CO4,L2)

5. (a) List some commercial practical applications of *Artificial Neural Networks*.(CO5,L1)

(or)

(b) Define *Hyper Parameter Tuning* with example. (CO5,L1)

SECTION-B

Answer ALL questions. All Questions Carry Equal Marks. (5×10 = 50 Marks)

6. (a) Explain the *work flow* in Machine Leaning Problem Solving. (CO1,L2)

(or)

(b) Explain *Supervised* and *Unsupervised Learning* with Examples. (CO1,L2)

7. (a) Discuss *Feature Transmission* in detail. (CO2, L6)

(or)

(b) Discuss *Feature Subset Selection* and its Application. (CO2,L6)

8. (a) Explain *Classification Problem* in Supervised Learning and Explain *Decision Tree Algorithm* for Classification. (CO3,L5)

(or)

(b) Explain *Linear and Multiple Linear Regression* in Python Library Stats Models. (CO3,L5)

9. (a) Apply *K-Means Clustering Algorithm* on following X and Y values (10,34), (45,55), (23,55), (14,66), (56,25),(12,16),(14,25). (CO4,L3)

(or)

(b) Choose suitable Algorithm in SK-Learn Package to perform *Hierarchical Clustering*. (CO4, L3)

10. (a) List basic features in Neuron and different types of *Activation Functions*. (CO5,L4)

(or)

(b) List various parameters of *Convolution Neural Networks*. (CO5,L4)

22CS3E4: APPLIED DATA ANALYTICS

Course Name	Applied Data Analytics		L	T	P	C	CIA	SEE	TM
Course Code	22CS3E4		4	0	0	4	30	70	100
Year of Introduction: 2022	**Year of Offering:** 2022	**Year of Revision**: 2022			**Percentage of Revision:** 100				
L-Lecture, **T**-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose: Applied Data Analytics is a course that illustrates concepts of R-Programming, Data Structures, Descriptive Statistical Analysis, Basic Graphs, Analysis of ANOVA, Multivariate Analysis, Files & Databases.

Course Objective: The Applied Data Analytics course aims to equip students with a comprehensive understanding of R-Programming, Data Structures, Descriptive Statistical Analysis, Basic Graphs, Analysis of ANOVA, Multivariate Analysis, and Files & Databases, fostering proficiency in applying these concepts to solve real-world problems through machine learning algorithms and techniques.

Specific Objectives include:

- To *install, code* and *use* R Programming Language in R Studio IDE to perform basic tasks on Control Flow Statements, Data Structures and can invoke Operations on Data Structures.
- To understand the *Basic Terminologies, Concepts and Techniques* employed in Descriptive Statistical Analysis.
- To familiar with *Basic Graphics* and *Analysis of* ANOVA.
- To gain knowledge on *Basic Multivariate Analysis*.
- To apply how to import *Different Files* and *Connecting Databases to R*.

Course Outcomes:

CO1: Upon completing the course students will gain a comprehensive proficiency in utilizing R for data analysis, mastering R environment, working with packages, understanding, manipulating, and cleaning diverse datasets, employing various data types and structures, handling missing values, sorting and merging data, subsetting datasets, implementing control flow statements, and performing aggregation and restructuring operations, empowering them to apply advanced data analysis techniques for solving complex real-world problems.

CO2: Upon completion of the course, students will acquire a comprehensive understanding of measures of central tendency, dispersion, and shapes, various sampling techniques, hypothesis testing methods including parametric and non-parametric tests, enabling them to effectively analyse and interpret data, make informed decisions, and contribute meaningfully to statistical research and applications.

CO3: Upon completion of the course on "Basic and Advanced Data Visualization, and Analysis of Variance," students will proficiently create a wide array of graphical representations using bar plots, pie charts, histograms, line plots, dot plots, kernel density plots, and utilize advanced visualization techniques with the ggplot2 package, while also mastering the application of various ANOVA models, including one-way ANOVA, one-way ANCOVA, two-way factorial ANOVA, repeated measures ANOVA, and multivariate analysis of variance (MANOVA), enabling them to visually and statistically analyze complex datasets and draw meaningful insights for research and decision-making purposes.

CO4: Upon completion of the course on "Basic Multivariate Analysis, Time Series Analysis, and Forecasting," students will gain a comprehensive understanding of regression techniques including simple linear regression, multiple linear regression, and logistic regression, along with proficiency in time series analysis encompassing the creation and decomposition of time series, exponential models, and forecasting methods such as simple moving averages, weighted moving averages, and single exponential smoothing,

empowering them to analyze multivariate data, model time-dependent patterns, and make accurate predictions for diverse real-world applications.
CO5: Upon completion of the course on "Connecting R to External Interfaces," students will proficiently import and export data between R and various external sources including CSV files, Microsoft Excel spread sheets, databases (MySQL) for creating, querying, and managing tables, XML and JSON files for structured data exchange, as well as binary files, enabling them to seamlessly interface R with diverse data formats and sources for effective analysis and manipulation.

UNIT-I (12 Hours)

Introduction to R: Why use R?, R Environment, Working with R Packages, Understanding Datasets, Data Types, Data Structures (Operations on Data Structures), Missing Values, Sorting Data, Merging Datasets, Subsetting Datasets, Control Flow Statements, Aggregation and Restructurings.

UNIT-II (12 Hours)

Descriptive Statistics: Introduction to Descriptive Statistics (Measures of Central Tendency, Measures of Dispersion of Variability, Measures of Shapes (Skewness and Kurtosis)), Introduction to Sampling(Sampling Types), Hypothesis Testing with R(One Sample Test, One Sample Sign Test, Two Samples Test), Parametric Test(Correlations, Z-Test, T-Test), Non Parametric Tests (Wilcoxon Signed- Rank Test, Chi Square Test).

UNIT-III (12 Hours)

Basic Graphs: Bar Plots, Pie Charts, Histograms, Line, Dot Plots, Kernel Density Plots and Dot Plots.
The Advanced Graphics: The ggplot2 Package.
Analysis of Variance: Fitting ANOVA Models, One-way ANOVA, One-way ANCOVA, Two-way factorial ANOVA, Repeated Measures ANOVA, Multivariate Analysis of Variance (MANOVA)

UNIT-IV (12 Hours)

Basic Multivariate Analysis: Regression (Simple Linear Regression, Multiple Linear Regression, Logistic Regression), Time Series Analysis (Creating Time Series, Components of Time Series Analysis, Seasonal Decomposition, Exponential Models), Forecasting (Simple Moving Averages, Weighted Moving Averages, Single Exponential Smoothing.)

UNIT-V (12 Hours)

Connecting R to External Interfaces: CSV Files (Reading From a CSV File, Writing to a CSV File), Microsoft Excel (Reading from XLSX File, Writing to XLSX File), Databases (Connecting R to MYSQL ,Creating Tables, Inserting Rows, Updating Rows, Deleting Rows, Querying Rows, Querying Tables, Dropping Tables), XML Files (Reading From XML Files, JSON Files, Reading From JSON Files), Binary Files (Writing to Binary Files, Reading From Binary Files).

Prescribed Text Book			
	Author	Title	Publisher
1	Dr. Rob Kabacoff	R in Action : Data Analysis and Graphics with R. [UNIT-I ,UNIT-II ,UNIT-III]	Manning Publications Co, Edition 2011.
2	Dr.Jeeva Jose	A Beginners Guide For Data Analysis Using R Programming. (UNIT IV and UNIT V) UNI IV: Chapter-11 11.3 [11.3.1 to 11.3.3] 11.5,11.6 [11.6.1 to 11.6.3] UNIT V: Chapter-6 [6.1 to 6.6]	Khanna Book Publishing Co.(P) Ltd, Edition 2019.

Reference Text Books			
	Author	Title	Publisher
1	Dr. Dhaval Maheta	Data Analysis using R	Notion Press, September 2021
2	Michael J.Crawley	The R Book	Wiley, Edition: 2007
3	Ken Black John	Business Statistics for Contemporary Decision Making	John Wiley & Sons, Inc., Edition 2013

P.B. Siddhartha College of Arts & Science, Vijayawada - 520 010.
(An Autonomous College in the jurisdiction of Krishna University)
M.Sc.(Computer Science) - III Semester
Title: Applied Data Analytics
Course Code: 22CS3E4
(w.e.f admitted batch 2020-21)

Time: 3 Hours **Max.Marks: 70**

Answer ALL questions **(5×4 = 20 Marks)**

1. (a) What are the different *Data Types* used in R. (CO1,L1)
(or)
(b) Define *Subsetting and merging*. (CO1,L1)

2. (a) Explain *Hypothesis Testing* in R? (CO2,L2)
(or)
(b) Explain Random *Sampling and cluser sampling* ? (CO2,L2)

3. (a) Explain about histograms with example using R (CO3.L5)
(or)
(b) Define ANOVA and uses of ANOVA CO3,L5)

4. (a) Explain about *Logistic Regression using R*. (CO4,L2)
(or)
(b) Explain *Time Series Analysis* and uses of time series analysis? (CO5,L2)

5. (a) What is the syntax used to read *XML Files*. (CO5,L1)
(or)
(b) How we can insert data into R using MYSQL ?(CO5,L1)

Answer Five Questions Choosing One Question from Each Unit.
All Questions Carry Equal Marks. **(5×10 = 50 Marks)**

6. (a) Outline the different *Data Structures* used in R. (CO1,L2)
(or)
(b) Explain *Control Flow Statements* in R. (CO1,L2)

7. (a) Explain the different statistical measures used in *Descriptive Statistics*. (CO2,L5)
(or)
(b) Explain *Non Parametric Test* and *Wilcoxon Signed-Rank Test* in R with example. (CO2,L5)

8. (a) List *Various Types of Charts* in R. (CO3,L4)
(or)
(b) Analyze *One-way ANOVA* and *Two-way factorial ANOVA*. (CO3,L4)

9. (a) Discuss *Simple* and *Multiple Regression* in R with Example. (CO4,L6)
(or)
(b) Elaborate different components used in *Time Series Analysis in R* with example. (CO4, L6)

10. (a) How do you *connect to a database* in R using MYSQL ? Give one example.(CO5,L5)
(or)
(b) How to do you import *csv file* and *binary file* in R with example? (CO5,L5)

22CS3E5: INTERNET OF THINGS (IoT)

Course Name	Internet of Things (IoT)		L	T	P	C	CIA	SEE	TM
Course Code	22CS3E5		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2022	Year of Revision: 2023			Percentage of Revision: 70%				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Descriptive and Purpose: This course aims to provide students with a comprehensive understanding and knowledge of various aspects of the Internet of Things (IoT). These areas of focus include an overview of IoT, models and layers in IoT systems, standardization efforts, protocols and design principles applicable to connected devices, principles of internet connectivity within IoT, a deep dive into IoT protocols and application layer protocols, techniques for acquiring IoT data, and an exploration of business models and processes relevant to IoT applications.

Course Objectives: The course help the students to understand and gain knowledge on *Over View* of *Internet of Things*, *Models*, *Layers* & *Standardization*, *Protocols* & *Design Principles* for Connected Devices, *Internet Connectivity Principles*, *Protocols* & *Application Layer Protocols*, *Data Acquiring*, *Business Models* and *Business Processes*.

Specific objectives include:
- To attain knowledge over view of *Internet of Things*.
- To understand *Models*, *Layers* & *Standardization*.
- To apply *Protocols* & *Design Principles* for Connected Devices.
- To understand *Internet Connectivity Principles*, *Protocols* & Application Layer Protocols.
- To understand *Data Acquiring*, *Business Models* and *Business Processes*.

Course Outcomes: On successful completion
CO1: This course provides a comprehensive understanding of the Internet of Things (IoT), covering its technology, sources, M2M communication, real-world examples, design principles for connected devices, and business models, enabling students to navigate and contribute to the IoT ecosystem effectively.
CO2: This course equips students with a deep understanding of design principles for connected devices in IoT/M2M systems, including OSI stack modifications, ETSI M2M domains, communication technologies, data management, and affordability considerations, enabling them to design and manage efficient and cost-effective IoT solutions.
CO3: This course imparts design principles and knowledge of web connectivity for connected devices, covering web communication protocols, message communication protocols, and practical web connectivity techniques, enabling students to create effective web-connected device solutions.
CO4: This course equips students with the skills to acquire, organize, and analyze data in IoT/M2M contexts, covering data acquisition, storage, business processes, and integration into enterprise systems, facilitating their ability to leverage IoT data for applications, services, and business processes effectively.
CO5: This course empowers students to master data acquisition, organization, and analytics within IoT/M2M, enabling them to drive innovative applications, services, and business processes while efficiently integrating data into enterprise systems.

UNIT-I (12 Hours)

The Internet of Things: An Overview of Internet of Things, Internet of Things Technology, Behind IoT Sources of the IoT, M2M Communication, Examples of IoT, Design Principles for Connected Devices, Business Models for Business Processes in the Internet of Things.

UNIT-II (12 Hours)

Design Principles for Connected Devices: IoT / M2M systems layers and Designs Standardizations, Modified OSI Stack for the IoT / M2M Systems, ETSI M2M Domains and High-level Capabilities ,Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway ease of Designing and Affordability.

UNIT-III (12 Hours)

Design Principles for the Web Connectivity: Design Principles for the Web Connectivity for Connected Devices, Web Communication Protocols for Connected Devices, Message Communication Protocols for Connected Devices, Web Connectivity for Connected Devices.

UNIT-IV (12 Hours)

Internet Connectivity Principles: Introduction, Internet Connectivity, Application Layer Protocols: *HTTP*, *HTTPS*, *FTP*, *Telnet.*

UNIT-V (12 Hours)

Data Acquiring, Organizing and Analytics in IoT / M2M: Introduction, Applications / Services / Business Processes, IOT / M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

Prescribed Text Book			
	Author	Title	Publisher
1	Rajkamal	Internet of Things : Architecture, Design Principles and Applications	McGraw Hill Higher Education

Reference Text Book			
	Author	Title	Publisher
1	Adrian McEwen and Hakim Cassimally	Designing the Internet of Things	Wiley
2	CunoPfister	Getting Started with the Internet of Things.	Oreilly

Course Focus: Employability

Websites of Interest:

1. https://dzone.com/iot-developer-tutorials-tools-news-reviews
1. https://www.ibm.com/blogs/internet-of-things/

(An Autonomous College in the jurisdiction of Krishna University)
M.Sc.(Computer Science), Third Semester
Course Name: Internet Of Things
Course Code: 22CS3E5
(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70**

SECTION-A

Answer ALL questions **(5×4=20 Marks)**

1.(a) Explain *M2M communication.* (CO1,L2)
(or)
(b) Explain *Internet of Things Technology.* (CO1,L2)

2.(a) What is *Gateway*. (CO2,L1)
(or)
(b) List out *Communication Technologies for IoT*. (CO2,L1)

3.(a) What is *Communication Protocol*? (CO3,L1)
(or)
(b) List out *Application Layer Protocols.* (CO3,L1)

4.(a) Explain *Business Processes for IoT*. (CO4,L2)
(or)
(b) Explain *Organizing Data in IoT*. (CO4,L2)

5.(a) Explain *Transactions for Business Processes.* (CO5,L2)
(or)
(b) Explain *Active* and *Passive Devices*. (CO5,L2)

SECTION-B

Answer Five Questions Choosing One Question from Each Unit.
All Questions Carry Equal Marks. **(5×10=50 Marks)**

6. (a) Explain *overview of Internet of Things*.(CO1,L2)
(or)
(b) Explain *Design Principles for Connected Devices*. (CO1,L2)

7. (a) Apply *IoT / M2M Designs Standardizations* with examples. (CO2,L3)
(or)
(b) Build *Modified OSI Stack for the IoT / M2M Systems*. (CO2,L3)

8. (a) What are *Design Principles for the Web Connectivity*.(CO3,L1)
(or)
(b) What are *Message Communication Protocols for Connected Devices*.(CO3,L1)

9. (a) Explain *IOT / M2M Data Acquiring and Storage*.(CO4,L2)
(or)
(b) Explain *IoT Business Models for Business Processes* with example.(CO4,L2)

10. (a) Explain *Applications and Service Business Processes for IoT*.(CO5,L5)
(or)
(b) Explain *Integration and Enterprise Systems*. (CO5,L5)

22CS3E6: BLOCK CHAIN TECHNOLOGY

Course Name	Block Chain Technology		L	T	P	C	CIA	SEE	TM
Course Code	22CS3E6		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2022	Year of Revision: No Revision			Percentage of Revision: 100				
L-Lecture, T-Tutorial, P-Practical, C-Credits, CIA-Internal Marks, SEE-External Marks, TM-Total Marks									

Course Description and Purpose: This course provides a comprehensive overview of blockchain technology, covering its necessity, operational processes, limitations, Bitcoin decentralization, Bitcoin and Ethereum storage and usage, smart contracts, real-world blockchain applications, mining consensus mechanisms, and security considerations.

Course Objectives: Block Chain Technology is a course that illustrates Block Chain Need, Working Process of Block Chain, Limitations of Block Chain Technology, Decentralization of Bitcoin, Storage and usage of Bitcoins, Ethereum and Smart Contracts, Block Chain Applications, Mining Consensus and Bitcoin Security.

Specific objectives include:

1. To understand basic concepts of *Blockchain* & *Limitations*.
1. To learn *How Bitcoin Achieves Decentralization.*
2. To familiar with *How to Store Bitcoins* and *How to Use Bitcoins*.
3. To know *Ethereum and Smart Contracts* and *Blockchain Applications*.
4. To gain knowledge on *Mining Consensus* and *Bitcoin Security.*

Course Outcomes:

Upon successful completion of the course

CO1: Students will have a comprehensive understanding of block chain technology, including its need in addressing core problems, the workings of public and private ledgers, the mechanics of block chain, such as hashing data, user account protection, transaction authorization, and data store security, as well as the limitations of block chain technology and potential avenues for innovation and improvement in the field.

CO2: Students will possess a thorough understanding of how Bitcoin achieves decentralization, including the distinctions between centralized and decentralized systems, the concept of distributed consensus, the mechanics of Bitcoin transactions and scripts, and the role of Bitcoin blocks in maintaining a decentralized ledger, enabling them to grasp the fundamental principles of block chain technology and crypto currency.

CO3: Students will be well-equipped to store and use Bitcoins effectively, understanding various storage methods, including local storage, hot and cold storage, and key management techniques. They will also gain proficiency in using Bitcoins through online wallets, exchanges, payment services, and currency exchange markets, enabling them to navigate the crypto currency ecosystem securely and efficiently.

CO4: Students will have a comprehensive understanding of Ethereum, smart contract programming, and various block chain applications, including Name coin, gas incentives, security considerations, data structures in Ethereum, and applications such as colored coins, Counterparty, payment channels, and state channels, equipping them to design and implement block chain-based solutions for diverse use cases.

CO5: Students will have a deep understanding of mining consensus in block chain networks, including decentralized consensus mechanisms, transaction verification, block mining, and consensus security considerations. Additionally, students will be well-versed in Bitcoin security principles and user best practices for securing crypto currency assets, enabling them to engage with block chain technologies securely and effectively.

UNIT-I (12 Hours)

Why Blockchain is Need: Discovering the Core Problem - Public Ledgers - Block in Blockchain - Public versus Private Blockchain.
How Blockchain Works: Planning the Blockchain - Hashing Data - Identifying & Protecting user Accounts - Authorizing Transactions - Using Data Store - Protecting Data Store - Choosing Transaction History - Paying for Integrity.
Limitations: Seeing the Limitations - Reinventing the Block Chain.

UNIT-II (12 Hours)

How Bitcoin Achieves Decentralization: Centralized versus Decentralization - Distributed Consensus - Bitcoin Transactions - Bitcoin Scripts - Applications of Bitcoin Scripts - Bitcoin Blocks.

UNIT-III (12 Hours)

How to Store Bitcoins: Simple Local Storage - Hot and Cold Storage - Splitting and Sharing Keys.
How to Use Bitcoins: Online Wallets and Exchanges - Payment Services - Transaction Fees - Currency Exchange Markets.

UNIT-IV (12 Hours)

Ethereum and Smart Contracts: Smart Contract Programming Model, Namecoin in Ethereum, Gas Incentives and Security, Data Structures in Ethereum.
Blockchain Applications: Applications from Building Blocks, Colored Coins, Counterparty, Payment Channels and State Channels, Routed Payment Channels.

UNIT-V (12 Hours)

Mining Consensus: Decentralized Consensus - Independent Verification of Transactions - Mining Nodes - Aggregating Transactions into Blocks - Mining the Block - Validating a New Block - Assembling and Selecting Chains of Blocks - Consensus Attacks.
Bitcoin Security: Security Principles - User Security Best Practices.

Prescribed Text Book			
	Author	Title	Publisher
1	Daniel Drescher	Blockchain Basics	A Press, Second Edition, 2017
2	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder	Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction.	Princeton University Press, 2016, Second Edition
3	Andreas M Antonopoulos	Mastering Bitcoin: Unlocking Digital Crypto Currencies	ORELLY,2015

Reference Text Book			
	Author	Title	Publisher
1	Melanie	Blockchain : Blue Print for New Economy	ORELLY,2015

PARVATHANENI BRAHMAYYA SIDDHARTHA COLLEGE OF ARTS & SCIENCE

(An Autonomous College in the jurisdiction of Krishna University)

M.Sc.(Computer Science), Third Semester

Course Name: Block Chain Technology

Course Code: 22CS3E6

(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70**

SECTION-A

Answer ALL Questions **(5×4=20Marks)**

1. (a) What is reinventing the Block Chain? (CO1,L1)

(or)

(b) How to use Data Store? (CO1,L1)

2. (a) Explain Block in Block Chain. (CO2,L2)

(or)

(b) Explain Script. (CO2,L2)

3. (a) What is Splitting? (CO3,L1)

(or)

(b) What is Transaction? (CO3,L1)

4. (a) Explain Payment Channel. (CO4,L2)

(or)

(b) Explain Colored Coin. (CO4,L2)

5.(a) What is Mining Node? (CO5,L1)

(or)

(b) What are Security Principles? (CO5,L1)

SECTION-B

Answer Five Questions Choosing One Question from Each Unit.

All Questions Carry Equal Marks. **(5×10=50Marks)**

6. (a) Explain Public Ledger, Public & Private Block Chains. (CO1,L2)

(or)

(b) Explain identifying and protecting User Accounts and Authorize Transactions. (CO1,L2)

7. (a) Apply Centralized & Decentralized in Bitcoin in applications. (CO2,L3)

(or)

(b) Build Bitcoin Scripts and their Applications. (CO2,L3)

1. (a) What are Hot & Cold Storages?. Explain in detail. (CO3,L1)

(or)

(b) How bitcoins are used in online Wallets & Exchanges and payment services? (CO3,L1)

1. (a) Explain Smart Contract Programming Model & Data Structures in Ethereum.(CO4,L2)

(or)

(b) Write about Applications from Building Blocks and Colored Coins.(CO4,L2)

(a) Explain Mining, Validating, Assembling and Selecting Chains of blocks. (CO5,L5)

(or)

(b) Explain the Security Principles in Bitcoin Security.(CO5,L5)

22CS3L1: DATA SCIENCE LAB

Course Name	Data Science Lab		L	T	P	C	CIA	SEE	TM
Course Code	22CS3L1		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2021	Year of Revision: 2022			Percentage of Revision: 100				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose: Data Science Lab is a course that illustrates concepts of Tableau Installation, Introduction, Exploring, Data Blending, Uni-variate Charts, Bi-variate Charts, Multi-variate Charts, Trend Line, Word cloud, Bubble Chart, Creating a Simple Dash Board, Creating Maps, Creating a Dash Board, Creating a Story and Data Munging, Importing Graphs, Group and Aggregate Data, Create a Dash Board in Power BI.

Course Objectives: The Data Science Lab course aims to provide comprehensive knowledge and practical skills in Tableau and Power BI, covering installation, data exploration, visualization techniques, dashboard creation, and data munging, enabling students to proficiently analyze and present complex data sets.

Specific objectives include:

1. To implement *Tableau Installation, Introduction, Exploring*.
2. To implement *Data Blending*.
3. To implement *Uni-variate Charts, Bi-variate Charts, Multi-variate Charts*.
4. To implement *Trend Line, Word cloud, Bubble Chart.*
5. To implement creating a Simple Dash Board, Creating Maps, Creating a Dash Board, Creating a Story and Data Munging, Importing Graphs, Group and Aggregate Data, Create a Dash Board in Power BI.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1: Implement tableau *Installation, Introduction, Exploring*.

CO2: Implement *Data Blending.*

CO3: Implement *Uni-variate Charts, Bi-variate Charts, Multi-variate Charts.*

CO4: Implement *Trend Line, Word Cloud, Bubble Chart.*

CO5:To implement creating a *Simple Dash Board, Creating Maps, Creating a Dash Board, Creating a Story* and Data Munging, Importing Graphs, Group and Aggregate Data, Create a *Dash Board* in *Power BI.*

1. Tableau installation. (CO1,L1)
2. Tableau Introduction / Exploring Tableau. (CO1,L1)
3. Data Blending. (CO2,L3)
4. Creating Univariate charts
   a.Bar Chart. (CO3,L3)
   b.Pie Chart. (CO3,L3)
   c. Line Charts
   d. Box plots
5. Dual Axis Chart. (CO3,L3)
6. Shared Axis. (CO3,L3)
7. Creating Bivariate Charts
   a. Cross Tab. (CO3,L3)
   b. Scatter Plot. (CO3,L3)
   c. Trend Line. (CO3,L3)

8. Creating Multi-variate Charts

a. Dual Axis Chart. (CO3,L3)

b. Area charts(CO3,L3)

9. Word Cloud. (CO4,L3)

10. Bubble Chart. (CO4,L3)

11. Creating a Simple Dash Board. (CO5,L3)

12. Creating Maps. (CO5, L3)

13. Creating a Dash Board. (CO5, L3)

14. Creating a Story. (CO5, L3)

Power BI:

15. Getting data from web. (CO4, L3)
16. Natural Language Queries. (CO4, L3)
17. Importing Data from Northwind ODATA feed T3_IMF. (CO4, L3)
18. Functions & list Dates in Power Bi. (CO4, L3)
19. Group By and unpivot in Power Bi. (CO4, L3)
20. Merging Queries in Power Bi. (CO4, L3)
21. IPL Statistics in Power Bi. (CO4, L3)
22. Merging Queries in Power Bi. (CO4, L3)
23. Append Query in Power Bi. (CO4, L3)
24. Charts in Power Bi (CO5,L3)
25. Data Modeling in Power Bi.(CO5,L3)
26. Dashboard for Corona Cases Analysis. (CO5,L3)

Note: The list of experiments is not limited to the above list. If the existing laboratory experiments completed in advance, the additional laboratory programs can added , and to be executed in the laboratory.

22CS3L2: MACHINE LEARNING LAB

Course Name	Machine Learning Lab		L	T	P	C	CIA	SEE	TM
Course Code	22CS3L2		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2021	Year of Revision: 2022			Percentage of Revision: 100				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose:

Machine Learning Lab is a course that illustrates concepts of *Load Data Sets from Different Sources*, *Basics of Data Pre-processing* and *Feature Selection*, *Supervised Learning and Regression Algorithms*, *Supervised Learning and Classification Algorithms*, *Concepts of Clustering Algorithms*.

Course Objectives:

This course will help enable the students to understand learn, apply / implement the *Load Data Sets from Different Sources*, *Basics of Data Pre-processing* and *Feature Selection*, *Supervised Learning and Regression Algorithms*, *Supervised Learning and Classification Algorithms*, Concepts of *Clustering Algorithms.*

The learning objectives include:

- To know the concepts of *Load Data Sets* from different Sources.
- To understand basics of *Data Pre-processing* and *Feature Selection.*
- To learn *Supervised Learning* and *Regression Algorithms*.
- To learn *Supervised Learning* and *Classification Algorithms*.
  - To understand the concepts of *Clustering Algorithms*.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1: Know the concepts of *Load Data Sets* from Different Sources.

CO2: Understand basics of *Data Pre-processing* and *Feature Selection*.

CO3: Learn *Supervised Learning* and *Regression Algorithms.*

CO4: Learn *Supervised Learning* and *Classification Algorithms*.

CO5: Understand the concepts of *Clustering Algorithms*.

1. Write a program to open Data Sets in Python. (CO1,L1)
2. Explain various *Plotting Techniques* of Python. (CO2, L2)

REGRESSION ALGORITHMS

2. Demonstrate *Simple Linear Regression* in Python with Sample Data Sets. (CO3,L2)
3. Demonstrate *Multiple Linear Regression* in Python with Sample Data Sets. (CO3,L2)
4. Demonstrate *Decision Tree Regression* in Python with Sample Data Sets. (CO3,L2)
5. Demonstrate *Support Vector Regression* in Python with Sample Data Sets. (CO3,L2)
6. Demonstrate *Random Forest Regression* in Python with Sample Data Sets. (CO3,L

CLASSIFICATION ALGORITHMS

7. Demonstrate *Logistic Regression in Python* with Sample Data Sets. (CO4,L2)
8. Demonstrate *Support Vector Classification* in Python with Sample Data Sets. (CO4,L2)
9. Demonstrate *Random Forest Classification* in Python with Sample Data Sets. (CO4,L2)

CLUSTERING ALGORITHMS

10. Demonstrate *K-Means Clustering* with Sample Data Sets. (CO5,L2)
11. Demonstrate *Hierarchical Clustering* with Sample Data Sets. (CO5,L2)

Note: The list of experiments is not limited to the above list. If the existing laboratory experiments completed in advance, the additional laboratory programs can added , and to be executed in the laboratory.

APPENDIX-II
PROGRAM STRUCTURE & SYLLABI FOR M.C.A PROGRAMME (R22)

P.B.Siddhartha College of Arts & Science, Vijayawada
Programme Structure for M.C.A
Under Choice Based Credit System (CBCS)
W.E.F 2022-23 (R22 Regulations)

I SEMESTER (For the batch of students admitted during 2023-2024)					M.C.A			
Course Code	**Course Name**	**Teaching Hours/Week**			**CORE/IDC/ DSE/SEC/OEC/ MOOCS**	**CIA**	**SEE**	**No. of Credits**
		Lecture	**Practical**	**Tutorial**				
22CA1T1	Programming and Problem Solving Using Python	4	0	0	Core	30	70	4
22CA1T2	Database Management Systems	4	0	0	Core	30	70	4
22CA1T3	Mathematical and Statistical Foundations	4	0	0	Core	30	70	4
22CA1T4	Operating Systems	4	0	0	Core	30	70	4
22PG101	Personality Development through Life Enlightenment Skills	3	1	0	Core	30	70	3
22CA1L1	Programming and Problem solving using Python Lab	0	6	0	Core	30	70	3
22CA1L2	Database Management Systems Lab	0	6	0	Core	30	70	3
TOTAL FOR FIRST SEMESTER						**210**	**490**	**25**

II SEMESTER (For the batch of students admitted during 2023-2024)					M.C.A			
Course Code	**Course Name**	**Teaching Hours/ Week**			**CORE/IDC/DSE/SEC/OEC /MOOCS**	**CIA**	**SEE**	**No. of Credits**
		Lecture	**Practical**	**Tutorial**				
22CA2T1	Computer Networks	4	0	0	Core	30	70	4
22CA2T2	Data Structures	4	0	0	Core	30	70	4
22CA2T3	Web Technologies	4	0	0	Core	30	70	4
22PG201	Research Methodology& IPR	3	1	0	SEC	30	70	3
DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY ONE)								
22CA2E1	Software Engineering	4	0	0	DSE	30	70	4
22CA2E2	Mobile Applications	4	0	0	DSE	30	70	4
22CA2E3	Unix Programming	4	0	0	DSE	30	70	4
LAB PRACTICALS								
22CA2L1	Data Structures Lab	0	6	0	Core	30	70	3
22CA2L2	Web Technologies Lab	0	6	0	Core	30	70	3
TOTAL FOR SECOND SEMESTER						**210**	**490**	**25**

At the end of 2nd semester, every student must undergo *Summer Internship/Apprenticeship/Project Work/Industrial Training/Research based Project Work* for ***Six Weeks*** and must prepare a report concerned as per approved project guidelines, and submit the same to the University 14 days before the commencement of third semester end examinations.

Note: Students may be allowed to register and appear for MOOCS from the third semester itself. However, students are to complete the MOOCS successfully and submit pass certificate of the same to the University through the Principal of the College concerned for approval and endorsement of the same on grade cards and PCA and ODs as per the regulations of the University.

III SEMESTER (For the batch of students admitted during 2022-2023)					M.C.A			
Course Code	**Course Name**	**Teaching Hours/ week**			**CORE/IDC/DSE/ SEC/OEC/MOOCS**	**CIA**	**SEE**	**No. of Credits**
		Lecture	**Practical**	**Tutorial**				
22CA3T1	Data Science	4	0	0	Core	30	70	4
DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY THREE)								
22CA3E1	Design & Analysis of Algorithms	4	0	0	DSE	30	70	4
22CA3E2	Cryptography & Network Security	4	0	0	DSE	30	70	4
22CA3E3	Machine Leaning	4	0	0	DSE	30	70	4
22CA3E4	Applied Data Analytics	4	0	0	DSE	30	70	4
22CA3E5	Internet of Things	4	0	0	DSE	30	70	4
22CA3E6	Block Chain Technologies	4	0	0	DSE	30	70	4
LAB PRACTICALS								
22CA3L1	Data Science Lab	0	6	0	Core	30	70	3
22CA3L2	Machine Leaning Lab	0	6	0	Core	30	70	3
OPEN ELECTIVE (INTERDISCIPLINARY/MULTIDISCIPLINARY) COURSES (CHOOSE ANY ONE)								
22OE301	R-Programming	3	0	0	OEC	30	70	3
22OE302	Mobile Networks	3	0	0	OEC	30	70	3
22OE303	UNIX Programming	3	0	0	OEC	30	70	3
22OE304	Power BI	3	0	0	OEC	30	70	3
22OE305	Python Programming	3	0	0	OEC	30	70	3
TOTAL FOR THIRD SEMESTER						**210**	**490**	**25**

IV SEMESTER (For the batch of students admitted during 2022-2023)						M.C.A		
Course Code	**Course Name**	**Teaching Hours/ Week**			**CORE/IDC/DSE/ SEC/OEC/MOOCS**	**CIA**	**SEE**	**No. of Credits**
		Lecture	**Practical**	**Tutorial**				
22CA4T1	Cloud Computing	4	0	0	Core	30	70	4
DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY THREE)								
22CA4E1	Big Data Analytics	4	0	0	DSE	30	70	4
22CA4E2	Deep Learning	4	0	0	DSE	30	70	4
22CA4E3	Artificial Intelligence	4	0	0	DSE	30	70	4
22CA4E4	Data Mining	4	0	0	DSE	30	70	4
22CA4E5	Cyber Security	4	0	0	DSE	30	70	4
22CA4E6	Information Security	4	0	0	DSE	30	70	4
LAB PRACTICALS								
22CA4L1	Cloud Computing Lab	0	6	0	Core	30	70	3
ENTREPRENURAL & INNOVATION/IT SKILL RELATED TO DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY ONE)								
22CA4E7	Social Media Analytics	3	0	0	SEC	30	70	3
22CAAE8	Dynamic Web Programming using Python	3	0	0	SEC	30	70	3
22CAAE9	Software Testing and Project Management	3	0	0	SEC	30	70	3
*** CHOOSE MOOCS FROM SWAYAM/NPTEL SOURCES**								
MOOCS								4
PROJECT WORK EVALUATION AND VIVA-VOCE						Nil	100	4

22CA3T1: DATA SCIENCE

Course Name	Data Science		L	T	P	C	CIA	SEE	TM
Course Code	22CA3T1		4	0	0	4	30	70	100
Year of Introduction: 2021	**Year of Offering:** 2022	**Year of Revision**: 2022			**Percentage of Revision:** NIL				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose: The course is intended to cover, Introduction to Tableau, Basic Visualization Design, Connecting to Data, Top 10 Chart Types (Uni-variate/Bi-Variate & Multi-variate Charts), Interacting with the Viewer, Tableau Maps, Creating Dashboards and Stories, Introduction to Power Bi, Power Pivot Model and Power BI Environment.

Course Objective: The course aims to equip participants with comprehensive skills in Tableau and Power BI, covering fundamental concepts, visualization design, data connection, diverse chart types, viewer interaction, mapping, dashboard and story creation, as well as Power Pivot modeling, empowering them to proficiently analyze and visualize data for insightful decision-making.

Course Objectives:

- To understand *Basics of Tableau, Visual Design and Connecting various Data Sources*.
- To know *Uni-variate Charts***,** *Bi-variate Charts***,** *Multi-variate Charts, Interacting with the Viewer.*
- To create *Tableau Maps* and *Creating Dashboards and Stories*.
- To implement *Data Operations* of *Power BI.*
- To implement *Power Pivot Model* and *Power BI Environment.*

Specific Objectives include:

CO1: Upon completing this Tableau course, participants will master the fundamentals of Tableau, including workbook management, basic visualization design, and advanced data connection techniques, enabling them to create visually compelling and interactive data visualizations, analyze complex datasets, and make data-driven decisions effectively.

CO2: Upon completing this course, participants will gain expertise in a wide range of chart types for univariate, bivariate, and multivariate data analysis, enabling them to effectively visualize and interpret complex datasets; additionally, they will acquire advanced skills in viewer interaction through various filtering techniques and actions, empowering them to create dynamic and insightful Tableau visualizations.

CO3: Upon completing this course, participants will master Tableau's mapping capabilities, including geocoding, custom geocoding, and advanced mapping techniques, allowing them to create visually appealing and insightful maps; furthermore, they will gain proficiency in crafting interactive and visually cohesive dashboards and stories, integrating various elements and actions for effective data communication and analysis.

CO4: Upon completion of this Power BI course, participants will acquire comprehensive knowledge and practical skills in utilizing Power BI, including data acquisition from diverse sources, implementing natural language queries, advanced data manipulation using functions, merging and transforming queries effectively, enabling them to create insightful data visualizations and analytics for informed decision-making and enhanced business intelligence.

CO5: Upon completing this course, participants will master Power Pivot and Power BI, enabling them to create robust data models, establish relationships, implement advanced querying and merging techniques, design compelling visualizations, and effectively utilize calculations and measures, empowering them to analyze complex data sets, create interactive dashboards, and perform in-depth data modeling for diverse applications, including detailed analysis of Corona Cases.

UNIT-I (12 Hours)

Introduction to Tableau: What is Tableau? - Opening Existing Workbooks - Creating New Workbooks.
Basic Visualization Design: Using Show Me - Choosing Mark Types - Color - Size - Shape and Label Options- Choosing Color Options - Setting Mark Size - Choosing Shapes - Text Tables and Mark Labels - Formatting Options - Evaluating Multiple Measures - Shared Axis Charts - Measure Names and Measure Values - Dual Axis Charts.
Connecting to Data: Connecting to Various Data Sources - The Data Source Page - Customizing Your View of the Data: Changing Data Type - Modifying Dimension / Measure Assignment - Hiding -Renaming and Combining Fields - Splitting Fields - Changing the Default Field Appearance - Organizing Dimensions in Hierarchies Using Table or Folder View - Saving and Sharing Metadata Extracting Data -Data Blending - Moving from Test to Production Database.

UNIT-II (12 Hours)

Top 10 Chart Types (Uni-variate/Bi-Variate & Multi-variate Charts): Bar Chart - Line/Area Chart - Pie Chart - Text Table / Crosstab - Scatter Plot - Bubble Chart - Bullet Graph - Box Plot - Tree Map - Word Cloud.
Interacting with the Viewer: Filtering Data - Include or Exclude from the Worksheet - Basic Filtering -Quick Filters - Parameters - Creating a Parameter - Displaying a Parameter - Using a Parameter in a Worksheet - Worksheet Actions - Filter Actions - Highlight Actions - URL Actions.

UNIT-III (12 Hours)

Tableau Maps: Geocoded Fields - Geographic Hierarchies and Ambiguity - Custom Geocoding - Background Maps and Layers - Navigating Maps and Selecting Marks - Map Options - Web Map Services - Mapping and Mark Types - Custom Background Images - Generating Your Own Coordinate System - Adding a Custom Background Image.
Creating Dashboards and Stories: Creating a Simple Dashboard - Setting Dashboard - Size - Adding Sheets - Associated Worksheet Elements - Supplementary Dashboard Features - Layout Container - Blank Text - Image - Webpage - Setting Dashboard and Element - Sizes - Dashboard Actions - Highlight Action - Filter Action - URL Action.

UNIT-IV (12 Hours)

Power Bi: Get Knowing Power Bi - Getting Data from Existing Systems - Data Sources of Power Bi - Natural Language Queries - Getting data from web - Importing Data from Northwind ODATA feed T3_IMF - Functions & list Dates in Power Bi - Group By and unpivot in Power Bi - Merging Queries in Power Bi - IPL Statistics in Power Bi

UNIT-V (12 Hours)

Power Pivot Model: Creating Data Model - Explain what a Data Model is, Create Relationships between Tables in the Model, Create and use a Star Schema - Merging Queries in Power Bi - Data Compute in Power Bi - Append Query in Power Bi - Charts in Power Bi - Data Modeling in Power Bi - Charts in Power Bi - Data Modeling in Power Bi.
Power BI:
Power BI Environment: Adding Calculations and Measures - Importing Graphs - User Graphs, Dash boards - Dashboard for Corona Cases analysis.

Prescribed Text Books			
	Author	Title	Publisher
1	George Peck	Tableau 9 - The Official Guide	McGraw Hill, 2016
2	Dan Clark	Beginning Power BI: A Practical Guide to Self Service Data Analytics with Excel 2016 and Power BI Desktop	O'Reilley, Second Edition

Reference Text Books			
	Author	Title	Publisher
1	Ashutosh Nandeshwar	Tableau Data Visualization Cookbook	Packt Publishing Ltd, 2013
2	Rob Collie & Avi Singh	Power Pivot and Power BI : The Excel User's Guide to DAX Power Query, Power BI & Power Pivot in Excel 2010-2016	Holy Macro! Books, 2016
3	Daniel G. Murray	Tableau Your Data! Fast and Easy Visual Analysis with Tableau Software Second Edition	John Wiley & Sons

(An Autonomous College in the Jurisdiction of Krishna University, A.P., India.)

M.C.A DEGREE EXAMINATIONS

THIRD SEMESTER

DATA SCIENCE

SYLLABUS W.E.F 2022-2023

Time 3 Hours **Max.Marks: 70**

SECTION-A

Answer ALL questions **(5×4 = 20 Marks)**

1. (a) What is *Tableau*? Explain its role in Industry (CO1,L1)
   (or)
   (b) How do you change *Data Type* in Tableau. (CO1,L1)

2. (a) What is *Tree Map*? (CO2,L1)
   (or)
   (b) What is *Quick Filter*? (CO2,L1)

3. (a) Name any two *Web Map Services*. (CO3,L1)
   (or)
   (b) Name any two features of *Supplementary Dashboard*. (CO3,L1)

4. (a) Explain Natural Language Processing. (CO4,L2)
   (or)
   (b) Explain Functions used in Power Bi. (CO4,L2)

5. (a) What is *Star Schema*? Explain (CO5,L1)
   (or)
   (b) What are the advantages of *Dashboard*? (CO5,L1)

Answer Five Questions Choosing One Question from Each Unit.
All Questions Carry Equal Marks. **(5×10 = 50 Marks)**

6. (a) Explain *Shape and Label Options* and *Formatting Options* in *Tableau*. (CO1,L2)
   (or)
   (b) Illustrate how data sources connected to *Tableau*. (CO1,L2)

7. (a) Build Uni-variate Charts. (CO2,L3)
   (or)
   (b) Experiment with *Basic Filters* and *Quick Filters*. (CO2,L3)

8. (a) Compare any two types of *Tableau Maps*. (CO3,L4)
   (or)
   (b) Examine the procedure to create Simple Dashboard. (CO3,L4)

9. (a) Explain how import data from various existing data sources. (CO4,L5)
   (or)
   (b) Explain how to merge queries and operations on IPL dataset. (CO4,L5)

10. (a) Create Relationships between Tables in the Model (CO5,L6)
    (or)
    (b) Discuss how to import Graphs in Power BI. (CO5,L6)
    (c) Discuss creating Measures in Power BI. (CO5,L6)

22CA3E1: DESIGN & ANALYSIS OF ALGORITHMS

Course Name	Design & Analysis of Algorithms		L	T	P	C	CIA	SEE	TM
Course Code	20CA3E1		4	0	0	4	30	70	100
Year of Introduction: 2005	Year of Offering: 2022	Year of Revision: 2022			Percentage of Revision: NIL				
L-Lecture, T-Tutorial, P-Practical, C-Credits, CIA-Internal Marks, SEE-External Marks, TM-Total Marks									

Course Description and Purpose: The course is intended to develop proficiency in *Problem Solving and Programming*, perform *Analysis of various Algorithms in regard to Time and Space Complexity*, gain of *good understanding of Applications of Data Structures*, develop base for *Advanced Study* in *Computer Science*, apply *Design Techniques* to solve different types of problems as per their *Complexity* and develop *ability to segregate NP-Hard and NP-Complete problems.*

Course Objective: This course will help the students t o understand and learn basic ideas about *Analysis of Algorithms, Divide-and-Conquer* and *Greedy Method, Dynamic Programing* & *Basic Traversal and Search Techniques, Backtracking* and *Branch and Bound* Techniques and *NP-Hard* and *NP-Complete* Problems.

Specific Objectives include:

- To understand Basic Ideas about *Analysis of Algorithms* and the *Concept of Data Structures*.
- To know *Divide and Conquer, Greedy Methods* and *Solving Various Problems* by applying them.
- To apply *Dynamic Programming Method* and *Basic Traversal* and *Search Techniques* to solve various Problems.
- To understand *Backtracking and Branch and Bound* Techniques to Design Algorithms.
- To categorize *NP-Har*d and *NP-Complete* Problems.

Course Leaning Outcomes: On successful completion of this course

CO1: The course imparts a foundational understanding of algorithms, data structures, performance analysis, randomized algorithms, and graph theory, enabling students to analyze, design, and implement efficient solutions to a wide array of computational problems.

CO2: Students will have a comprehensive understanding of advanced algorithmic paradigms, including Divide-and-Conquer and Greedy methods, enabling them to apply these techniques to solve a wide range of computational problems efficiently and effectively.

CO3: The course empowers students with a comprehensive understanding of dynamic programming techniques, traversal and search algorithms for binary trees and graphs, equipping them with the skills to solve complex optimization problems efficiently and effectively in diverse domains.

CO4: The course provides students with a comprehensive understanding of backtracking and branch-and-bound algorithms, enabling them to efficiently solve complex combinatorial and optimization problems, such as the 8-Queens problem, graph coloring, and the traveling salesman problem, across various application domains.

CO5: The course equips students with a profound understanding of NP-Hard and NP-Complete problems, enabling them to recognize, analyze, and address computationally challenging problems across various domains, including graph theory, scheduling, code generation, and decision problem solving, while comprehending the theoretical underpinnings and implications of these complexities.

UNIT-I (12 Hours)

Introduction: What is Algorithm, Algorithm Specification Pseudo code Conventions, Recursive Algorithms, Performance Analysis: Space Complexity Time Complexity, Asymptotic Notation, Performance Measurement, Randomized Algorithms: Basics of Probability Theory, Randomized Algorithms Identifying the Repeated Element, Primality Testing: Advantages and Disadvantages.

Elementary Data Structures: Stacks and Queues, Trees: Terminology, Binary Trees, Dictionaries: Binary Search Trees, Priority Queues, Heaps , Heapsort , Sets and Disjoint Set Union: Introduction-Union and Find Operations, Graphs: Introduction, Definitions, Graph Representations.

UNIT-II (12 Hours)

Divide-and-Conquer: General Method, Defective Chess Board, Binary Search, Finding Maximum and Minimum, Merge Sort, Quick Sort, Selection Problem, Strassen's Matrix Multiplication, Convex Hull: Some Geometric Primitives, The Quick Hull Algorithm, Graham's Scan, An O(nlogn) Divide and Conquer Algorithm.
The Greedy Method: The General Method, Container Loading, Knapsack Problem, Tree Vertex Splitting, Job Sequencing with Deadlines, Minimum Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm, Optimal Storage on Tapes, Optimal Merge Patterns, Single Source Shortest Paths.

UNIT-III (12 Hours)

Dynamic Programming: The General Method, Multi Stage Graphs, All Pairs Shortest Paths, Single Source Shortest Paths, Optimal Binary Search Trees, String Editing -0/1 Knapsack, Reliability Design, The Traveling Sales Person Problem, Flow Shop Scheduling.
Basic Traversal and Search Techniques: Techniques for Binary Trees, Techniques for Graphs: Breadth First Search and Traversal-Depth First Search, Connected Components and Spanning Trees, Bi-Connected Components and DFS.

UNIT-IV (12 Hours)

Backtracking: The General Method, The 8-Queens Problem, Sum of Subsets, Graph Coloring, Hamiltonian Cycles, Knapsack Problem.
Branch and Bound: The Method: Least Cost Search, The 15 Puzzle Control Abstractions for LC Search, Bounding, FIFO Branch and Bound , LC Branch and Bound, 0/1 Knapsack Problem, LC Branch and Bound Solution, FIFO Branch and Bound Solution, Traveling Sales person.

UNIT-V (12 Hours)

NP-Hard and NP-Complete Problems: Basic Concepts: Non Deterministic Algorithms, The Classes NP Hard and NP Complex, Cook's Theorem, NP Hard Graph Problems, Clique Decision Problem, Node Cover Decision Problem Chromatic Number Decision Problem, Directed Hamiltonian Cycle, Traveling Sales Person Decision Problem, AND/OR Graph Decision Problem, NP-Hard Scheduling Problems, Scheduling Identical Processors, Flow Shop Scheduling, Job Scheduling, NP-Hard Code Generation Problems, Code Generation With Common Sub Expressions, Implementing Parallel Assignment Instructions, Some Simplified NP-Hard Problems.

Prescribed Text Book:

1.Sartaj Sahni, Fundamentals of Computer Algorithms, Second Edition, Universities Press, 2nd Edition, 2008.

Reference Text Books:

1. Anany Levitin, Introduction to the Design & Analysis of Algorithms, 2nd Edition, Pearson Education, 2007.
2. I.Chandra Mohan, Design and Analysis of Algorithms, PHI, 2nd Edition, 2012.
3. Prabhakar Gupta, Vineet Agrawal, Design and Analysis of Algorithms, PHI, 2nd Edition 2012.
4. Parag Himanshu, Dave, Design and Analysis of Algorithms, Pearson Education, 1st Edition 2008.

Course Focus: Foundation / Skill Development.

Reference Websites:

- https://epgp.inflibnet.ac.in/Home
- https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/lecture-notes/
- https://www.cukashmir.ac.in/cukashmir/User_Files/imagefile/DIT/StudyMaterial/DAA/DAA_UNIT I_6th-Sem_StudyMaterial.pdf

P.B.SIDDHARTHA COLLEGE OF ARTS & SCIENCE (AUTONOMOUS), VIJAYAWADA-520010

(An Autonomous College in the Jurisdiction of Krishna University, A.P., India.)

M.C.A DEGREE EXAMINATIONS

THIRD SEMESTER

DESIGN & ANALYSIS OF ALGORITHMS

SYLLABUS W.E.F 2022-2023

Time 3 Hours **Max.Marks: 70**

SECTION-A

Answer ALL questions **(5×4 = 20 Marks)**

1. (a) Define *Algorithm*. Explain the algorithm specification briefly.(CO1,L1)

(or)

(b) What are the operations in a *Priority Queue*? (CO1, L1)

2. (a) Explain the Divide and Conquer Algorithms to solve *Convex Hull Problem.* (CO2,L1)

(or)

(b) What is *Tree Vertex Splitting?* (CO2,L1)

3. (a) What is *String Editing?* (CO3,L1)

(or)

(b) Differentiate *DFS and BFS*. (CO3,L1)

4. (a) What is *Graph Colouring?* (CO4,L1)

(or)

(b) What is *Branch and Bound* technique*?*(CO4,L1)

5. (a) Compare *NP hard and NP Complete Classes.* (CO5,L1)

(or)

(b) Explain *flow shop scheduling* in *NP Hard Scheduling Problems.* (CO5,L1)

SECTION - B

Answer all questions. All question carry equal marks. **5 × 10 = 50 Marks**

6. (a) Define Algorithm. Discuss *Performance Analysis of Algorithms* briefly. (CO1,L2)

(or)

(b) Explain *Disjoint Sets, Disjoint Set Union* & *Find Operations* with Algorithms. (CO1,L2)

7. (a) Discuss the method for *Divide and Conquer* approach and write algorithm for Quick Sort with an example. (CO2,L6)

(or)

(b) Discuss the general method for *Greedy Method.* Apply it on *Single Source Shortest Path* by writing an algorithm with suitable example. (CO2,L6)

8. (a) Examine algorithm and procedure of finding *Optimal Binary Search Tree* using Dynamic Programming with example. (CO3,L4)

(or)

(b) Examine *Traversal Techniques for Graphs* with an example. (CO3,L4)

9. (a) Explain *Control Abstraction for LC Search*. Solve *0/1-Knapsack Problem* using *Branch and Bound Technique*. (CO4,L5)

(or)

(b) Explain the *Sum of Subsets Problem* using *Back Tracking Technique.* (CO4,L5)

10. (a) Make use of different formulae prove *COOKs Theorem.*. (CO5,L3)

(or)

(b) Choose *NP-Hard Graph Problems* and explain. (CO5,L3)

20CA3E2: CRYPTOGRAPHY & NETWORK SECURITY

Course Name	Cryptography & Network Security		L	T	P	C	CIA	SEE	TM
Course Code	20CA3E2		4	0	0	4	30	70	100
Year of Introduction: 2005	Year of Offering: 2021	Year of Revision: 2022			Percentage of Revision: 30%				
L-Lecture, T-Tutorial, P-Practical, C-Credits, CIA-Internal Marks, SEE-External Marks, TM-Total Marks									

Course Description and Purpose: The course is intended to understand and gain knowledge on Computer & Network Security, Number Theory, Classical Encryption Techniques, Advanced Encryption Standard and Random Bit Generation and Stream Ciphers, Number Theory, Public Key Cryptography and RSA, Other Public-Key Crypto Systems and Message Authentication Codes, Digital Signatures, Key Management and Distribution and User Authentication, Transport Level Security, Electronic Mail Security and IP Security and Intruders and Firewalls.

Course Objective: The course aims to provide a comprehensive understanding of computer and network security, covering topics such as number theory, classical and advanced encryption techniques, public-key cryptography, digital signatures, key management, user authentication, transport level security, email and IP security, and intrusion detection, enabling students to secure digital communication and defend against cyber threats.

Specific Objectives include:

- To understand Basic Ideas about *Analysis of Algorithms* and the *Concept of Data Structures*.
- To know *Divide and Conquer*, *Greedy Methods* and *Solving Various Problems* by applying them.
- To apply *Dynamic Programming Method* and *Basic Traversal* and *Search Techniques* to solve various Problems.
- To understand *Backtracking and Branch and Bound* Techniques to Design Algorithms.
- To categorize *NP-Har*d and *NP-Complete* Problems.

Course Outcomes:

CO1: Upon completion of this course, students will master fundamental computer and network security concepts, classical encryption techniques (symmetric ciphers, substitutions, transpositions), Advanced Encryption Standard (AES) implementation, and random bit generation principles, equipping them with essential skills for securing digital systems and data against various threats.

CO2: Upon completion of this course, students will have a comprehensive understanding of fundamental number theory concepts, public key cryptography principles (including RSA, Diffie-Hellman, and elliptic curve cryptography), message authentication codes, and security protocols, enabling them to apply advanced cryptographic techniques in secure communication and data protection.

CO3: Upon completion of this course, students will possess in-depth knowledge of digital signatures, key management, and user authentication techniques, including the NIST Digital Signature Algorithm, symmetric key distribution using asymmetric encryption, distribution of public keys, Kerberos, and remote user authentication using asymmetric encryption, empowering them to design and implement robust security protocols for digital communication systems.

CO4: Upon completion of this course, students will be proficient in implementing Transport Layer Security, securing electronic mail using techniques like S/MIME and Pretty Good Privacy, and ensuring IP Security through comprehensive understanding of IP Security policy, Encapsulating Security Payload, and Combining Security Associations, enabling them to safeguard digital communication at the transport and network levels effectively.

CO5: Upon completion of this course, students will possess expertise in identifying and defending against intruders through intrusion detection techniques, implementing robust password management strategies, understanding the necessity of firewalls, grasping firewall characteristics and access policies, and recognizing different types of firewalls, enabling them to design and deploy effective security measures against unauthorized access and cyber threats.

Syllabus

UNIT-I (12 Hours)

Computer & Network Security Concepts: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security.
Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques
Advanced Encryption Standard: AES Structure, An AES Example, AES Implementation.
Random Bit Generation and Stream Ciphers: Principles of Pseudo Random Number Generation, Pseudo Random Number Generators.

UNIT-II (12 Hours)

Introduction to Number Theory: Divisibility and the Division Algorithm, The Euclidean Algorithm, Modular Arithmetic, Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms.
Public Key Cryptography and RSA: Principles of Public Key Crypto Systems, The RSA Algorithm.
Other Public-Key Crypto Systems: Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.
Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs, MACs Based on Hash Functions: HMAC.

UNIT-III (12 Hours)

Digital Signatures: Digital Signatures, NIST Digital Signature Algorithm.
Key Management and Distribution: Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys.
User Authentication: Kerberos, Remote User-Authentication Using Asymmetric Encryption.

UNIT-IV (12 Hours)

Transport Level Security: Transport Layer Security.
Electronic Mail Security: S/MIME, Pretty Good Privacy.
IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations.

UNIT-V (12 Hours)

Intruders: Intruders, Intrusion Detection, Password Management.
Firewalls: The Need for Firewalls, Firewall Characteristics and Access Policy, Types of Firewalls.

Prescribed Text Book

	Author	Title	Publisher
1	William Stallings	Cryptography and Network Security	Pearson, Seventh Edition, 2017

Reference Text Book			
	Author	Title	Publisher
1	William Stallings	Cryptography and Network Security	Pearson, Sixth Edition, 2014
2	William Stallings	Network Essentials - Security Applications and Standards	Pearson Education (2007), Third Edition.
3	Chris McNab	Network Security Assessment	OReilly (2007), 2nd Edition
4	Jon Erickson	Hacking-The Art of Exploitation	Press (2006),SPD
5	Neal Krawety	Introduction to Network Security	Thomson (2007).
6	Ankit Fadia	Network Security-A Hackers Perspective	Macmillan (2008)
7	Behrouz A Forouzan, Debdeep Mukhopadhyay	Cryptography and Network Security	MCGraw-Hill, Indian Special Edition, Third Edition, 2015

Course has focus on : Employability

Websites of Interest :

2. https://www.pearsonhighered.com/assets/hip/us/hip_us_pearsonhighere d/preface/0132775069.pdf
3. http://faculty.mu.edu.sa/public/uploads/1360993259.0858Cryptography%20and%20Network%20Security%20Principles%20and%20Practice,%205th %20Edition.pd

Co-curricular Activities: Programming Contests, Hackathons & Quiz.

(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70**

SECTION-A

AnswerALLquestions **(5×4=20Marks)**

1. (a) Explain Caesar Cipher.(CO1,L2)

(or)

(b) Explain TRNGs, PRNGs. (CO1,L2)

2. (a) What is Modular Arithmetic? Explain. (CO2,L1)

(or)

(b) Explain RSA Algorithm. (CO2,L1)

3. (a) What is Digital Signatures? (CO3,L1)

(or)

(b) List the Distribution of Public Keys. (CO3,L1)

4. (a) Explain Handshake Protocol in TLS. (CO4,L2)

(or)

(b) Explain Pretty Good Privacy. (CO4,L2)

5. (a) Explain Password Management Briefly. (CO5,L2)

(or)

(b) Explain Firewall Characteristics? (CO5,L2)

SECTION-B

Answer Five Questions Choosing One Question from each unit.

All Questions Carry Equal Marks. **(5×10=50Marks)**

6. (a) Explain various Security Attacks and Security Services. (CO1,L2)

(or)

(b) Explain AES Encryption and Decryption Process. (CO1,L2)

7. (a) Illustrate Diffie-Hellman Key Exchange. (CO2,L2)

(or)

(b) Explain Internal and External Error Control in Message Authentication Functions. (CO2,L2)

8. (a) Explain NIST Digital Signature Algorithm with diagram. (CO3,L5)

(or)

(b) Explain Kerberos in detail. (CO3,L5)

9. (a) Explain Confidentiality and Authentication in S/MIME (CO5,L5)

(or)

(b) Illustrate Overview of IP Security. (CO4,L5)

10. (a) Discuss what are the problems that may intruder create and explain how to overcome those problem? (CO5,L6)

(or)

(b) Discuss Various Types of Firewalls. (CO5,L6)

22CA3E3: MACHINE LEARNING

Course Name	Machine Learning		L	T	P	C	CIA	SEE	TM
Course Code	22CA3E3		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2021	Year of Revision: 2022			Percentage of Revision: NIL				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose: Machine Learning is a course that illustrates *concepts* of *Machine Learning, Basics* of *Data Preprocessing* and *Feature Engineering, Supervised Learning Algorithms, Regression Algorithms, Unsupervised Learning Algorithms, concepts* of *Neural Networks*.

Course Objectives: This course will help enable the students t o understand and learn various *Concepts* of *Machine Learning, Basics* of *Data Preprocessing* and *Feature Engineering, Supervised Learning Algorithms, Regression Algorithms, Unsupervised Learning Algorithms, Concepts* of *Neural Networks.*

Specific Objectives include:
- To know the concepts of *Machine Leaning*.
- To understand basics of *Data Pre-processing* and *Feature Selection.*
- To learn *Supervised Learning* and *Regression Algorithms*.
- To learn the concepts of *Unsupervised Learning.*
- To understand the concepts of *Neural Networks.*

Course Outcomes:
CO1: In this course, students will explore the foundations of machine learning, including human learning principles, various types of machine learning, programming languages and tools, and a comprehensive framework for developing and evaluating machine learning models, equipping them with the skills to build and assess sophisticated machine learning applications.
CO2: In this course, students will master the fundamentals of data pre-processing and feature engineering, encompassing techniques such as feature transformation, scaling, construction, subset selection, dimensionality reduction, explorative data analysis, and hyper parameter tuning, with a comprehensive introduction to the SK Learn package, empowering them to proficiently manipulate data and optimize machine learning models.
CO3: In this course, students will gain a deep understanding of supervised learning, covering a range of classification algorithms including Naïve Bayes, KNN, Decision Trees, Random Forest, Support Vector Machines, and XG Boost, as well as regression techniques like Simple Linear Regression, Multiple Linear Regression, Polynomial Regression, and Logistic Regression with Regularization (Lasso and Ridge), enabling them to build accurate predictive models for diverse real-world applications.
CO4: In this course, students will explore the principles of unsupervised learning, differentiating it from supervised learning, and delve into unsupervised learning models, dimensionality reduction techniques, clustering methods, association rule mining, and practical applications, enabling them to analyse complex, unstructured data and derive valuable insights for various domains.
CO5: In this course, students will master the fundamentals of neural networks, covering artificial neural networks, convolutional neural networks for tasks like hand digit and image classification, hyper parameter tuning techniques, and advanced topics including recurrent neural networks and Long Short-Term Memory networks, empowering them to design and optimize sophisticated deep learning models for diverse applications in computer vision and sequential data analysis.

UNIT-I (12 Hours)

Introduction to Machine Learning: Human Learning and Machine Learning - Types of Machine Learning - Languages and Tools in Machine Learning - Framework for Developing Machine Learning Models - Preparing to Model - Modeling and Evaluation Metrics.

UNIT-II (12 Hours)

Basics of Data Preprocessing and Feature Engineering: Feature Transformation - Feature Scaling- Feature Construction and Feature Subset Selection - Dimensionality Reduction - Explorative Data Analysis - Hyper Parameter Tuning - Introduction to SK Learn Package.

UNIT-III (12 Hours)

Supervised Learning: Introduction - Classification (Common Cassification Algorithms):Naïve Bayes,KNN, Decision Trees, Random Forest, Support Vector Machines, XGBoost.
Regression(Common Regression Algorithms): Simple Linear Regression and Multiple Linear Regression - Polynomial Regression - Logistic Regression-Regularisation:Lasso and Ridge.

UNIT-IV (12 Hours)

Unsupervised Learning: Introduction - Unsupervised Vs Supervised Learning - Unsupervised Learning Models - Dimensionality Reduction - Clustering : Association Rule Mining - Applications of Unsupervised Learning.

UNIT-V (12 Hours)

Introduction to Neural Networks: Artificial Neural Networks - Hand Digit Classification - Convolution Neural Networks - Image Classification - Hyper Parameter Tuning - Recurrent Neural Networks - Building Recurrent NN - Long Short Term Memory.

Reference Text Books:

1. Hastie, T., R. Tibshirani, and J. H. Friedman. , The Elements of Statistical Learning: Data Mining, Inference and Prediction, New York, NY: Springer, 2011, ISBN: 97803879
2. EthemAlphaydin, An introduction to Machine Learning, PHI Learning Private Limited, 2020
3. AurelienGeron, Hands-On Machine Learning with Scikit Learn, Keras and Tensor Flow, O'REILY - 2019
4. Tom Mitchell, Machine Learning, Tata McGraw Hill, 2013
5. Francois Chollet, Deep Learning with Python, Manning , 2019

PARVATHANENI BRAHMAYYA SIDDHARTHA COLLEGE OF ARTS & SCIENCE

(An Autonomous College in the jurisdiction of Krishna University)

M.C.A, Third Semester

Course Name: Machine Learning

Course Code: 22CA3E3

(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70 Marks**

SECTION-A

Answer ALL questions. All Questions Carry Equal Marks. (5×4 = 20 Marks)

1. (a) Define *Machine Learning* and list different *Machine Learning Techniques*. (CO1,L1)

(or)

(b) What are the *different tools* used in Machine Learning? (CO1,L1)

2. (a) What are the techniques of *Feature Scaling*? (CO2,L1)

(or)

(b) Define *Dimensionality Reduction* and explain its Techniques. (CO2,L1)

3. (a) What are the various algorithms used for *Classification*? (CO3,L1)

(or)

(b) Define *Logistic Regression*. (CO3,L1)

4. (a) Explain *Clustering* and list out different *Clustering Algorithms*? (CO4, L2)

(or)

(b) Explain the Applications of *Unsupervised Learning*? (CO4,L2)

5. (a) List some commercial practical applications of *Artificial Neural Networks*.(CO5,L1)

(or)

(b) Define *Hyper Parameter Tuning* with example. (CO5,L1)

SECTION-B

Answer ALL questions. All Questions Carry Equal Marks. (5×10 = 50 Marks)

6. (a) Explain the *work flow* in Machine Leaning Problem Solving. (CO1,L2)

(or)

(b) Explain *Supervised* and *Unsupervised Learning* with Examples. (CO1,L2)

7. (a) Discuss *Feature Transmission* in detail. (CO2, L6)

(or)

(b) Discuss *Feature Subset Selection* and its Application. (CO2,L6)

8. (a) Explain *Classification Problem* in Supervised Learning and Explain *Decision Tree Algorithm* for Classification. (CO3,L5)

(or)

(b) Explain *Linear and Multiple Linear Regression* in Python Library Stats Models. (CO3,L5)

9. (a) Apply *K-Means Clustering Algorithm* on following X and Y values (10,34), (45,55), (23,55), (14,66), (56,25),(12,16),(14,25). (CO4,L3)

(or)

(b) Choose suitable Algorithm in SK-Learn Package to perform *Hierarchical Clustering*. (CO4, L3)

10. (a) List basic features in Neuron and different types of *Activation Functions*. (CO5,L4)

(or)

(b) List various parameters of *Convolution Neural Networks*. (CO5,L4)

22CA3E4: APPLIED DATA ANALYTICS

Course Name	Applied Data Analytics		L	T	P	C	CIA	SEE	TM
Course Code	22CA3E4		4	0	0	4	30	70	100
Year of Introduction: 2022	**Year of Offering:** 2022	**Year of Revision**: 2022			**Percentage of Revision:** NIL				
L-Lecture, **T**-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose: Applied Data Analytics is a course that illustrates concepts of R-Programming, Data Structures, Descriptive Statistical Analysis, Basic Graphs, Analysis of ANOVA, Multivariate Analysis, Files & Databases.

Course Objective: The Applied Data Analytics course aims to equip students with a comprehensive understanding of R-Programming, Data Structures, Descriptive Statistical Analysis, Basic Graphs, Analysis of ANOVA, Multivariate Analysis, and Files & Databases, fostering proficiency in applying these concepts to solve real-world problems through machine learning algorithms and techniques.

Specific Objectives include:

- To *install, code* and *use* R Programming Language in R Studio IDE to perform basic tasks on Control Flow Statements, Data Structures and can invoke Operations on Data Structures.
- To understand the *Basic Terminologies, Concepts and Techniques* employed in Descriptive Statistical Analysis.
- To familiar with *Basic Graphics* and *Analysis of* ANOVA.
- To gain knowledge on *Basic Multivariate Analysis*.
- To apply how to import *Different Files* and *Connecting Databases to R*.

Course Outcomes:

CO1: Upon completing the course students will gain a comprehensive proficiency in utilizing R for data analysis, mastering R environment, working with packages, understanding, manipulating, and cleaning diverse datasets, employing various data types and structures, handling missing values, sorting and merging data, subsetting datasets, implementing control flow statements, and performing aggregation and restructuring operations, empowering them to apply advanced data analysis techniques for solving complex real-world problems.

CO2: Upon completion of the course, students will acquire a comprehensive understanding of measures of central tendency, dispersion, and shapes, various sampling techniques, hypothesis testing methods including parametric and non-parametric tests, enabling them to effectively analyse and interpret data, make informed decisions, and contribute meaningfully to statistical research and applications.

CO3: Upon completion of the course on "Basic and Advanced Data Visualization, and Analysis of Variance," students will proficiently create a wide array of graphical representations using bar plots, pie charts, histograms, line plots, dot plots, kernel density plots, and utilize advanced visualization techniques with the ggplot2 package, while also mastering the application of various ANOVA models, including one-way ANOVA, one-way ANCOVA, two-way factorial ANOVA, repeated measures ANOVA, and multivariate analysis of variance (MANOVA), enabling them to visually and statistically analyze complex datasets and draw meaningful insights for research and decision-making purposes.

CO4: Upon completion of the course on "Basic Multivariate Analysis, Time Series Analysis, and Forecasting," students will gain a comprehensive understanding of regression techniques including simple linear regression, multiple linear regression, and logistic regression, along with proficiency in time series analysis encompassing the creation and decomposition of time series, exponential models, and forecasting methods such as simple moving averages, weighted moving averages, and single

exponential smoothing, empowering them to analyze multivariate data, model time-dependent patterns, and make accurate predictions for diverse real-world applications.
CO5: Upon completion of the course on "Connecting R to External Interfaces," students will proficiently import and export data between R and various external sources including CSV files, Microsoft Excel spread sheets, databases (MySQL) for creating, querying, and managing tables, XML and JSON files for structured data exchange, as well as binary files, enabling them to seamlessly interface R with diverse data formats and sources for effective analysis and manipulation.

UNIT-I (12 Hours)

Introduction to R: Why use R?, R Environment, Working with R Packages, Understanding Datasets, Data Types, Data Structures (Operations on Data Structures), Missing Values, Sorting Data, Merging Datasets, Subsetting Datasets, Control Flow Statements, Aggregation and Restructurings.

UNIT-II (12 Hours)

Descriptive Statistics: Introduction to Descriptive Statistics (Measures of Central Tendency, Measures of Dispersion of Variability, Measures of Shapes (Skewness and Kurtosis)), Introduction to Sampling(Sampling Types), Hypothesis Testing with R(One Sample Test, One Sample Sign Test, Two Samples Test), Parametric Test(Correlations, Z-Test, T-Test), Non Parametric Tests (Wilcoxon Signed- Rank Test, Chi Square Test).

UNIT-III (12 Hours)

Basic Graphs: Bar Plots, Pie Charts, Histograms, Line, Dot Plots, Kernel Density Plots and Dot Plots.
The Advanced Graphics: The ggplot2 Package.
Analysis of Variance: Fitting ANOVA Models, One-way ANOVA, One-way ANCOVA, Two-way factorial ANOVA, Repeated Measures ANOVA, Multivariate Analysis of Variance (MANOVA)

UNIT-IV (12 Hours)

Basic Multivariate Analysis: Regression (Simple Linear Regression, Multiple Linear Regression, Logistic Regression), Time Series Analysis (Creating Time Series, Components of Time Series Analysis, Seasonal Decomposition, Exponential Models), Forecasting (Simple Moving Averages, Weighted Moving Averages, Single Exponential Smoothing.)

UNIT-V (12 Hours)

Connecting R to External Interfaces: CSV Files (Reading From a CSV File, Writing to a CSV File), Microsoft Excel (Reading from XLSX File, Writing to XLSX File), Databases (Connecting R to MYSQL ,Creating Tables, Inserting Rows, Updating Rows, Deleting Rows, Querying Rows, Querying Tables, Dropping Tables), XML Files (Reading From XML Files, JSON Files, Reading From JSON Files), Binary Files (Writing to Binary Files, Reading From Binary Files).

Prescribed Text Book			
	Author	Title	Publisher
1	Dr. Rob Kabacoff	R in Action : Data Analysis and Graphics with R. [UNIT-I ,UNIT-II ,UNIT-III]	Manning Publications Co, Edition 2011.
2	Dr.Jeeva Jose	A Beginners Guide For Data Analysis Using R Programming. (UNIT IV and UNIT V) UNI IV: Chapter-11 11.3 [11.3.1 to 11.3.3] 11.5,11.6 [11.6.1 to 11.6.3] UNIT V: Chapter-6 [6.1 to 6.6]	Khanna Book Publishing Co.(P) Ltd, Edition 2019.

Reference Text Books			
	Author	Title	Publisher
1	Dr. Dhaval Maheta	Data Analysis using R	Notion Press, September 2021
2	Michael J.Crawley	The R Book	Wiley, Edition: 2007
3	Ken Black John	Business Statistics for Contemporary Decision Making	John Wiley & Sons, Inc., Edition 2013

(An Autonomous College in the jurisdiction of Krishna University)
M.C.A - III Semester
Title: Applied Data Analytics
Course Code: 22CA3E4
(w.e.f admitted batch 2020-21)

Time: 3 Hours **Max.Marks: 70**

Answer ALL questions **(5×4 = 20 Marks)**

1. (a) What are the different *Data Types* used in R. (CO1,L1)

(or)

(b) Define *Subsetting and merging*. (CO1,L1)

2. (a) Explain *Hypothesis Testing* in R? (CO2,L2)

(or)

(b) Explain Random *Sampling and cluser sampling* ? (CO2,L2)

3. (a) Explain about histograms with example using R (CO3.L5)

(or)

(b) Define ANOVA and uses of ANOVA CO3,L5)

4. (a) Explain about *Logistic Regression using R*. (CO4,L2)

(or)

(b) Explain *Time Series Analysis* and uses of time series analysis?(CO5,L2)

5. (a) What is the syntax used to read *XML Files*. (CO5,L1)

(or)

(b) How we can insert data into R using MYSQL ?(CO5,L1)

Answer Five Questions Choosing One Question from Each Unit.
All Questions Carry Equal Marks. **(5×10 = 50 Marks)**

6. (a) Outline the different *Data Structures* used in R. (CO1,L2)

(or)

(b) Explain *Control Flow Statements* in R. (CO1,L2)

7. (a) Explain the different statistical measures used in *Descriptive Statistics*. (CO2,L5)

(or)

(b) Explain *Non Parametric Test* and *Wilcoxon Signed-Rank Test* in R with example. (CO2,L5)

8. (a) List *Various Types of Charts* in R. (CO3,L4)

(or)

(b) Analyze *One-way ANOVA* and *Two-way factorial ANOVA*. (CO3,L4)

9. (a) Discuss *Simple* and *Multiple Regression* in R with Example. (CO4,L6)

(or)

(b) Elaborate different components used in *Time Series Analysis in R* with example. (CO4, L6)

10. (a) How do you *connect to a database* in R using MYSQL ? Give one example. (CO5,L5)

(or)

(b) How to do you import *csv file* and *binary file* in R with example? (CO5,L5)

22CA3E5: INTERNET OF THINGS (IoT)

Course Name	Internet of Things (IoT)			L	T	P	C	CIA	SEE	TM
Course Code	22CA3E5			4	0	0	4	30	70	100
Year of Introduction: 2021		Year of Offering: 2022	Year of Revision: 2023			Percentage of Revision: 70%				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks										

Course Descriptive and Purpose: This course aims to provide students with a comprehensive understanding and knowledge of various aspects of the Internet of Things (IoT). These areas of focus include an overview of IoT, models and layers in IoT systems, standardization efforts, protocols and design principles applicable to connected devices, principles of internet connectivity within IoT, a deep dive into IoT protocols and application layer protocols, techniques for acquiring IoT data, and an exploration of business models and processes relevant to IoT applications.

Course Objectives: The course help the students to understand and gain knowledge on *Over View* of *Internet of Things*, *Models*, *Layers* & S*tandardization*, *Protocols* & *Design Principles* for Connected Devices, *Internet Connectivity Principles*, *Protocols* & *Application Layer Protocols*, *Data Acquiring*, *Business Models* and *Business Processes*.

Specific objectives include:
- To attain knowledge over view of *Internet of Things*.
- To understand *Models*, *Layers* & *Standardization*.
- To apply *Protocols* & *Design Principles* for Connected Devices.
- To understand *Internet Connectivity Principles*, *Protocols* & Application Layer Protocols.
- To understand *Data Acquiring*, *Business Models* and *Business Processes*.

Course Outcomes: On successful completion

CO1: This course provides a comprehensive understanding of the Internet of Things (IoT), covering its technology, sources, M2M communication, real-world examples, design principles for connected devices, and business models, enabling students to navigate and contribute to the IoT ecosystem effectively.

CO2: This course equips students with a deep understanding of design principles for connected devices in IoT/M2M systems, including OSI stack modifications, ETSI M2M domains, communication technologies, data management, and affordability considerations, enabling them to design and manage efficient and cost-effective IoT solutions.

CO3: This course imparts design principles and knowledge of web connectivity for connected devices, covering web communication protocols, message communication protocols, and practical web connectivity techniques, enabling students to create effective web-connected device solutions.

CO4: This course equips students with the skills to acquire, organize, and analyze data in IoT/M2M contexts, covering data acquisition, storage, business processes, and integration into enterprise systems, facilitating their ability to leverage IoT data for applications, services, and business processes effectively.

CO5: This course empowers students to master data acquisition, organization, and analytics within IoT/M2M, enabling them to drive innovative applications, services, and business processes while efficiently integrating data into enterprise systems.

UNIT-I (12 Hours)

The Internet of Things: An Overview of Internet of Things, Internet of Things Technology, Behind IoT Sources of the IoT, M2M Communication, Examples of IoT, Design Principles for Connected Devices, Business Models for Business Processes in the Internet of Things.

UNIT-II (12 Hours)

Design Principles for Connected Devices: IoT / M2M systems layers and Designs Standardizations, Modified OSI Stack for the IoT / M2M Systems, ETSI M2M Domains and High-level Capabilities ,Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway ease of Designing and Affordability.

UNIT-III (12 Hours)

Design Principles for the Web Connectivity: Design Principles for the Web Connectivity for Connected Devices, Web Communication Protocols for Connected Devices, Message Communication Protocols for Connected Devices, Web Connectivity for Connected Devices.
Internet Connectivity Principles: Introduction, Internet Connectivity, Application Layer Protocols: *HTTP, HTTPS, FTP, Telnet.*

UNIT-IV (12 Hours)

Data Acquiring, Organizing and Analytics in IoT / M2M: Introduction, Applications / Services / Business Processes, IOT / M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

UNIT-V (12 Hours)

Data Acquiring, Organizing and Analytics in IoT / M2M: Introduction, Applications / Services / Business Processes, IOT / M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

Prescribed Text Book			
	Author	Title	Publisher
1	Rajkamal	Internet of Things : Architecture, Design Principles and Applications	McGraw Hill Higher Education

Reference Text Book			
	Author	Title	Publisher
1	Adrian McEwen and Hakim Cassimally	Designing the Internet of Things	Wiley
2	CunoPfister	Getting Started with the Internet of Things.	Oreilly

Course Focus: Employability

Websites of Interest:

1. https://dzone.com/iot-developer-tutorials-tools-news-reviews
2. https://www.ibm.com/blogs/internet-of-things/

(An Autonomous College in the jurisdiction of Krishna University)
M.C.A, Third Semester
Course Name: Internet of Things
Course Code: 22CA3E6
(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70**

SECTION-A

Answer ALL questions **(5×4=20 Marks)**

1.(a) Explain *M2M communication.* (CO1,L2)
(or)
(b) Explain *Internet of Things Technology.* (CO1,L2)

2.(a) What is *Gateway*. (CO2,L1)
(or)
(b) List out *Communication Technologies for IoT*. (CO2,L1)

3.(a) What is *Communication Protocol*? (CO3,L1)
(or)
(b) List out *Application Layer Protocols.* (CO3,L1)

4.(a) Explain *Business Processes for IoT*. (CO4,L2)
(or)
(b) Explain *Organizing Data in IoT*. (CO4,L2)

5.(a) Explain *Transactions for Business Processes.* (CO5,L2)
(or)
(b) Explain *Active* and *Passive Devices*. (CO5,L2)

SECTION-B

Answer Five Questions Choosing One Question from Each Unit.
All Questions Carry Equal Marks. **(5×10=50 Marks)**

6. (a) Explain *overview of Internet of Things.*(CO1,L2)
(or)
(b) Explain *Design Principles for Connected Devices*. (CO1,L2)

7. (a) Apply *IoT / M2M Designs Standardizations* with examples. (CO2,L3)
(or)
(b) Build *Modified OSI Stack for the IoT / M2M Systems*. (CO2,L3)

8. (a) What are *Design Principles for the Web Connectivity*.(CO3,L1)
(or)
(b) What are *Message Communication Protocols for Connected Devices*.(CO3,L1)

9. (a) Explain *IOT / M2M Data Acquiring and Storage*.(CO4,L2)
(or)
(b) Explain *IoT Business Models for Business Processes* with example.(CO4,L2)

10. (a) Explain *Applications and Service Business Processes for IoT*.(CO5,L5)
(or)
(b) Explain *Integration and Enterprise Systems*.(CO5,L5)

22CS3E6: BLOCK CHAIN TECHNOLOGY

Course Name	Block Chain Technology		L	T	P	C	CIA	SEE	TM
Course Code	22CA3E6		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2022	Year of Revision: No Revision			Percentage of Revision: 100				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose: This course provides a comprehensive overview of blockchain technology, covering its necessity, operational processes, limitations, Bitcoin decentralization, Bitcoin and Ethereum storage and usage, smart contracts, real-world blockchain applications, mining consensus mechanisms, and security considerations.

Course Objectives: Block Chain Technology is a course that illustrates Block Chain Need, Working Process of Block Chain, Limitations of Block Chain Technology, Decentralization of Bitcoin, Storage and usage of Bitcoins, Ethereum and Smart Contracts, Block Chain Applications, Mining Consensus and Bitcoin Security.

Specific objectives include:

To understand basic concepts of *Blockchain* & *Limitations*.

1. To learn *How Bitcoin Achieves Decentralization.*
2. To familiar with *How to Store Bitcoins* and *How to Use Bitcoins*.
3. To know *Ethereum and Smart Contracts* and *Blockchain Applications*.
4. To gain knowledge on *Mining Consensus* and *Bitcoin Security.*

Course Outcomes:

Upon successful completion of the course

CO1: Students will have a comprehensive understanding of block chain technology, including its need in addressing core problems, the workings of public and private ledgers, the mechanics of block chain, such as hashing data, user account protection, transaction authorization, and data store security, as well as the limitations of block chain technology and potential avenues for innovation and improvement in the field.

CO2: Students will possess a thorough understanding of how Bitcoin achieves decentralization, including the distinctions between centralized and decentralized systems, the concept of distributed consensus, the mechanics of Bitcoin transactions and scripts, and the role of Bitcoin blocks in maintaining a decentralized ledger, enabling them to grasp the fundamental principles of block chain technology and crypto currency.

CO3: Students will be well-equipped to store and use Bitcoins effectively, understanding various storage methods, including local storage, hot and cold storage, and key management techniques. They will also gain proficiency in using Bitcoins through online wallets, exchanges, payment services, and currency exchange markets, enabling them to navigate the crypto currency ecosystem securely and efficiently.

CO4: Students will have a comprehensive understanding of Ethereum, smart contract programming, and various block chain applications, including Name coin, gas incentives, security considerations, data structures in Ethereum, and applications such as colored coins, Counterparty, payment channels, and state channels, equipping them to design and implement block chain-based solutions for diverse use cases.

CO5: Students will have a deep understanding of mining consensus in block chain networks, including decentralized consensus mechanisms, transaction verification, block mining, and consensus security considerations. Additionally, students will be well-versed in Bitcoin security principles and user best practices for securing crypto currency assets, enabling them to engage with block chain technologies securely and effectively.

UNIT-I (12 Hours)

Why Blockchain is Need: Discovering the Core Problem - Public Ledgers - Block in Blockchain - Public versus Private Blockchain.
How Blockchain Works: Planning the Blockchain - Hashing Data - Identifying & Protecting user Accounts - Authorizing Transactions - Using Data Store - Protecting Data Store - Choosing Transaction History - Paying for Integrity.
Limitations: Seeing the Limitations - Reinventing the Block Chain.

UNIT-II (12 Hours)

How Bitcoin Achieves Decentralization: Centralized versus Decentralization - Distributed Consensus - Bitcoin Transactions - Bitcoin Scripts - Applications of Bitcoin Scripts - Bitcoin Blocks.

UNIT-III (12 Hours)

How to Store Bitcoins: Simple Local Storage - Hot and Cold Storage - Splitting and Sharing Keys.
How to Use Bitcoins: Online Wallets and Exchanges - Payment Services - Transaction Fees - Currency Exchange Markets.

UNIT-IV (12 Hours)

Ethereum and Smart Contracts: Smart Contract Programming Model, Namecoin in Ethereum, Gas Incentives and Security, Data Structures in Ethereum.
Blockchain Applications: Applications from Building Blocks, Colored Coins, Counterparty, Payment Channels and State Channels, Routed Payment Channels.

UNIT-V (12 Hours)

Mining Consensus: Decentralized Consensus - Independent Verification of Transactions - Mining Nodes - Aggregating Transactions into Blocks - Mining the Block - Validating a New Block - Assembling and Selecting Chains of Blocks - Consensus Attacks.
Bitcoin Security: Security Principles - User Security Best Practices.

Prescribed Text Book			
	Author	Title	Publisher
1	Daniel Drescher	Blockchain Basics	A Press, Second Edition, 2017
2	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder	Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction.	Princeton University Press, 2016, Second Edition
3	Andreas M Antonopoulos	Mastering Bitcoin: Unlocking Digital Crypto Currencies	ORELLY,2015

Reference Text Book			
	Author	Title	Publisher
1	Melanie	Blockchain : Blue Print for New Economy	ORELLY,2015

(An Autonomous College in the jurisdiction of Krishna University)
M.Sc.(Computer Science), Third Semester
Course Name: Block Chain Technology
Course Code: 22CA3E6
(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70**

SECTION-A

Answer ALL Questions **(5×4=20Marks)**

1. (a) What is reinventing the Block Chain? (CO1,L1)
(or)
(b) How to use Data Store? (CO1,L1)

2. (a) Explain Block in Block Chain. (CO2,L2)
(or)
(b) Explain Script. (CO2,L2)

3. (a) What is Splitting? (CO3,L1)
(or)
(b) What is Transaction? (CO3,L1)

4. (a) Explain Payment Channel. (CO4,L2)
(or)
(b) Explain Colored Coin. (CO4,L2)

5.(a) What is Mining Node? (CO5,L1)
(or)
(b) What are Security Principles? (CO5,L1)

SECTION-B

Answer Five Questions Choosing One Question from Each Unit.
All Questions Carry Equal Marks. **(5×10=50Marks)**

6. (a) Explain Public Ledger, Public & Private Block Chains. (CO1,L2)
(or)
(b) Explain identifying and protecting User Accounts and Authorize Transactions. (CO1,L2)

7. (a) Apply Centralized & Decentralized in Bitcoin in applications. (CO2,L3)
(or)
(b) Build Bitcoin Scripts and their Applications. (CO2,L3)

8. (a) What are Hot & Cold Storages?. Explain in detail. (CO3,L1)
(or)
(b) How bitcoins are used in online Wallets & Exchanges and payment services? (CO3,L1)

9. (a) Explain Smart Contract Programming Model & Data Structures in Ethereum.(CO4,L2)
(or)
(b) Write about Applications from Building Blocks and Colored Coins.(CO4,L2)

10. (a) Explain Mining, Validating, Assembling and Selecting Chains of blocks. (CO5,L5)
(or)
(b) Explain the Security Principles in Bitcoin Security.(CO5,L5)

22CA3L1: DATA SCIENCE LAB

Course Name	Data Science Lab			L	T	P	C	CIA	SEE	TM
Course Code	22CA3L1			4	0	0	4	30	70	100
Year of Introduction: 2021		Year of Offering: 2021	Year of Revision: 2022			Percentage of Revision: 100				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks										

Course Description and Purpose: Data Science Lab is a course that illustrates concepts of Tableau Installation, Introduction, Exploring, Data Blending, Uni-variate Charts, Bi-variate Charts, Multi-variate Charts, Trend Line, Word cloud, Bubble Chart, Creating a Simple Dash Board, Creating Maps, Creating a Dash Board, Creating a Story and Data Munging, Importing Graphs, Group and Aggregate Data, Create a Dash Board in Power BI.

Course Objectives: The Data Science Lab course aims to provide comprehensive knowledge and practical skills in Tableau and Power BI, covering installation, data exploration, visualization techniques, dashboard creation, and data munging, enabling students to proficiently analyze and present complex data sets.

Specific objectives include:

1. To implement *Tableau Installation*, *Introduction*, *Exploring*.
2. To implement *Data Blending*.
3. To implement *Uni-variate Charts***,** *Bi-variate Charts*, *Multi-variate Charts*.
4. To implement *Trend Line*, *Word cloud*, *Bubble Chart.*
5. To implement creating a Simple Dash Board, Creating Maps, Creating a Dash Board, Creating a Story and Data Munging, Importing Graphs, Group and Aggregate Data, Create a Dash Board in Power BI.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1: Implement tableau *Installation*, *Introduction*, *Exploring*.

CO2: Implement *Data Blending.*

CO3: Implement *Uni-variate Charts***,** *Bi-variate Charts***,** *Multi-variate Charts.*

CO4: Implement *Trend Line*, *Word Cloud*, *Bubble Chart.*

CO5:To implement creating a *Simple Dash Board*, *Creating Maps*, *Creating a Dash Board*, *Creating a Story* and Data Munging, Importing Graphs, Group and Aggregate Data, Create a *Dash Board* in *Power BI.*

1. Tableau installation. (CO1,L1)
2. Tableau Introduction / Exploring Tableau. (CO1,L1)
3. Data Blending. (CO2,L3)
4. Creating Univariate charts
   a.Bar Chart. (CO3,L3)
   b.Pie Chart. (CO3,L3)
   c. Line Charts
   d. Box plots
5. Dual Axis Chart. (CO3,L3)
6. Shared Axis. (CO3,L3)
7. Creating Bivariate Charts
   a. Cross Tab. (CO3,L3)
   b. Scatter Plot. (CO3,L3)
   c. Trend Line. (CO3,L3)

8. Creating Multi-variate Charts

a. Dual Axis Chart. (CO3,L3)

b. Area charts(CO3,L3)

9. Word Cloud. (CO4,L3)

10. Bubble Chart. (CO4,L3)

11. Creating a Simple Dash Board. (CO5,L3)

12. Creating Maps. (CO5, L3)

13. Creating a Dash Board. (CO5, L3)

14. Creating a Story. (CO5, L3)

Power BI:

27. Getting data from web. (CO4, L3)
28. Natural Language Queries. (CO4, L3)
29. Importing Data from Northwind ODATA feed T3_IMF. (CO4, L3)
30. Functions & list Dates in Power Bi. (CO4, L3)
31. Group By and unpivot in Power Bi. (CO4, L3)
32. Merging Queries in Power Bi. (CO4, L3)
33. IPL Statistics in Power Bi. (CO4, L3)
34. Merging Queries in Power Bi. (CO4, L3)
35. Append Query in Power Bi. (CO4, L3)
36. Charts in Power Bi (CO5,L3)
37. Data Modeling in Power Bi.(CO5,L3)
38. Dashboard for Corona Cases Analysis. (CO5,L3)

Note: The list of experiments is not limited to the above list. If the existing laboratory experiments completed in advance, the additional laboratory programs can added , and to be executed in the laboratory.

22CA3L2: MACHINE LEARNING LAB

Course Name	Machine Learning Lab		L	T	P	C	CIA	SEE	TM
Course Code	22CA3L2		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2021	Year of Revision: 2022			Percentage of Revision: 100				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose:

Machine Learning Lab is a course that illustrates concepts of *Load Data Sets from Different Sources*, *Basics of Data Pre-processing* and *Feature Selection*, *Supervised Learning and Regression Algorithms*, *Supervised Learning and Classification Algorithms*, *Concepts of Clustering Algorithms*.

Course Objectives:

This course will help enable the students to understand learn, apply / implement the *Load Data Sets from Different Sources*, *Basics of Data Pre-processing* and *Feature Selection*, *Supervised Learning and Regression Algorithms*, *Supervised Learning and Classification Algorithms*, Concepts of *Clustering Algorithms.*

The learning objectives include:

- To know the concepts of *Load Data Sets* from different Sources.
- To understand basics of *Data Pre-processing* and *Feature Selection.*
- To learn *Supervised Learning* and *Regression Algorithms*.
- To learn *Supervised Learning* and *Classification Algorithms*.
- To understand the concepts of *Clustering Algorithms*.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1: Know the concepts of *Load Data Sets* from Different Sources.

CO2: Understand basics of *Data Pre-processing* and *Feature Selection*.

CO3: Learn *Supervised Learning* and *Regression Algorithms.*

CO4: Learn *Supervised Learning* and *Classification Algorithms*.

CO5: Understand the concepts of *Clustering Algorithms*.

1. Write a program to open Data Sets in Python. (CO1,L1)
2. Explain various *Plotting Techniques* of Python. (CO2, L2)

REGRESSION ALGORITHMS

3. Demonstrate *Simple Linear Regression* in Python with Sample Data Sets. (CO3,L2)
4. Demonstrate *Multiple Linear Regression* in Python with Sample Data Sets. (CO3,L2)
5. Demonstrate *Decision Tree Regression* in Python with Sample Data Sets. (CO3,L2)
6. Demonstrate *Support Vector Regression* in Python with Sample Data Sets. (CO3,L2)
7. Demonstrate *Random Forest Regression* in Python with Sample Data Sets. (CO3,L

CLASSIFICATION ALGORITHMS

8. Demonstrate *Logistic Regression in Python* with Sample Data Sets. (CO4,L2)
9. Demonstrate *Support Vector Classification* in Python with Sample Data Sets. (CO4,L2)
10. Demonstrate *Random Forest Classification* in Python with Sample Data Sets. (CO4,L2)

CLUSTERING ALGORITHMS

11. Demonstrate *K-Means Clustering* with Sample Data Sets. (CO5,L2)
12. Demonstrate *Hierarchical Clustering* with Sample Data Sets. (CO5,L2)

Note: The list of experiments is not limited to the above list. If the existing laboratory experiments completed in advance, the additional laboratory programs can added , and to be executed in the laboratory.

APPENDIX-III
PROGRAM STRUCTURE & SYLLABI FOR M.Sc.(COMPUTATIONAL DATA SCIENCE)

P.B.Siddhartha College of Arts & Science, Vijayawada
Programme Structure for M.Sc.(Computational Data Science)
Under Choice Based Credit System (CBCS)
W.E.F 2022-23 (R22 Regulations)

I SEMESTER (For the batch of students admitted during 2022-2023)					M.Sc.(Computational Data Science)			
Course Code	**Course Name**	**Teaching Hours / Week**			**CORE/IDC /DSE/SEC/ OEC/MOOCS**	**CIA**	**SEE**	**No. of Credits**
		Lecture	**Practical**	**Tutorial**				
22DS1T1	Data Structures	4	0	0	Core	30	70	4
22DS1T2	Object Oriented Programming	4	0	0	Core	30	70	4
22DS1T3	Advanced Database Management Systems	4	0	0	Core	30	70	4
22DS1T4	Data Mining Techniques	4	0	0	Core	30	70	4
22DS1T5	Personality Development through Life Enlightenment Skills	3	1	0	Core	30	70	3
22DS1L1	Data Structures Lab	0	6	0	Core	30	70	3
22DS1L2	Object Oriented Programming Lab	0	6	0	Core	30	70	3
TOTAL FOR FIRST SEMESTER						**210**	**490**	**25**

II SEMESTER (For the batch of students admitted during 2022-2023)					M.Sc.(Computational Data Science)			
Course Code	**Course Name**	**Teaching Hours / Week**			**CORE/IDC /DSE/SEC/ OEC/MOOCS**	**CIA**	**SEE**	**No. of Credits**
		Lecture	**Practical**	**Tutorial**				
22DS2T1	Essentials of Statistics for Data Science using R	4	0	0	Core	30	70	4
22DS2T2	Machine Learning	4	0	0	Core	30	70	4
22DS2T3	Web Technologies	4	0	0	Core	30	70	4
22PG201	Research Methodology& IPR	3	1	0	SEC	30	70	3
DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY ONE)								
22DS2E1	Mobile Computing	4	0	0	DSE	30	70	4
22DS2E2	Design & Analysis of Algorithms	4	0	0	DSE	30	70	4
22DS2E3	Cyber Security	4	0	0	DSE	30	70	4
LAB PRACTICALS								
22DS2L1	Machine Learning Lab	0	6	0	Core	30	70	3
22DS2L2	Web Technologies Lab	0	6	0	Core	30	70	3
TOTAL FOR SECOND SEMESTER						**210**	**490**	**25**

At the end of 2nd semester, every student must undergo *Summer Internship/Apprenticeship/Project Work/Industrial Training/Research based Project Work* for ***Six Weeks*** and must prepare a report concerned as per approved project guidelines, and submit the same to the University 14 days before the commencement of third semester end examinations.

III SEMESTER (For the batch of students admitted during 2022-2023)					M.Sc.(Computational Data Science)			
Course Code	**Course Name**	**Teaching Hours/Week**			**CORE / IDC/DSE/ SEC/OEC/MOOCS**	**CIA**	**SEE**	**No. of Credits**
		Lecture	**Practical**	**Tutorial**				
22DS3T1	Data Science	4	0	0	Core	30	70	4

DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY THREE)								
22DS3E1	Cloud Computing	4	0	0	DSE	30	70	4
22DS3E2	Internet of Things	4	0	0	DSE	30	70	4
22DS3E3	Big Data and Analytics	4	0	0	DSE	30	70	4
22DS3E4	Deep Learning	4	0	0	DSE	30	70	4
22DS3E5	Software Engineering	4	0	0	DSE	30	70	4
22DS3E6	Block Chain Technology	4	0	0	DSE	30	70	4
LAB PRACTICALS								
22DS3L1	Deep Learning Lab	0	6	0	Core	30	70	3
22DS3L2	Big Data and Analytics Lab	0	6	0	Core	30	70	3
OPEN ELECTIVE (INTERDISCIPLINARY/MULTIDISCIPLINARY) COURSES (CHOOSE ANY ONE)								
22OE301	R Programming	3	0	0	OEC	30	70	3
22OE302	Mobile Networks	3	0	0	OEC	30	70	3
22OE303	UNIX Programming	3	0	0	OEC	30	70	3
22OE304	Power BI	3	0	0	OEC	30	70	3
22OE305	Python Programming	3	0	0	OEC	30	70	3
						210	**490**	**25**

IV SEMESTER (For the batch of students admitted during 2022-2023) | M.Sc.(Computational Data Science)

Course Code	**Course Name**	**Teaching Hours/ Week**			**CORE / IDC/DSE/ SEC/OEC/MOOCS**	**CIA**	**SEE**	**No. of Credits**
		Lecture	**Practical**	**Tutorial**				
22DS4T1	Data Visualization	4	0	0	Core	30	70	4
DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY THREE)								
22DS4E1	Natural Language Processing	4	0	0	DSE	30	70	4
22DS4E2	Business Analytics	4	0	0	DSE	30	70	4
22DS4E3	Software Testing and Project Management	4	0	0	DSE	30	70	4
22DS4E4	Applied Data Analysis	4	0	0	DSE	30	70	4
22DS4E5	Artificial Intelligence	4	0	0	DSE	30	70	4
22DS4E6	Cryptography & Network Security	4	0	0	DSE	30	70	4
LAB PRACTICALS								
22DS4L1	Data Visualization Lab	0	6	0	Core	30	70	3
ENTREPRENURAL & INNOVATION/IT SKILL RELATED TO DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY ONE)								
22DS4E7	Social Media Analytics	3	0	0	SEC	30	70	3
22DS4E8	Dynamic Web Programming using Python	3	0	0	SEC	30	70	3
22DS4E9	Mobile Application Development	3	0	0	SEC	30	70	3
*** CHOOSE MOOCs FROM SWAYAM/NPTEL SOURCES**								
MOOCS								4
PROJECT WORK EVALUATION AND VIVA-VOCE						100		4
TOTAL FOR IV SEMESTER						**180**	**520**	**30**

Note: Students may be allowed to register and appear for MOOCS from the third semester itself. However, students are to complete the MOOCS successfully and submit pass certificate of the same to the University through the Principal of the College concerned for approval and endorsement of the same on grade cards and PCs and ODs as per the regulations of the University. **22DS3T1: DATA SCIENCE**

Course Name	Data Science		L	T	P	C	CIA	SEE	TM
Course Code	22DS3T1		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2023	Year of Revision: 2023			Percentage of Revision: NA				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Descriptive and Purpose: This course provides a comprehensive exploration of essential data manipulation and visualization tools, including NumPy, Pandas, Matplotlib, and techniques for handling, cleaning, merging, reducing, and transforming data.

Course Objectives: This course is designed to illustrate Modules of NumPy and Pandas, Matplotlib, Data, Universal Data Structures, Data Visualization, Data Cleaning, Data Fusion and Data Integration, Data Reduction, and Data Transformation and Massaging.

Specific objectives include:
- Overview of the Basic Functions of NumPy, Pandas and Matplotlib.
- Data, Universal Data Structure and Data Visualization.
- Data Pre-processing and Data Cleaning.
- Data Fusion and Data Integration and Data Reduction.
- Data Transformation and Massaging

Course outcomes:
Upon completion of the course
CO1: The course covers fundamental data manipulation and visualization techniques in Python, including NumPy and Pandas functions for data handling, Matplotlib for creating and customizing various plots, and techniques for subplots, resizing visuals, and saving them, providing a comprehensive foundation for data analysis and visualization in Python.
CO2: Acquire the knowledge and skills to distinguish between data types, perform data summarization and visualization, and investigate relationships between attributes, laying a solid foundation for data analytics and decision-making in real-world scenarios.
CO3: Proficient in conducting thorough data cleaning, enabling them to prepare high-quality datasets for analysis, make informed decisions, and build reliable predictive models, contributing to more accurate and actionable insights in data-driven projects.
CO4: Navigate data fusion and integration challenges, resulting in the ability to merge disparate data sources, reduce data redundancy, and perform data reduction using various techniques, thus enhancing their capabilities in managing and analyzing complex datasets for meaningful insights.
CO5: Possess the capability to apply data transformation and massaging techniques effectively, allowing them to prepare and optimize data for analysis, extract valuable features, and enhance the quality and usability of datasets for better decision-making and modeling outcomes.

UNIT-I (12 Hours)

Review of the Core Modules of NumPy and Pandas:
Overview of the Basic Functions of NumPy: The np.arange() function,The np.zeros() and np.ones() functions,The np.linspace() function
Overview of Pandas: (a)Pandas data access (b) Boolean masking for filtering a Data Frame (c) Pandas functions for exploring a DataFrame (d) Pandas applying a function (e) The Pandas groupby function (f) Pandas multi-level indexing (g) Pandas pivot and melt functions.

Review of Matplotlib:
1. Drawing the Main Plots in Matplotlib: (a) Summarizing numerical attributes using histograms or boxplots (b) Observing trends in the data using a line plot (c) Relating two numerical attributes using a scatterplot.
2. Modifying the Visuals: (a) Adding a title to visuals and labels to the axis (b) adding legends (c) Modifying ticks (d) Modifying markers
3. Subplots, Resizing Visuals and Saving them: (a) Resizing (b) Saving

UNIT-II (12 Hours)

Data: (a) What is Data? b) DIKW Pyramid (c) Data Preprocessing for Data Analytics versus Data Preprocessing for Machine Learning
The Most Universal Data Structure: A Table: (a) Data Objects b) Data Attributes
Types of Data Values: (a) **Analytics** Standpoint (b) Programming Standpoint
Information versus Pattern: (a) Understanding everyday use of the word "Information" (b) Statistical use of the word “Information” (c) Statistical meaning of the word “Pattern”.
Analytic Goals:
Data Visualization-T, **Summarizing a Population: (**a) Example of summarizing Numerical Attributes (b) Example of summarizing Categorical Attributes.
Comparing Populations: (a) Example of comparing populations using Box Plots (b) Example of comparing populations using Histograms c) Example of comparing populations using Bar Charts.
Investigating the relationship between Two Attributes: (a) Visualizing the relationship between two Numerical Attributes (b) Visualizing the relationship between two Categorical Attributes (c) Visualizing the relationship between a Numerical Attribute and a Categorical Attribute.

UNIT-III (12 Hours)

The Pre-processing:
Data Cleaning Level I : Cleaning up the Table
The Levels, Pools, and Purposes of Data Cleaning: (a) Purpose of Data Analytics (b) Tools for Data Analytics (c) Levels of Data Cleaning (d) Mapping the purposes and tools of analytics to the levels of Data Cleaning.
Example 1: Unwise data collection **Example 2:** Reindexing (Multi-level Indexing), **Example 3:** Intuitive but long column titles.

Data Cleaning Level II: Unpacking, Restructuring, and Reformulating the Table
Example 1: Unpacking columns and reformulating the table**:** (a) Unpacking File Name (b) Unpacking Content (c) Reformulating a new table for Visualization (d) The last step - drawing the Visualization
Example 2: Restructuring the table.
Example 3: Level I and II Data Cleaning: Doing the analytics Using linear regression to create a predictive model.

Data Cleaning Level III: Missing Values, Outliers, and Errors
Missing Values: (a) Detecting Missing Values (b) Example of detecting Missing Values (c) Causes of Missing Values (d) Types of Missing Values (e) Diagnosis of Missing Values (f) Dealing with Missing Values.
Outliers: (a) Detecting Outliers (b) Dealing with Outliers.
Errors: (a) Types of Errors b) Dealing with Errors b) Detecting Systematic Errors.

UNIT- IV (12 Hours)

Data Fusion and Data Integration:
What are data fusion and data integration?
(a) Data Fusion versus Data Integration (b) Directions of Data Integration

F**requent challenges regarding Data Fusion and Integration:** (a) Challenge 1-Entity identification with Example (b) Challenge 2-Unwise data collection with Example (b) Challenge 3-Index mismatched formatting

with Example (c) Challenge 4 - Aggregation mismatch with example (d) Challenge 5- Duplicate data objects with example

Data Reduction:

The distinction between data reduction and data redundancy, The objectives of data reduction, Types of data reduction. **Performing Numerosity Data Reduction:** (a) Random Sampling (b) Stratified Sampling (c) Random over/under Sampling.

Performing dimensionality data reduction: (a) Linear Regression as a Dimension Reduction Method (b) Using a Decision Tree as a Dimension Reduction Method (c) Using a Random Forest as a Dimension Reduction Method.

UNIT-V (12 Hours)

Data Transformation and Massaging:

The whys of data transformation and massaging: (a) Data Transformation versus Data Massaging
(b) Normalization and Standardization

Binary Coding, Ranking Transformation, and Discretization: (a) Binary Coding of Nominal Attribute, Binary Coding or Ranking Transformation of Ordinal Attributes, Discretization of Numerical Attributes.

Attribute Construction: Construct one transformed Attribute from two Attributes.

Feature Extraction: Extract three Attributes from one Attribute.

Smoothing, Aggregation, And Binning: Smoothing, Aggregation, Binning.

Case Studies: 1.Mental Health in Tech, 2.Predicting COVID-19 Hospitalizations.

Text Books:

1. Hands-On Data Preprocessing in Python, Roy Jafari, Packt Publishing, 2022.
2. Python Data Analysis, Third Edition, Avinash Navlani Armando Fandango Ivan Idris, Packt Publishing, 2021.
3. Data Cleaning, Ihab F. Ilyas Xu Chu, Association for Computing Machinery, 2019.

M.Sc.(Computer Science), Third Semester

Course Name: Data Science C**ourse Code:** 22DS3T1

(w.e.f admitted batch 2022-23)

SECTION-A

Time: 3 Hours **Max. Marks: 70**

Answer ALL questions **(5×4 = 20 Marks)**

1. (a) Explain Slicing and Pandas Series within the Context of a Data Frame (CO1,L2)

(or)

(b) Explain the concept of Multi-Level Indexing in Pandas. (CO1,L2)

2. (a) What are the different types of data values from two different stand points (CO2,L2)

(or)

(b) How Data Visualization can be used to summarize numerical and categorical attributes with examples?.(CO2,L2)

3. (a) What are the different approaches used in dealing with Missing Values? CO3,L1)

(or)

(b) Define Outlier. What are the different tools used to detect outliers? (CO3,L1)

4. (a) Comparison between Data Fusion and Data Integration? (CO4.L2)

(or)

(b) Comparison between Data Reduction and Data Redundancy (CO4,L2)

5. (a) Comparison between Data Transformation and Data Massaging (CO5,L2)

(or)

(b) Demonstrate the creation of One Transformed Attribute Derived from two existing attributes. (CO5,L2)

SECTION-B

Answer Five Questions Choosing One Question from Each Unit.

All Questions Carry Equal Marks. **(5×10 = 50 Marks)**

6. (a) Explain the purpose and usage of basic NumPy Functions.(CO1, L2)

(or)

(b) Explain main types of Matplotlib Plots used in Exploratory Data Analysis such as Histograms Line Plots and Scatter Plots. (CO1,L2)

7. (a) Define the concept of DIKW Pyramid and compare Data Preprocessing techniques for Data Analytics and Machine Learning. (CO2,L1)

(or)

(b) How to investigate the relationship between Two Attributes in Data Visualization with Examples ? (CO2, L1)

8. (a) How to clean up a table at Level I of data cleaning with examples? (CO3,L1)

(or)

(b) How to Unpack, Restructure, and Reformulate the table at Level II of Data Cleaning with examples ? (CO3,L1)

9.(a) What are the frequent challenges regarding Data Fusion and Integration (CO4,L1)

(or)

(b) What are the different methods used to perform Numerosity Data Reduction. (CO4,L1)

10. (a) Explain the process of binary coding for Nominal Attributes, Ranking Transformation for ordinal attributes, and discretization for Numerical Attributes. (CO5,L5)

(or)

(b) Explain about Functional Smoothing and Rolling Smoothing with example. (CO5,L5)

DOMAIN SPECIFIC ELECTIVES

22DS3E1: CLOUD COMPUTING

Course Name	Cloud Computing		L	T	P	C	CIA	SEE	TM
Course Code	22DS3E1		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2022	Year of Revision: No Revision			Percentage of Revision: Nil				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Descriptive and Purpose: This course is designed to provide students with a comprehensive understanding of a range of topics in the field of cloud computing. These topics include fundamental cloud computing concepts, data visualization, cloud computing service models, open-source cloud platforms and their management, designing application architectures for cloud environments, programming for the cloud, evaluating risks, consequences, and costs associated with cloud computing, implementing AAA (Authentication, Authorization, and Accounting) for cloud administration, and developing applications for both cloud and mobile platforms.

Course Objectives: This course will help the students to learn about basic concepts of Cloud Computing, Visualizations, Cloud Computing Services, Open Source Cloud Implementations and Administration, Application Architecture for Cloud, Cloud Programming, Risks, Consequences and Costs for Cloud Computing, AAA Administration for Clouds, Application Development for Cloud and Mobile Cloud Computing.

Specific objectives include:

- To understand the *Benefits of Cloud Computing* and *Virtualization.*
- To understand the *Services* and *Deployment Models* of *Cloud Computing*.
- To develop *Cloud Applications* using *Open Source Cloud Software*.
- To understand the *Risks*, *Consequences* and *Costs for Cloud Computing, AAA Model*.
- To understand *Application Development for Cloud* and *Architecture*, *Challenges and Benefits of*
- *Mobile Cloud Computing.*

Course Outcomes:

On successful completion

CO1: This course provides a comprehensive understanding of the cloud computing era, including its foundational concepts, comparisons with other architectures (peer-to-peer, client-server, grid computing), the evolution of cloud computing, virtualization principles and benefits, various levels of virtualization, mechanisms, open source technologies, and hardware support, enabling students to grasp the core components and delivery models of cloud computing.

CO2: This course equips students with in-depth knowledge of various cloud computing services, including IaaS, PaaS, SaaS, and DBaaS, while also providing hands-on experience in deploying and administering open-source cloud implementations such as Eucalyptus and Open Stack, enabling them to effectively manage cloud environments for private and multi-node deployments.

CO3: This course provides a deep understanding of cloud application architecture, covering requirements, recommendations, fundamental principles, and the relevance of client-server and service-oriented architectures for cloud applications, as well as practical skills in cloud programming and deployment using platforms like Google App Engine, Bigtable, Chubby, AWS, enabling students to design and deploy cloud-based applications effectively..

CO4: This course delves into the comprehensive understanding of risks, consequences, and costs associated with cloud computing, encompassing risk assessment, vendor lock-in, compliance, resource scarcity, security threats, and cost calculations, while also addressing AAA administration for clouds, covering authentication, authorization, and industry implementations, equipping students with the knowledge and skills to manage cloud-related challenges effectively.

CO5: This course empowers students with the ability to develop and manage cloud applications, encompassing the differences between on-premises and cloud applications, modification of traditional applications for cloud deployment, development stages, agile methodologies, best practices, and static code analysis, while also addressing the unique aspects of mobile cloud computing, including its architecture, benefits, and challenges.

UNIT-I (12 Hours)

Era of Cloud Computing: Getting to Know the Cloud - Peer to Peer - Client Server and Grid Computing - Cloud Computing versus Client Server Architecture - Cloud computing versus Peer To Peer Architecture - Cloud computing versus Grid Computing - How we got to the Cloud - Server Virtualization versus Cloud Computing - Components of Cloud Computing - Cloud Types - Cloud Computing Service Delivery Models.
Introducing Virtualization: Introducing Virtualization and its Benefits - Implementation Levels of Virtualization - Virtualization at the OS Level - Virtualization Structure - Virtualization Mechanisms - Open Source Virtualization Technology - Binary Translation with Full Virtualization - Virtualization of CPU - Memory and I/O Devices - Hardware support for Virtualization in Intex x86 Processor.

UNIT-II (12 Hours)

Cloud Computing Services: Infrastructure as a Service - Platform as a Service - Language and Pass - Software as a Service - Database as a Service.
Open Source Cloud Implementations and Administration: Open Source Eucalyptus Cloud Architecture - Open Source Open Stack Cloud Architecture - Private Cloud Deployment using Eucalyptus - Cloud Implementation using OpenStack and Meghdooth (Single Node & Multi Node).

UNIT-III (12 Hours)

Application Architecture for Cloud: Cloud Application Requirements - Recommendations for Cloud Application Architecture - Fundamental Requirements for Cloud Application Architecture - Relevance and use of Client Server architecture for Cloud Application - Service Oriented Architecture for Cloud Applications.
Cloud Programming: Programming Support for Google Apps Engine - Big Table as Google's NOSQL System - Chubby as Google Distributed Lock Service - Administrating AWS - Deploying in AWS.

UNIT-IV (12 Hours)

Risks, Consequences and Costs for Cloud Computing: Introducing Risks in Cloud Computing - Risk Assessment and Management - Risk of Vendor Lock In - Risk of Loss Control - Risk of Not Meeting Regulatory Compliances - Risk of Resource Scarcity - Risk in Multi Tenant Environment - Risk of Failure - Risk of Failure of Supply Chain - Risk of Malware and Internet Attacks - Risk of Inadequate SLA - Risk of Management of Cloud Resources - Risk of Network Outages - Risks in the Physical Infrastructure - Direct and Indirect Cloud Costs - Calculating Total Cost of Ownership for Cloud Computing - Cost Allocations in a Cloud.
AAA Administration for Clouds: The AAA Model - Single Sign On for Clouds - Industry Implementations for AAA - Authentication Management in the Cloud - Authorization Management in the Cloud.

UNIT-V (12 Hours)

Application Development for Cloud: Developing on Premise Versus Cloud Applications - Modifying Traditional Applications for Deployment in Cloud - Stages during the development process of Cloud Application - Managing a Cloud Application - Using Agile Software Development for Cloud Application - Cloud Applications: What Not to do - Static Code Analysis for Cloud Applications - Developing Synchronous and Asynchronous Cloud Applications.

Mobile Cloud Computing: Definition of Mobile Cloud Computing - Architecture of Mobile Cloud Computing - Benefits of Mobile Cloud Computing - Mobile Cloud Computing Challenges.

Prescribed Text Books			
S.No	Author	Title	Publisher

1	Kailash Jayaswal,Jagannath Kallakurchi, Donald J. Houde& Dr. Deven Shah	Cloud Computing, Black Book	Dreamtech Press

Reference Text Books			
S.No	Author	Title	Publisher
1	Thomas Erl, ZaighamMahmood, Ricardo Puttini	Cloud Computing- Concepts Technology and Architecture	Pearson
2	Raj Kumar Buyya, Christen Vecctiola, S Tammaraiselvi	Mastering Cloud Computing, Foundations and Application Programming	TMH

Time: 3 Hours **Max Marks: 70**

SECTION-A

Answer ALL Questions **(5×4=20Marks)**

1. (a) Explain SaaS (CO1,L2)

(or)

(b) Explain Virtualization (CO1,L2)

2. (a) What is an Open Source? (CO2,L1)

(or)

(b) What is Eucalyptus? (CO2,L1)

3. (a) What are the advantages of SOA?(CO3,L1)

(or)

(b) What are the drawbacks of GFS? (CO3,L1)

4. (a) Explain the risk of Malware (CO4,L2)

(or)

(b) Explain Authentication (CO4,L2)

5. (a) What not to do in Cloud Application Development? (CO5,L1)

(or)

(b) What are the advantages of MCC? (CO5,L1)

SECTION-B

Answer Five Questions Choosing One Question from Each Unit.
All Questions Carry Equal Marks. **(5×10=50Marks)**

6. (a) Explain the various Types of Cloud with neat diagrams.(CO1,L2)
(b) Compare and contrast Cloud Computing Architecture with Peer to Peer Architecture. (CO1,L2)

(or)

(c) Explain Virtualization and its benefits and levels.(CO1,L2)

7. (a) Apply Cloud Computing Services on private cloud. (CO2,L3)

(or)

(b) Build Open Source Cloud Architecture with example. (CO2,L3)

8. (a) What requirements of Cloud Application? (CO3,L1)

(or)

(b) What is Big Table as Google's NoSQL System? Explain EBS. (CO3,L1)

9. (a) Explain Risks in Cloud Computing.(CO4,L2)

(or)

(b) Explain AAA Model for Clouds. (CO4,L2)

11. (a) Explain Stages during the Development Process of Cloud Applications. (CO5, L5)

(or)

(b) Explain Mobile Cloud Computing its Advantages and Disadvantages. (CO5,L5)

22DS3E2: INTERNET OF THINGS (IoT)

Course Name	Internet of Things (IoT)		L	T	P	C	CIA	SEE	TM
Course Code	22DS3E2		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2022	Year of Revision: 2023			Percentage of Revision: 70%				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Descriptive and Purpose: This course aims to provide students with a comprehensive understanding and knowledge of various aspects of the Internet of Things (IoT). These areas of focus include an overview of IoT, models and layers in IoT systems, standardization efforts, protocols and design principles applicable to connected devices, principles of internet connectivity within IoT, a deep dive into IoT protocols and application layer protocols, techniques for acquiring IoT data, and an exploration of business models and processes relevant to IoT applications.

Course Objectives: The course help the students to understand and gain knowledge on *Over View* of *Internet of Things*, *Models*, *Layers* & *Standardization*, *Protocols* & *Design Principles* for Connected Devices, *Internet Connectivity Principles*, *Protocols* & *Application Layer Protocols*, *Data Acquiring*, *Business Models* and *Business Processes*.

Specific objectives include:
- To attain knowledge over view of *Internet of Things*.
- To understand *Models*, *Layers* & *Standardization*.
- To apply *Protocols* & *Design Principles* for Connected Devices.
- To understand *Internet Connectivity Principles*, *Protocols* & Application Layer Protocols.
- To understand *Data Acquiring*, *Business Models* and *Business Processes*.

Course Outcomes: On successful completion

CO1: This course provides a comprehensive understanding of the Internet of Things (IoT), covering its technology, sources, M2M communication, real-world examples, design principles for connected devices, and business models, enabling students to navigate and contribute to the IoT ecosystem effectively.

CO2: This course equips students with a deep understanding of design principles for connected devices in IoT/M2M systems, including OSI stack modifications, ETSI M2M domains, communication technologies, data management, and affordability considerations, enabling them to design and manage efficient and cost-effective IoT solutions.

CO3: This course imparts design principles and knowledge of web connectivity for connected devices, covering web communication protocols, message communication protocols, and practical web connectivity techniques, enabling students to create effective web-connected device solutions.

CO4: This course equips students with the skills to acquire, organize, and analyze data in IoT/M2M contexts, covering data acquisition, storage, business processes, and integration into enterprise systems, facilitating their ability to leverage IoT data for applications, services, and business processes effectively.

CO5: This course empowers students to master data acquisition, organization, and analytics within IoT/M2M, enabling them to drive innovative applications, services, and business processes while efficiently integrating data into enterprise systems.

UNIT-I (12 Hours)

The Internet of Things: An Overview of Internet of Things, Internet of Things Technology, Behind IoT Sources of the IoT, M2M Communication, Examples of IoT, Design Principles for Connected Devices, Business Models for Business Processes in the Internet of Things.

UNIT-II (12 Hours)

Design Principles for Connected Devices: IoT / M2M systems layers and Designs Standardizations, Modified OSI Stack for the IoT / M2M Systems, ETSI M2M Domains and High-level Capabilities ,Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway ease of Designing and Affordability.

UNIT-III (12 Hours)

Design Principles for the Web Connectivity: Design Principles for the Web Connectivity for Connected Devices, Web Communication Protocols for Connected Devices, Message Communication Protocols for Connected Devices, Web Connectivity for Connected Devices.

UNIT-IV (12 Hours)

Internet Connectivity Principles: Introduction, Internet Connectivity, Application Layer Protocols: *HTTP, HTTPS, FTP, Telnet.*

UNIT-V (12 Hours)

Data Acquiring, Organizing and Analytics in IoT / M2M: Introduction, Applications / Services / Business Processes, IOT / M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

Prescribed Text Book			
	Author	Title	Publisher
1	Rajkamal	Internet of Things: Architecture, Design Principles and Applications	McGraw Hill Higher Education

Reference Text Book			
	Author	Title	Publisher
1	Adrian McEwen and Hakim Cassimally	Designing the Internet of Things	Wiley
2	CunoPfister	Getting Started with the Internet of Things.	Oreilly

Course Focus: Employability

Websites of Interest:

3. https://dzone.com/iot-developer-tutorials-tools-news-reviews
4. https://www.ibm.com/blogs/internet-of-things/

M.Sc.(Computational Data Science), Third Semester
Course Name: Internet of Things
Course Code: 22DS3E2
(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70**

SECTION-A

Answer ALL questions **(5×4=20 Marks)**

1.(a) Explain *M2M communication.* (CO1,L2)

(or)

(b) Explain *Internet of Things Technology*. (CO1,L2)

2.(a) What is *Gateway*. (CO2,L1)

(or)

(b) List out *Communication Technologies for IoT*. (CO2,L1)

3.(a) What is *Communication Protocol*? (CO3,L1)

(or)

(b) List out *Application Layer Protocols.* (CO3,L1)

4.(a) Explain *Business Processes for IoT*. (CO4,L2)

(or)

(b) Explain *Organizing Data in IoT*. (CO4,L2)

5.(a) Explain *Transactions for Business Processes.* (CO5,L2)

(or)

(b) Explain *Active* and *Passive Devices*. (CO5,L2)

SECTION-B

Answer Five Questions Choosing One Question from Each Unit.
All Questions Carry Equal Marks. **(5×10=50 Marks)**

6. (a) Explain *overview of Internet of Things.*(CO1,L2)

(or)

(b) Explain *Design Principles for Connected Devices*. (CO1,L2)

7. (a) Apply *IoT / M2M Designs Standardizations* with examples. (CO2,L3)

(or)

(b) Build *Modified OSI Stack for the IoT / M2M Systems*. (CO2,L3)

8. (a) What are *Design Principles for the Web Connectivity*.(CO3,L1)

(or)

(b) What are *Message Communication Protocols for Connected Devices*.(CO3,L1)

9. (a) Explain *IOT / M2M Data Acquiring and Storage*.(CO4,L2)

(or)

(b) Explain *IoT Business Models for Business Processes* with example.(CO4,L2)

10. (a) Explain *Applications and Service Business Processes for IoT*.(CO5,L5)

(or)

(b) Explain *Integration and Enterprise Systems*.(CO5,L5)

22DS3E3: BIG DATA AND ANALYTICS

Course Name	Big Data and Analytics		L	T	P	C	CIA	SEE	TM
Course Code	22DS3E3		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2022	Year of Revision: No Revision			Percentage of Revision: 7%				
L-Lecture, T-Tutorial, P-Practical, C-Credits, CIA-Internal Marks, SEE-External Marks, TM-Total Marks									

Course Descriptive and Purpose: This course is designed to assist students in comprehending the significance of big data in everyday life. It covers topics such as data storage and processing using Hadoop, gaining knowledge about contemporary database systems, utilizing Tableau for data visualization, and implementing Apache Spark through APIs, including SQL and Data Frames, for efficient data processing and analysis.

Course Objectives: The course help the students to understand Big data and its role in Daily Life, Data Storage and Processing in Hadoop, Knowledge acquisition on Modern Databases, Visualization of Data with Tableau, Implementation of Apache Spark with API- SQL and Data Frames.

Specific objectives include:

1. To understand *Bigdata* and its role in *Daily Life*.
1. To know How data is *Stored* and *Processed* in Hadoop.
1. To acquire knowledge on *Modern Databases* working with MongoDB.
2. To implement Apache pig and Hive
3. To implement *Apache Spark* with *API- SQL and Data Frames*.

Course Outcomes:

CO1: This course provides a comprehensive understanding of digital data classification, introduces the concepts and evolution of Big Data, explores its characteristics and challenges, distinguishes it from traditional business intelligence, and delves into the significance of Big Data analytics and the technologies required to address its challenges, equipping students with the knowledge to navigate and harness the potential of Big Data in various domains.

CO2: Students will have a comprehensive understanding of Hadoop, including its key features, advantages, various versions, the Hadoop ecosystem, distributions, and why it is a preferred solution over RDBMS for handling big data. Students will also learn about the challenges of distributed computing, the history of Hadoop, and gain a thorough overview of the Hadoop Distributed File System. Additionally, students will acquire practical skills in managing resources and applications with Hadoop using YARN and interacting effectively within the Hadoop ecosystem.

CO3: Students will have a comprehensive understanding of MapReduce programming concepts, including Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, and Compression. Additionally, students will gain insights into NoSQL databases, their applications, types, advantages, and use in industry, as well as a comparison between SQL and NoSQL, enabling them to make informed decisions in data processing and storage solutions.Working with MongoDB

CO4: Students will have a comprehensive understanding of key components within the Hadoop ecosystem, including Hive, Pig, and HBase. They will gain insights into Hive's architecture, data types, file formats, and query language, as well as its use of RC Files and user-defined functions. Students will also learn about Pig, including its anatomy, philosophy, use cases, Pig Latin, data types, execution modes, HDFS commands, operators, functions, complex data types, and user-defined functions. Additionally, students will gain knowledge of HBase, its concepts, clients, and how it compares to traditional RDBMS systems, enabling them to work effectively with big data technologies.

CO5: Students will be skilled in common DataFrame and Spark SQL operations like unions and joins, and they will know how to perform windowing operations. They will also be proficient in working with Datasets, creating sample data, and transforming it effectively, enabling them to work with Apache Spark for various data processing and analytics tasks.

UNIT-I (12 Hours)

Types of Digital Data: Classification of Digital Data.
Introduction to Big Data: Characteristics of Data - Evolution of Big Data - Definition of Big Data - Challenges with Big Data - What is Big Data? - Other Characteristics of Data - Why Big Data? -Traditional Business Intelligence versus Big Data - Typical Data Warehouse Environment - Typical Hadoop Environment - Coexistence of Big Data and Data Warehouse - What is Changing in the realms of Big Data.

Big Data Analytics: What is Big Data Analytics - What Big Data Analytics is not? - Why this sudden Hype around Big Data Analytics? - Classification of Analytics - Greatest Challenges that Prevent Business from Capitalizing Big Data - Top Challenges facing Big Data - Why Big Data Analytics Important? - What Kind of Technologies are we looking toward to help meet the challenges posed by Big Data? - Data Science - Data Scientist - Terminologies used in Big Data Environments.

UNIT-II (12 Hours)

Hadoop: Features of Hadoop - Key advantages of Hadoop - Versions of Hadoop - Overview of Hadoop Ecosystem - Hadoop Distributions - Why Hadoop? - Why not RDBMS - RDBMS versus Hadoop - Distribution Computing Challenges - History of Hadoop - Hadoop Overview - Hadoop Distributed File System.
Processing Data with Hadoop: Managing Resource and Applications with Hadoop with YARN (Yet Another Recourse Negotiator) - Interacting with Hadoop Ecosystem.

UNIT-III (12 Hours)

Introduction to Map Reduce Programming: Introduction - Mapper - Reducer - Combiner - Partitioner - Searching - Sorting – Compression.
NoSQL: Where it is used? - What is it? - Types of NoSQL Databases - Why NoSQL? - Advantages ofNoSQL - What we miss with NoSQL? - Use of NoSQL in Industry - SQL versus NoSQL
MongoDB: What is MongoDB, Why MongoDB, Using JavaScript, Script Object Notation, Generating Unique Key, Support for Dynamic Queries, Storing Binary Data, Replication, Sharding, Updating Information in Place, Terms used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language?

UNIT-IV (12 Hours)

Hadoop Eco System:
Hive: What is Hive? - Hive Architecture - Hive Data Types - Hive File Format - Hive Query Language (HQL) - RC File Implementation - User Defined Function.
PIG: What is PIG? - Anatomy of Pig - Pig on Hadoop - Pig Philosophy - Use Case for Pig - Pig Latin - Data type in Pig - Running Pig - Execution Mode of Pig - HDFS Commands - Relational Operators - Eval Funtions - Complex Data Types - User Defined Functions - Parameter Substitution.
HBase: HBasics - Concepts - Clients - HBase versus RDBMS.

UNIT-V (12 Hours)

Apache Spark:
Introduction to Apache Spark: A Unified Analytics - What Is Apache Spark? Unified Analytics - The Developer's Experience - Using Scala and PySpark Shell - Understanding Spark Application Concepts - Transformations - Actions and Lazy Evaluation - The Spark UI.
Apache Spark's API: What's Underneath an RDD? - Structuring Spark - The Data Frame API - The Dataset API - Data Frames Versus Datasets - When to Use RDDs - Spark SQL and the Underlying Engine.
Spark SQL and Data Frames: Introduction to built in Data Sources - Using Spark SQL in Spark Applications - SQL Tables and Views - Data Sources for Data Frames and SQL Tables : Data Frame Reader - Data Frame Writer - JSON - CSV- Images - Binary Files.
Common Data Frames and Spark SQL Operations: Unions - Joins - Windowing Spark SQL and Datasets: Working with Datasets: Creating Sample Data - Transforming Sample Data.

Prescribed Text Books			
S.No	Author	Title	Publisher

1	Seema Acharya- Subhashini Chellappan	Big Data and Analytics	Wiley Publications - Second Edition (UNIT I, II, III,IV)
2	Karau H, Konwinski A, Wendell P, Zaharia M	Learning Spark : Lightning Fast Data Analytics	O'Reilley Second Edition (UNIT V: 1 to 6 Chapters)

Reference Text Books			
S.No	Author	Title	Publisher
1	Tom White	Hadoop:The Definitive Guide	O'Reilly, Yahoo Press, Third Edition
2	Bill Chambers & Matei Zaharia	SPARK: The Definitive Guide	O'Reilley, 2018 Edition
3	Guller M	Big data Analytics with Spark: A Practitioner's Guide to using Spark for Large Scale Data Analysis	Apress, 2015

Time: 3 Hours **Max Marks: 70**

SECTION-A

Answer ALL questions **(5×4 = 20 Marks)**

1. (a) Function Big Data. (CO1,L4)
   (or)
   (b) Classify the analytics. (CO1,L4)
2. (a) Compare RDBMS and Hadoop. (CO2,L2)
   (or)
   (b) List the Key Components Of Yarn? (CO2,L1)
3. (a) What is Hadoop Map Reduce? (CO3, L1)
   (or)
   (b) List the types of NoSQL Databases. (CO3,L1)
4. (a) Explain various Data Yypes for Hive. (CO4, L2)
   (or)
   (b) Compare HBase versus RDBMS (CO4,L2)
5. (a) What is Apache Spark?(CO5,L1)
   (or)
   (b) Define JSON. (CO5,L1)

Answer all questions.
All question carry equal marks. 5 × 10 = 50 Marks

6. (a) Explain the Digital Data with examples. (CO1,L2) 5Marks
   (b) Summarize the challenges faced by Bigdata. (CO1,L2) 5 Marks
   (or)
   (c) Explain Brewers Theorem with examples. (CO1,L2) 5 Marks
   (d) Explain the In-memory Analytics. (CO1,L2) 5 Marks
7. (a) Explain Hadoop Eco System with neat diagram. (CO2,L2) 10 Marks
   (or)
   (b) Explain HDFS File Systems with neat diagram. (CO2 ,L2) 10 Marks
8. (a) Make use of Map Reduce in Hadoop with example. (CO3,L3) 10 Marks
   (or)
   (b) Make use of File Read and File Write in Hadoop. (CO3,L3) 10 Marks
9. (a) Explain Hive Architecture with neat diagram. (CO4, L2) 10 Marks
   (or)
   (b) Explain CRUD Operations in MongoDB with examples. (CO4,L2) 5 Marks
   (c) Explain MongoDB import and export with examples. (CO4,L2) 5 Marks
10. (a) Explain TDD in Apache Spark with examples. (CO5,L2) 10 Marks
    (or)
    (b) Explain Common Data Frames and Distinguish between Data Frames Vs Datasets. (CO5, L5) 5 Marks
    (b) Explain Spark SQL Operations in spark. (CO5,L5) 5 Marks

22DS3E4: DEEP LEARNING

Course Name	Deep Learning		L	T	P	C	CIA	SEE	TM
Course Code	22DS3E4		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2022	Year of Revision: No Revision			Percentage of Revision: Nil				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Descriptive and Purpose: This course is intended to facilitate students' comprehension of several key aspects of deep learning. It covers foundational principles of deep learning, explores memory-augmented neural networks, delves into deep reinforcement learning, provides hands-on experience with neural networks in TensorFlow, and examines practical applications of deep learning in various fields.

Course Objectives: The course help the students to understand Basics of Deep Learning, Memory Augmented Neural Networks, Deep Reinforcement Learning, Neural Networks in Tensor Flow, Applications of Deep Learning.

Specific objectives include:
1. To gain familiarity in Basics of Deep Learning.
2. To understand the concepts of Memory Augmented Neural Networks.
3. To acquire knowledge Deep Reinforcement Learning.
4. To implement Neural Networks in Tensor Flow
5. To understand the Applications of Deep Learning.

Course Outcomes:
Upon successful completion of the course, the student will be able to:
CO1: Students will possess a comprehensive understanding of Convolutional Neural Networks (CNNs), including their architecture, feature extraction, max pooling, image preprocessing, batch normalization, and training algorithms, equipping them with the knowledge and skills to effectively apply CNNs to various computer vision tasks and artistic style replication
CO2: Students will have a deep understanding of Memory Augmented Neural Networks, including Neural Turing Machines and Differentiable Neural Computers, along with their memory addressing mechanisms, interference-free writing, temporal linking, and practical implementation in Tensor Flow, enabling them to apply these advanced memory-augmented models for tasks requiring memory and comprehension.
CO3: Students will have mastered Deep Reinforcement Learning, including its application in mastering Atari games, understanding the fundamentals of Reinforcement Learning, Markov Decision Processes (MDP), exploration-exploitation trade-offs, policy and value learning, and practical implementation of algorithms like Q-Learning and Deep Q Networks (DQN) for solving complex decision-making problems.
CO4: students will be proficient in implementing neural networks in Tensor Flow, including creating and manipulating Tensor Flow variables, performing operations, working with placeholder tensors, managing sessions, handling variable scopes, specifying and training models for various tasks, and effectively utilizing Tensor Flow for deep learning projects.
CO5: This course will equip students with the knowledge and skills to apply large-scale deep learning techniques to a wide range of applications, including computer vision, speech recognition, natural language processing, and various other domains, enabling them to solve complex real-world problems using deep learning models.

UNIT-I (12 Hours)

Basics of Deep Leaning- Deep learning architectures: Convolutional Neural Networks : Neurons in Human Vision - The Shortcomings of Feature Selection - Vanilla Deep Neural Networks Don’t Scale - Filters and Feature Maps - Full Description of the Convolutional Layer - Max Pooling - Full Architectural Description of Convolution Networks - Closing the Loop on MNIST with Convolutional Networks - Image Preprocessing Pipelines Enable More Robust Models - Accelerating Training with Batch Normalization -Building a Convolutional Network for CIFAR 10 - Visualizing Learning in Convolutional Networks - Leveraging Convolutional Filters to Replicate Artistic Styles - Learning Convolutional Filters for Other Problem Domains - Training algorithms.

UNIT-II (12 Hours)

Memory Augmented Neural Networks: Neural Turing Machines - Attention Based Memory Access - NTM Memory Addressing Mechanisms - Differentiable Neural Computers - Interference Free Writing in DNCs-DNC Memory Reuse - Temporal Linking of DNC Writes - Understanding the DNC Read Head - The DNC Controller Network - Visualizing the DNC in Action-Implementing the DNC in Tensor Flow - Teaching a DNC to Read and Comprehend.

UNIT-III (12 Hours)

Deep Reinforcement Learning: Deep Reinforcement Learning Masters Atari Games - What Is Reinforcement Learning? - Markov Decision Processes (MDP) - Explore Versus Exploit - Policy versus Value Learning - Pole Cart with Policy Gradients- Q Learning and Deep Q Networks - Improving and Moving Beyond DQN.

UNIT-IV (12 Hours)

Implementing Neural Networks in Tensor Flow: What Is Tensor Flow? - How Does Tensor Flow Compare to Alternatives? - Installing Tensor Flow - Creating and Manipulating Tensor Flow Variables - Tensor Flow Operations-Placeholder Tensors-Sessions in Tensor Flow - Navigating Variable Scopes and Sharing Variables - Managing Models over the CPU and GPU - Specifying the Logistic Regression Model in Tensor Flow - Logging and Training the Logistic Regression Model.

UNIT-V (12 Hours)

Applications: Large Scale Deep Learning - Computer Vision - Speech Reorganization - Natural Language Processing - Other Applications.

Prescribed Text Books			
	Author	Title	Publisher
1	Nikhil Buduma, Nicholas Locascio	Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms.	O'Reilly Media, 2017
2	Ian Goodfellow, YoshuaBengio, Aaron Courville	Deep Learning (Adaptive Computation and Machine Learning series).	MIT Press, 2017

Reference Text Books			
	Author	Title	Publisher
1	Douwe Osinga	Deep learning Cook Book, Practical Recipes to Get Started Quickly	O'Reilly

e-Resources:
1) https://keras.io/datasets/
2) http://deeplearning.net/tutorial/deeplearning.pdf
3) https://arxiv.org/pdf/1404.7828v4.pdf
4) https://github.com/lisa-lab/DeepLearningTutorials

Course Name: Deep Learning
Course Code: 22DS3E4
(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70**

SECTION-A

Answer ALL questions **(5×4=20Marks)**

1. (a) Explain Max Pooling.(CO1, L2)

(or)

(b) Explain Accelerating Training with Batch Normalization. (CO1,L2)

2. (a) What is Attention Based Memory? Explain.(CO2,L1)

(or)

(b) Explain Visualizing the DNC in Action.(CO2,L1)

3.(a) What are the differences between Explore and Exploit? (CO3,L1)

(or)

(b) List out the Algorithm steps in implementation of Reinforce. (CO3,L1)

4.(a) Explain Creating and Manipulating Tensorflow Variables. (CO4,L2)

(or)

(b) Explain Operations in Tensorflow. (CO4,L2)

5.(a) Explain Neural Machine Translation. (CO5,L2)

(or)

(b) Explain Speech Recognition and its applications? (CO5,L2)

SECTION-B

Answer Five Questions Choosing One Question from each unit.

All Questions Carry Equal Marks. **(5×10=50Marks)**

6. (a) Explain about Filters and Feature Maps..(CO1,L2)

(or)

(b) Explain Building a Convolutional Network for CIFAR 10.(CO1,L2)

7. (a) Divide various NTM Memory Addressing Mechanisms. (CO2,L4)

(or)

(b) Explain about Differentiable Neural Computers. (CO2,L4)

8. (a) What is Markov Decision Processes ? Explain. (CO3,L1)

(or)

(b)What is Deep Reinforcement Learning? Explain. (CO3,L1)

9.(a) Explain Placeholder Tensors and Sessions in Tensor Flow. (CO4,L2)

(or)

(b) Explain Specifying the Logistic Regression Model in Tensorflow. (CO4,L2)

12. (a) Explain Pre Processing and Data Set Augmentation in Computer Vision.(CO5,L5)

(or)

(b) Explain use of Shortlist and Hierarchical Softmax in NLP. (CO5,L5)

22DS3E5: SOFTWARE ENGINEERING

Course Name	Software Engineering			L	T	P	C	CIA	SEE	TM
Course Code	22DS3E5			4	0	0	4	30	70	100
Year of Introduction: 1991	Year of Offering: 2022	Year of Revision: No Revision		Percentage of Revision: Nil						
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks										

Course Description and Purpose: Software Engineering is a course that illustrates Process Models, Agile Development, Core Principles, Requirements Modeling, Data Modeling, Software Quality Assurance, Software Testing Strategies, Testing Conventional Applications, Project Management Concepts, Process and Project Metrics, Formal Modeling and Verification and Estimation for Software Project.

Course Objectives: The course will help the students to understand, learn and build Process Models, Agile Models, Core Principles, Requirement Models, Data Models, Software Quality Assurance Procedures, Software Testing Strategies, and Strategies to Test Conventional Applications, Project Management Concepts, Process and Project Metrics, Formal Modeling and Verification and Models to estimate Software Projects.

Specific objectives include:

- To understand various Software Engineering Methods, Practices, Process Models and Agile Development Strategies.
- To understand and apply Core Principles, Requirements & Modeling Concepts.
- To understand and apply different Software Testing Approaches and various aspects of Software Quality Assurance.
- To understand and apply *Process & Project Management* Concepts.
- To understand and apply *Software Estimates for Projects* & apply *Formal Methods Modeling*.

Course Learning Outcomes:

Upon successful completion of the course:

CO1: Students will have a comprehensive understanding of software and software engineering, including the nature of software, software engineering practices, various process models (generic, prescriptive, specialized, personal, team), and agile development methodologies (such as Extreme Programming, Scrum, and Lean Software Development), enabling them to effectively design, develop, and manage software projects in diverse application domains.

CO2: Students will be equipped with a strong foundation in software engineering principles, including core principles, communication, planning, modeling, construction, and deployment principles. They will also gain practical skills in requirements modeling, scenario-based modeling, data modeling concepts, and class-based modeling techniques, enabling them to effectively analyze, design, and document software systems in real-world scenarios.

CO3: Students will have a comprehensive understanding of software quality assurance, including SQA tasks, goals, metrics, statistical SQA, software reliability, safety, ISO 9000 standards, and software testing strategies, encompassing unit testing, integration testing, validation testing, system testing, and debugging techniques for both conventional and object-oriented applications, equipping them to ensure software quality and reliability in real-world projects.

CO4: Students will possess a solid understanding of project management concepts, including managing people, products, processes, and projects. They will be proficient in process and project metrics, including size-oriented and function-oriented metrics, as well as software measurement techniques and metrics for assessing software quality, enabling them to effectively manage and improve software development processes and projects.

CO5: Students will be well-versed in formal modeling and verification techniques, including functional specification, cleanroom design, and formal methods concepts. They will also gain practical skills in applying mathematical notation and formal specification languages like OCL and Z. Additionally, students will have a solid understanding of software project estimation, including decomposition techniques, empirical estimation models such as COCOMO II, and estimation for object-oriented projects, enabling them to effectively plan and manage software development projects with accuracy.

UNIT-I (12 Hours)

Software and Software Engineering: The Nature of Software: Defining Software, Software

Application Domains, Legacy Software, The Unique Nature of Web Apps, Software Engineering, The Software Process, Software Engineering Practices: The Essence of Practice, General Principles, Software Myths.

Process Models: A Generic Process Model: Defining a Framework Activity, Identifying a Task Set, Process Patterns, Process Assessment and Improvement, Prescriptive Process Models: The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, A Final Word on Evolutionary Processes, Specialized Process Models: Component-Based Development, The Formal Methods Model, Aspect-Oriented Software Development, The Unified Process: A Brief History, Phases of the Unified Process, Personal and Team Process Models: Personal Software Process (PSP), Team Software Process (TSP).

Agile Development: What Is Agility, Agility and the Cost of Change, What Is an Agile Process: Agility Principles, The Politics of Agile Development, Human Factors, Extreme Programming (XP): XP Values, The XP Process, Industrial XP, The XP Debate, Other Agile Process Models: Adaptive Software Development (ASD), Scrum, Dynamic Systems Development Method (DSDM), Crystal, Feature Driven Development (FDD), Lean Software Development (LSD), Agile Modeling (AM), Agile Unified Process (AUP).

UNIT-II (12 Hours)

Principles that Guide Practice: Core Principles: Principles That Guide Process, Principles That Guide Practice**,** Principles That Guide Each Framework Activity: Communication Principles, Planning Principles, Modeling Principles, Construction Principles, Deployment Principles.

Requirements Modeling: Scenarios, Information, and Analysis Classes: Requirements Analysis: Overall Objectives and Philosophy, Analysis Rules of Thumb, Domain Analysis, Requirements Modeling Approaches, Scenario-Based Modeling: Creating a Preliminary Use Case, Refining a Preliminary Use Case, Writing a Formal Use Case, UML Models That Supplement the Use Case: Developing an Activity Diagram, Swim lane Diagrams.

Data Modeling Concepts: Data Objects, Data Attributes, Relationships, Class-Based Modeling: Identifying Analysis Classes, Specifying Attributes, Defining Operations, Class-Responsibility-Collaborator (CRC) Modeling, Associations and Dependencies, Analysis Packages.

UNIT-III (12 Hours)

Software Quality Assurance: Background Issues, Elements of Software Quality Assurance, SQA Tasks, Goals, and Metrics: SQA Tasks, Goals, Attributes, and Metrics, Formal Approaches to SQA, Statistical Software Quality Assurance: A Generic Example, Six Sigma for Software Engineering, Software Reliability : Measures of Reliability and Availability, Software Safety, The ISO 9000 Quality Standards, The SQA Plan.

Software Testing Strategies: A Strategic Approach to Software Testing : Verification and Validation, Organizing for Software Testing, Software Testing Strategy-The Big Picture, Criteria for Completion of Testing, Strategic Issues, Test Strategies for Conventional Software: Unit Testing, Integration Testing, Test Strategies for Object-Oriented Software: Unit Testing in the OO Context, Integration Testing in the OO Context, Test Strategies for Web Apps, Validation Testing: Validation-Test Criteria, Configuration Review, Alpha and Beta Testing, System Testing: Recovery Testing, Security Testing, Stress Testing, Performance Testing, Deployment Testing, The Art of Debugging: The Debugging Process, Psychological Considerations, Debugging Strategies, Correcting the Error

Testing Conventional Applications: Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing: Flow Graph Notation, Independent Program Paths, Deriving Test Cases, Graph Matrices, Control Structure Testing: Condition Testing, Data Flow Testing, Loop Testing, Black-Box Testing: Graph-Based Testing Methods, Equivalence Partitioning, Boundary Value Analysis, Orthogonal Array Testing.

UNIT-IV (12 Hours)

Project Management Concepts: The Management Spectrum: The People, The Product, The Process,

The Project, People: The Stakeholders, Team Leaders, The Software Team, Agile Teams, Coordination and Communication Issues, The Product: Software Scope, Problem Decomposition, The Process: Melding the Product and the Process, Process Decomposition, The Project, The W5HH Principles.

Process and Project Metrics: Metrics in the Process and Project Domains: Process Metrics and Software Process Improvement, Project Metrics, Software Measurement: Size-Oriented Metrics, Function-Oriented Metrics, Reconciling LOC and FP Metrics, Object-Oriented Metrics, Use-Case–Oriented Metrics, Web App Project Metrics, Metrics for Software Quality: Measuring Quality, Defect Removal Efficiency.

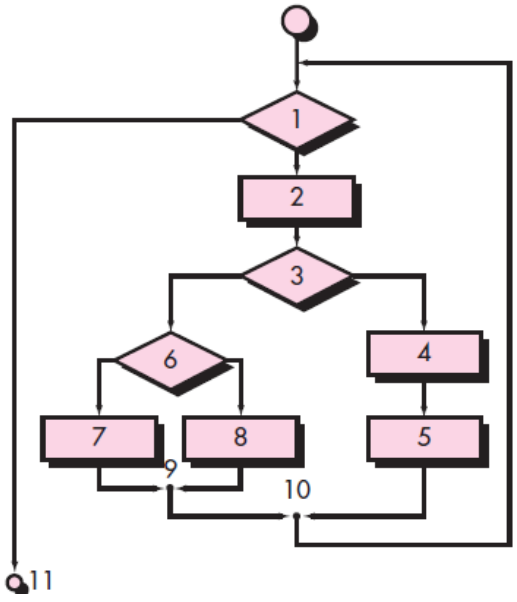
UNIT-V (12 Hours)

Formal Modeling And Verification: The Cleanroom Strategy, Functional Specification: Black-Box Specification, State-Box Specification, Clear-Box Specification, Cleanroom Design: Design Refinement, Design Verification, Cleanroom Testing: Statistical Use Testing, Certification, Formal Methods Concepts, Applying Mathematical Notation for Formal Specification, Formal Specification Languages: Object Constraint Language (OCL), The Z Specification Language.

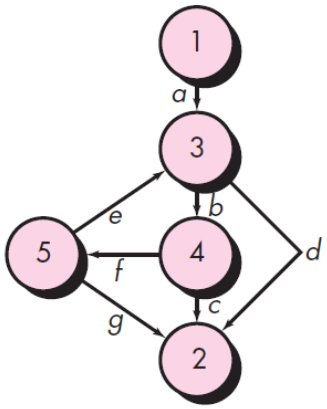
Estimation for Software Projects: Resources: Human Resources, Reusable Software Resources, Environmental Resources, Software Project Estimation, Decomposition Techniques: Software Sizing, Problem-Based Estimation, An Example of LOC-Based Estimation, An Example of FP-Based Estimation, Empirical Estimation Models: The Structure of Estimation Models, The COCOMO II Model, The Software Equation, Estimation for Object-Oriented Projects.

Case Studies:

- Draw example for Process Pattern when requirements are uncertain.
- Draw UML use case diagram for Safehome Security Function.
- Draw UML Activity Diagram for Access camera surveillance via the Internet - display camera views function.
- Draw UML Swimlane Diagram for Access camera surveillance via the Internet - display camera views function.
- Draw UML Class Diagram for Floor Plan.
- Draw UML Package for specifying Environment, Characters of the Game and Rules of the Game.
- Draw Level 1 DFD for Safehome Security Function
- Draw State diagram for Safehome Security Function
- Draw Sequence Diagram (partial) for the Safehome Security Function
- A UML Deployment Diagram for Safehome Security Function.
- Draw Flow Graph for Flow Chart and find the Cyclomatic Complexity.



- Draw the Graph Matrix for the Flow Graph



Flow graph

- Draw Generalization diagram by specifying Structural Constraint.
- Specify sample (a) Project Metrics (b) Product Metrics
- Specify (i) Decision Table (ii) Decision Tree in Block Box Testing
- Draw the Block Diagram for Block Handler and also specify the logic using Object Constraint Language (OCL)
  2. No block will be marked as both unused and used.
  3. All the sets of blocks held in the queue will be subsets of the collection of currently used blocks
  4. No elements of the queue will contain the same block numbers.
  5. The collection of used blocks and blocks that are unused will be the total collection of blocks that make up files.
  6. The collection of unused blocks will have no duplicate block numbers.
  7. The collection of used blocks will have no duplicate block numbers.
  8. Using Z Specification Language describes the state of the block handler and the data invariant:

Text Book:

1. Roger S Pressman, Software Engineering - A Practitioner's Approach, Ninth Edition, McGraw - Hill, A Business Unit of The McGraw-Hill Companies, Inc., 2020.

Reference Text Books:

1. Roger S Pressman, Software Engineering - A Practitioner's Approach, Seventh Edition, McGraw - Hill, A Business Unit of The McGraw-Hill Companies, Inc., 2010.
1. Sommerville, Software Engineering, 7th Edition, Pearson Education, 2004.
2. S.A.Kelkar, Software Engineering - AConcise Study, PHI, January 2007.
3. Waman, Software Engineering, TMH, June 2004.
4. AH Behforooz and Frederick J.Hudson, Software Engineering Fundamentals, Oxford, 2008.

(An Autonomous College in the jurisdiction of Krishna University)

M.Sc.(Computational Data Science), Third Semester

Course Name: Software Engineering

Course Code: 22DS3E5

(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70**

SECTION-A

Answer ALL questions. All Questions Carry Equal Marks. (5×4 = 20 Marks)

1. (a) What are various aspects of is *PSP* and *TSP*? (CO1,L1)

(or)

(b) What is *SCRUM*? Explain it in detail. (CO2, L1)

2. (a) What are the phases of *Extreme Programming (XP)*? (CO2,L1)

(or)

(b) What is *Class-Based Modeling*? Explain it by writing Class Diagram (CO2,L1)

3. (a) What is *Software Reliability*? Explain in detail. (CO3,L1)

(or)

(b) What is *Alpha* and *Beta* Testing? Explain in detail. (CO3,L1)

4. (a) List W5HH Principles. (CO4,L1)

(or)

(b) What is *Use Case Diagram*? Demonstrate with example. (CO4,L2)

5. (a) State various *resources* of Information System. (CO5,L5)

(or)

(b) What is *Software Sizing*? Explain it (CO5,L5)

SECTION-B

Answer ALL questions. All Questions Carry Equal Marks. (5×10 = 50 Marks)

6. (a) Explain various types of *Software Myths*. (CO1,L2)

(or)

(b) Explain *Incremental Process Models*. (CO1,L2)

7. (a) List *(i) Planning Principles (ii) Modeling Principles*. (CO2,L4)

(or)

(b) Examine various aspects of *Scenario-Based Modeling.* (CO2,L4)

8. (a) Develop various test strategies to test *Conventional Software.* (CO3,L3)

(or)

(b) Develop various strategies for *White Box Testing.* (CO3,L3)

9. (a) Discuss the *Management Spectrum* in detail. (CO4,L6)

(or)

(b) Discuss *(i) Size-Oriented Metrics (ii) Function-Oriented Metrics* in detail. (CO4,L6)

10. (a) Explain *Functional Specification* of *Cleanroom Strategy*. (CO5,L5)

(or)

(b) Explain *(i) The COCOMO II Model (ii) The Software Equation* of EmpiricalEstimation Models. (CO5,L5)

22DS3E6: BLOCK CHAIN TECHNOLOGY

Course Name	Block Chain Technology		L	T	P	C	CIA	SEE	TM
Course Code	22DS3E6		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2022	Year of Revision: No Revision			Percentage of Revision: Nil				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose: This course provides a comprehensive overview of blockchain technology, covering its necessity, operational processes, limitations, Bitcoin decentralization, Bitcoin and Ethereum storage and usage, smart contracts, real-world blockchain applications, mining consensus mechanisms, and security considerations.

Course Objectives: Block Chain Technology is a course that illustrates Block Chain Need, Working Process of Block Chain, Limitations of Block Chain Technology, Decentralization of Bitcoin, Storage and usage of Bitcoins, Ethereum and Smart Contracts, Block Chain Applications, Mining Consensus and Bitcoin Security.

Specific objectives include:

5. To understand basic concepts of *Blockchain* & *Limitations*.
6. To learn *How Bitcoin Achieves Decentralization.*
7. To familiar with *How to Store Bitcoins* and *How to Use Bitcoins*.
8. To know *Ethereum and Smart Contracts* and *Blockchain Applications*.
9. To gain knowledge on *Mining Consensus* and *Bitcoin Security.*

Course Outcomes:

Upon successful completion of the course

CO1: Students will have a comprehensive understanding of block chain technology, including its need in addressing core problems, the workings of public and private ledgers, the mechanics of block chain, such as hashing data, user account protection, transaction authorization, and data store security, as well as the limitations of block chain technology and potential avenues for innovation and improvement in the field.

CO2: Students will possess a thorough understanding of how Bitcoin achieves decentralization, including the distinctions between centralized and decentralized systems, the concept of distributed consensus, the mechanics of Bitcoin transactions and scripts, and the role of Bitcoin blocks in maintaining a decentralized ledger, enabling them to grasp the fundamental principles of block chain technology and crypto currency.

CO3: Students will be well-equipped to store and use Bitcoins effectively, understanding various storage methods, including local storage, hot and cold storage, and key management techniques. They will also gain proficiency in using Bitcoins through online wallets, exchanges, payment services, and currency exchange markets, enabling them to navigate the crypto currency ecosystem securely and efficiently.

CO4: Students will have a comprehensive understanding of Ethereum, smart contract programming, and various block chain applications, including Name coin, gas incentives, security considerations, data structures in Ethereum, and applications such as colored coins, Counterparty, payment channels, and state channels, equipping them to design and implement block chain-based solutions for diverse use cases.

CO5: Students will have a deep understanding of mining consensus in block chain networks, including decentralized consensus mechanisms, transaction verification, block mining, and consensus security considerations. Additionally, students will be well-versed in Bitcoin security principles and user best practices for securing crypto currency assets, enabling them to engage with block chain technologies securely and effectively.

UNIT-I (12 Hours)

Why Blockchain is Need: Discovering the Core Problem - Public Ledgers - Block in Blockchain - Public versus Private Blockchain.
How Blockchain Works: Planning the Blockchain - Hashing Data - Identifying & Protecting user Accounts - Authorizing Transactions - Using Data Store - Protecting Data Store - Choosing Transaction History - Paying for Integrity.
Limitations: Seeing the Limitations - Reinventing the Block Chain.

UNIT-II (12 Hours)

How Bitcoin Achieves Decentralization: Centralized versus Decentralization - Distributed Consensus - Bitcoin Transactions - Bitcoin Scripts - Applications of Bitcoin Scripts - Bitcoin Blocks.

UNIT-III (12 Hours)

How to Store Bitcoins: Simple Local Storage - Hot and Cold Storage - Splitting and Sharing Keys.
How to Use Bitcoins: Online Wallets and Exchanges - Payment Services - Transaction Fees - Currency Exchange Markets.

UNIT-IV (12 Hours)

Ethereum and Smart Contracts: Smart Contract Programming Model, Namecoin in Ethereum, Gas Incentives and Security, Data Structures in Ethereum.
Blockchain Applications: Applications from Building Blocks, Colored Coins, Counterparty, Payment Channels and State Channels, Routed Payment Channels.

UNIT-V (12 Hours)

Mining Consensus: Decentralized Consensus - Independent Verification of Transactions - Mining Nodes - Aggregating Transactions into Blocks - Mining the Block - Validating a New Block - Assembling and Selecting Chains of Blocks - Consensus Attacks.
Bitcoin Security: Security Principles - User Security Best Practices.

Prescribed Text Book			
	Author	Title	Publisher
1	Daniel Drescher	Blockchain Basics	A Press, Second Edition, 2017
2	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder	Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction.	Princeton University Press, 2016, Second Edition
3	Andreas M Antonopoulos	Mastering Bitcoin: Unlocking Digital Crypto Currencies	ORELLY,2015

Reference Text Book			
	Author	Title	Publisher
1	Melanie	Blockchain : Blue Print for New Economy	ORELLY,2015

(An Autonomous College in the jurisdiction of Krishna University)
M.Sc.(Computational Data Science), Third Semester
Course Name: Block Chain Technology
Course Code: 22DS3E6
(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70**

SECTION-A

Answer ALL Questions **(5×4=20Marks)**

1. (a) What is reinventing the Block Chain? (CO1,L1)
(or)
(b) How to use Data Store? (CO1,L1)

2. (a) Explain Block in Block Chain. (CO2,L2)
(or)
(b) Explain Script. (CO2,L2)

3. (a) What is Splitting? (CO3,L1)
(or)
(b) What is Transaction? (CO3,L1)

4. (a) Explain Payment Channel. (CO4,L2)
(or)
(b) Explain Colored Coin. (CO4,L2)

5.(a) What is Mining Node? (CO5,L1)
(or)
(b) What are Security Principles? (CO5,L1)

SECTION-B

Answer Five Questions Choosing One Question from Each Unit.
All Questions Carry Equal Marks. **(5×10=50Marks)**

6. (a) Explain Public Ledger, Public & Private Block Chains. (CO1,L2)
(or)
(b) Explain identifying and protecting User Accounts and Authorize Transactions. (CO1,L2)

7. (a) Apply Centralized & Decentralized in Bitcoin in applications. (CO2,L3)
(or)
(b) Build Bitcoin Scripts and their Applications. (CO2,L3)

9. (a) What are Hot & Cold Storages?. Explain in detail. (CO3,L1)
(or)
(b) How bitcoins are used in online Wallets & Exchanges and payment services? (CO3,L1)

10. (a) Explain Smart Contract Programming Model & Data Structures in Ethereum.(CO4,L2)
(or)
(b) Write about Applications from Building Blocks and Colored Coins.(CO4,L2)

(a) Explain Mining, Validating, Assembling and Selecting Chains of blocks. (CO5,L5)
(or)
(b) Explain the Security Principles in Bitcoin Security.(CO5,L5)

22DS3L1: DEEP LEARNING LAB

Course Name	Deep Leaning Lab		L	T	P	C	CIA	SEE	TM
Course Code	22DS3L1		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2022	Year of Revision: No Revision			Percentage of Revision: Nil				
L-Lecture, T-Tutorial, P-Practical, C-Credits, CIA-Internal Marks, SEE-External Marks, TM-Total Marks									

Course Description and Purpose: This laboratory course focuses on practical skills in developing facial recognition, voice recognition, object recognition, object counting, sentiment analysis, and fake news detection applications.

Course Objectives: This laboratory course aimed to develop *Face Recognition Application, Voice Recognition Application, Object Recognition Application, Object Counting Application* and *Sentiment Analysis Application & Fake News Detection Application*

Specific objectives include:

1. To learn developing *Face Recognition Application*.
1. To learn developing *Voice Recognition Application*.
2. To learn developing *Object Recognition Application*.
3. To learn developing *Object Counting Application*.
4. To learn developing *Sentiment Analysis Application & Fake News Detection Application.*

Course Outcomes:

On successful completion of this course

CO1: Students will have developed the practical skills to implement a face recognition application using a chosen framework, enabling them to apply facial recognition technology in real-world applications.

CO2: Students will be proficient in developing a voice recognition application using their chosen framework, equipping them to integrate voice recognition technology into various real-world applications.

CO3: students will be skilled in developing object recognition applications, enabling them to create software capable of identifying and classifying objects within images or video streams for various practical applications.

CO4: Students will have the expertise to develop object counting applications, allowing them to create software that accurately counts and tracks objects within images or video streams for diverse real-world scenarios.

CO5: Students will be proficient in developing both sentiment analysis and fake news detection applications, equipping them to analyze text data for sentiment and identify misleading or false information in text content for various applications.

Lab Exercises:

1. Implement *Face Recognition Application* using any frame work. (CO1,L6)
1. Implement *Voice Recognition Application* using any frame work. (CO2,L6)
2. Implement *Object Recognition Application* using any frame work. (CO3,L6)
3. Implement *Object Counting Application* using any frame work. (CO4,L6)
4. Implement *Sentiment Analysis Application* using any frame work. (CO5,L6)
5. Implement *Detection of Fake News Application* using any frame work. (CO5,L6)

22DS3L2: BIG DATA AND ANALYTICS LAB

Course Name	Big Data Analytics Lab		L	T	P	C	CIA	SEE	TM
Course Code	22DS3L2		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2022	Year of Revision: No Revision			Percentage of Revision: Nil				
L-Lecture, T-Tutorial, P-Practical, C-Credits, CIA-Internal Marks, SEE-External Marks, TM-Total Marks									

Course Description and Purpose: This laboratory course focuses on hands-on experience with Hadoop installations and commands, implementing word count in Hadoop, Pig installations and commands, MongoDB tasks and operations, including bulk documents, arrays, and MapReduce, as well as Spark installation and operations, including RDDs, data frames, and Spark SQL.

Course Objectives: This laboratory course aimed to implement Hadoop Installations, Hadoop Commands,Word Count in Hadoop, Pig Installation, Pig Commands, MongoDB, MongoDB Commands, Tasks On Mongodb, Bulk Documents in Mongodb, Arrays in Mongodb, Map Reduce in Mongodb, Aggregate Functions in Mongodb, Mongo Import & Export and Spark Installation, Operations of Rdd, Working With Data Frames, Spark SQL Operations.

Specific objectives include:

1. To implement Hadoop Installations, Hadoop Commands,Word Count in Hadoop.
1. To implement Pig Installation, Pig Commands, MongoDB.
2. To implement MongoDB Commands, Tasks On Mongodb, Bulk Documents in Mongodb, Arrays in Mongodb.
3. To implement Map Reduce in Mongodb, Aggregate Functions in Mongodb, Mongo Import & Export.
4. To implement Spark Installation, Operations of Rdd, Working With Data Frames, Spark SQL Operations.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1: Students will be capable of setting up Hadoop installations, executing Hadoop commands, and implementing the Word Count program in Hadoop, enabling them to work with distributed data processing using Hadoop technology.

CO2: Students will be proficient in installing Pig, utilizing Pig commands, and integrating with MongoDB, equipping them with the skills to work with data processing and analysis in a Hadoop ecosystem using Pig and MongoDB technologies.

CO3: Students will possess the ability to effectively use MongoDB commands, perform various tasks in Mongo DB, manage bulk documents, and work with arrays in MongoDB, enabling them to work with NoSQL databases for data storage and retrieval efficiently.

CO4: Students will be proficient in implementing MapReduce in MongoDB, utilizing aggregate functions for data analysis, and performing data import and export operations, equipping them with essential skills for processing and managing data in MongoDB efficiently.

CO5: Students will be adept at installing Spark, performing operations on RDDs (Resilient Distributed Datasets), working with DataFrames, and conducting Spark SQL operations, enabling them to harness the power of distributed data processing with Apache Spark for various data analysis tasks.

1. Hadoop Installation Steps. (CO1,L3)
2. Hadoop Commands. (CO1,L3)
3. Word Count Program in Hadoop. (CO2,L1)
4. Pig Installation Steps. (CO2,L3)
5. Pig Commands. (CO3,L3)
6. Introduction To Mongodb. (CO3,BTL1)
7. Mongodb Commands. (CO3,BTL3)
8. Tasks on Mongodb. (CO4,BTL3)

9. Creating Bulk Documents In Mongodb. (CO4,L6)
10. Arrays in Mongodb. (CO3,L1)
11. Map Reduce in Mongodb. (CO4,L3)
12. Aggregate Functions in Mongodb. (CO4,L3)
13. Mongo Import. (CO4,L3)
14. Mongo Export. (CO4,L3)
15. Spark Installation. (CO5,L3)
16. Operations of Rdd. (CO5,L3)
17. Working With Data Frames. (CO5,L3)
18. Spark Sql Operations. (CO5,L3)

APPENDIX-IV
PROGRAM STRUCTURE & SYLLABI FOR OPEN ELECTIVES

22OE301: R-PROGRAMMING

Course Name	R-Programming		L	T	P	C	CIA	SEE	TM
Course Code	22OE301		3	0	0	3	30	70	100
Year of Introduction: 2020	Year of Offering: 2023	Year of Revision: No Revision			Percentage of Revision: Nil				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose: This course provides a comprehensive understanding of R programming, descriptive statistics, bi-variate analysis, regression, analysis of variance, hypothesis testing, parametric and non-parametric tests, and connecting R to external interfaces for practical data analysis and interpretation. This course equip learners with essential skills in R programming and statistical analysis, enabling them to manipulate data, conduct hypothesis tests, perform regression analysis, and connect R to external interfaces for robust decision-making in various fields.

Course Objectives: This course will help the students to learn about Introduction to R Programming, Descriptive Statistics and Bi-variate Analysis using R, Regression Using R, Analysis of Variance Using R, Testing of Hypothesis Using R, Parametric Tests, Non Parametric Tests and Connecting R to External Interfaces.

Specific objectives include:
- To provide an understanding on Introduction to R Programming ..
- To learn Descriptive Statistics and Bi-variate Analysis using R
- To gain knowledge on Regression Using R and Analysis of Variance Using R.
- To lean about Testing of Hypothesis Using R, Parametric Tests and Non Parametric Tests.
- To provide understanding on Connecting R to External Interfaces.

Course Outcomes:

CO1: By mastering R programming fundamentals, data manipulation techniques, and statistical functions, students will gain the ability to explore, analyze, and visualize diverse datasets effectively, making informed decisions through a variety of data representation methods.

CO2: Students will develop expertise in descriptive statistics, mastering measures of central tendency, dispersion, and correlation, enabling them to analyze diverse data sets, discern patterns, and make informed decisions in both categorical and numerical contexts.

CO3: Students will master regression techniques (simple linear, multiple linear, and logistic) and ANOVA methods (one-way, two-way, multivariate, and repeated measures), enabling them to model complex relationships and conduct in-depth analysis of variance in diverse datasets using R programming.

CO4: Students will acquire expertise in hypothesis testing methodologies, mastering the steps and types of hypothesis testing, as well as parametric tests (t-test, z-test, f-test) and non-parametric tests (Mann-Whitney U test, Kruskal-Wallis test, Chi-Square test), empowering them to assess and draw valid conclusions from a wide array of data sets using R programming.

CO5: Students will gain the ability to seamlessly connect R to external interfaces, including CSV files, Microsoft Excel, databases (MySQL), XML files, and JSON files, enabling them to efficiently import, export, manipulate, and analyze data from diverse sources, enhancing their data integration and analysis capabilities.

UNIT-I (12 Hours)

Introduction to R Programming: Why use R?, R Features, R Environment, Working with R Packages, Define Dataset, Data Types using R, Data Structures using R, Missing Values, Sorting Data, Merging Datasets, Subsetting Datasets, Operators in R, Important Statistical Functions in R, Exploratory Data Analysis - Bar Chart, Pie Chart, Histogram, Line Plot, Box Plot, Scatter Plot and Density Plot.

UNIT-II (12 Hours)

Descriptive Statistics and Bi-variate Analysis using R: Introduction to Descriptive Statistics Measures of Central Tendency, Measures of Dispersion of Variability, Measures of Shapes-Skewness and Kurtosis, Correlation Meaning - Types of Correlation-Measures of Correlation - Scatter Diagram, Karl Pearson's Coefficient of Correlation, Spearman's Rank Correlation Coefficient, Bi Serial Correlation, Bi-variate Analysis of Categorical Variables and Numerical Variables.

UNIT-III (12 Hours)

Regression Using R: Estimation the Method of Least Square, Introduction to regression, Types of Regression Models-Simple Linear Regression, Multiple Linear Regression, Logistic Regression and its implementation using R Programming

Analysis of Variance Using R: Definition of ANOVA, Types of ANOVA - One way ANOVA-Two way ANOVA-Multivariate Analysis of Variance (MANOVA) and Repeated Measure ANOVA

UNIT-IV (12 Hours)

Testing of Hypothesis Using R: Definition of Hypothesis Testing, Steps in Testing of Hypothesis, Types of Hypothesis Testing - Null Hypothesis, Alternative Hypothesis and Statistical Hypothesis.

Parametric Tests: t-test, z-test and f-test, Differences between t-test and z-test.

Non Parametric Tests: The Mann Whitney U Test, Kruskal Wallis Test and Chi Square Test.

UNIT-V (12 Hours)

Connecting R to External Interfaces: CSV Files (Reading From a CSV File, Writing to a CSV File) - Microsoft Excel (Reading from XLSX File, Writing to XLSX File) - Databases (Connecting R to MYSQL (Creating Tables, Inserting Rows, Updating Rows, Deleting Rows, Querying Rows, Querying Tables, Dropping Tables)) - XML Files (Reading From XML Files, JSON Files, Reading From JSON Files)

Reference Text Books:

1. Sharma, J. K., Business Statistics (UNIT-I,UNIT-III), New Delhi: Pearson Education, 2013
1. Anderson,D.,Sweeney,D.,Williams,T., Camm, J., & Cochran, J., Statistics for Business and Economics, Cengage Learning, 2013, New Delhi
2. Dr. Rob Kabacoff, R in Action: Data Analysis and Graphics with R (UNIT-IV), Manning Publications CO, Edition 2011.
3. Dr.Jeeva Jose, A Beginners Guide for Data Analysis Using R Programming. (UNIT-II, UNIT-V, UNIT-III), Khanna Book Publishing Co.(P) Ltd, Edition 2019.
4. Michael J. Crawley, John Wiley & Sons, Statistics: An Introduction using R, Weily, 2015.
5. Aczel,A.D.& Sounderpandian, J, Complete Business Statistics, Tata McGraw Hill, 2011, New Delhi.
6. Davis, G., & Pecar, B., Business Statistics using Excel, New Delhi: Oxford University Press, 2014.

PARVATHANENI BRAHMAYYA SIDDHARTHA COLLEGE OF ARTS & SCIENCE

(An Autonomous College in the jurisdiction of Krishna University)

Course Name: R-Programming (Open Elective), Third Semester

Course Code: 22OE301

(w.e.f admitted batch 2022-23)

SECTION-A

Time: 3 Hours **Max. Marks: 70**

Answer ALL questions **(5×4 = 20 Marks)**

1. (a) What are the different *Data Types* used in R ? (CO1,L1)

(or)

(b) What are the important statistical functions used in R.?(CO1, L1)

2. (a) Explain about Skewness as a measure of shape in Descriptive Statistics (CO2,L2)

(or)

(b) Explain about Types of Correlations used in R (CO2, L2)

3. a) Explain about Logistic Regression used in R CO3,L5)

(or)

b) Explain about MANOVA used in R (CO3,L5)

4. (a) What are the different steps used in hypothesis testing? (CO4.L1)

(or)

(b) What is meant by f-test with example ? (CO4,L1)

5. a) How we can insert data into R using MYSQL ? (CO5,L2)

(or)

b) Explain process of reading data from XML file with example (CO5, L2)

SECTION-B

Answer Five Questions Choosing One Question from Each Unit.

All Questions Carry Equal Marks. **(5×10 = 50 Marks)**

6. (a) Outline the different *Data Structures* used in R. (CO1,L2)

(or)

(b) Explain about different Operators in R. (CO1,L2)

7. (a) Explain measure of central tendency and measure of dispersion used in *Descriptive Statistic*s (CO2,L2)

(or)

(b) Explain Bi-variate Analysis of Categorical Variables and Numerical Variables using R with examples **.** (CO2,L2)

8. (a) Apply Simple Linear Regression and Multiple Linear Regression using R. (CO3,L3)

(or)

(b) Construct One Way ANOVA and Two Way ANOVA using R. (CO3, L3)

9. (a) Explain different Types of Hypothesis Testing used in R. (CO4,L2)

(or)

(b) Explain about z-test and its types used in R with examples. (CO4,L2)

10. (a) Explain process of Reading and writing data from CSV and Excel files with examples. (CO5,L5)

(or)

(b) How do you connect to a database in R using MYSQL ? Give one example (CO5, L5)

22OE302: MOBILE NETWORKS

Course Name	Mobile Networks			L	T	P	C	CIA	SEE	TM
Course Code	22OE302			3	0	0	3	30	70	100
Year of Introduction: 2023	Year of Offering: 2023	Year of Revision: No Revision		Percentage of Revision: Nil						
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks										

Course Descriptive and Purpose: The primary objective of the Mobile Network course is to help learners understand the fundamental principles and concepts of mobile computing and telecommunication systems. Upon completion of the course, learners will be able to understand the basics of mobile telecommunication systems, network layer protocols, transport and application layer protocols, and different mobile platforms. They will also be able to develop applications for mobile platforms.
Course Objectives: This course will help the students to learn about basic concepts of Computer Networks, TCP/IP Protocol & Internet Protocol, Types of Cellular Networks, MANETS and Wireless Sensor Networks.

Specific objectives include:
- To provide understanding of the basic concepts of Computer Networks.
- To gain knowledge on TCP/IP Protocol & Internet Protocol.
- To understand various types of Cellular Networks.
- To gain knowledge on MANETS.
- To provide basic knowledge on Wireless Sensor Networks.

Course outcomes:
Upon successful completion of the course, the student will be able to:
CO1: To demonstrate a comprehensive understanding of computer networks, including LANs and VANs, network devices, various network topologies, and the role of hubs in network communication.
CO2: Acquire deep understanding of the TCP/IP protocol stack, the uses and functions of TCP protocols, and will be able to discern and explain the key differences between IPv4 and IPv6 addressing schemes.
CO3: Have a comprehensive knowledge of the evolution of mobile communication networks from 1G to 5G, including their distinctive features, an understanding of GSM architecture, and insight into GPS architecture.
CO4: Proficient in identifying MANETs, providing examples of MANET applications, recognizing the issues and challenges associated with MANETs, and understanding the practical applications of MANET technology.
CO5: Capable of defining wireless sensor networks, articulating their advantages and applications, comprehending the concept of the Internet of Things (IoT), and explaining the integration of IoT with wireless sensor networks for various practical scenarios.

SYLLABUS

UNIT-I (12 Hours)

Computer Networks: LAN, VAN, Network Device, Hubs, Networks Topologies.

UNIT-II (12 Hours)

TCP/IP: TCP/IP Protocol Stack, Uses & Functions of TCP Protocols, Difference between IPV4 and IPV6.

UNIT-III (12 Hours)

Cellular Networks: 1G, 2G, 3G, 4G and 5G and Features of these Networks, GSM Architecture, GPS Architecture.

UNIT-IV (12 Hours)

MANETS: MANETS, Examples of MANETS, Issues and Challenges of MANETS, Application of MANETS.

UNIT-V (12 Hours)

Wireless Sensor Networks: Wireless Sensor Networks, Advantages and uses of Wireless Sensor Networks, IOT, Integration of IOT with Wireless Sensor Networks.

Text Book:

1. Computer Networks, Andrew S.Tanenbaum, 5th Edition, Pearson, 2010

References:

1. Itu-t recommendations networks 2.0-3.0
1. Itu-t recommendation for next network 2030
2. Itu-t recommendation aloha

PARVATHANENI BRAHMAYYA SIDDHARTHA COLLEGE OF ARTS & SCIENCE

(An Autonomous College in the jurisdiction of Krishna University)

Course Name: Mobile Networks

Course Code: 22OE302

(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70**

SECTION-A

Answer ALL Questions **(5×4=20Marks)**

1.(a)Explain LAN.(CO1,L2)

(or)

(b) Explain Hubs. (CO1,L2)

2. (a) What is Protocol? Explain TCP/IP Protocol Stack. (CO2,L1)

(or)

(b) List out and explain Functions of TCP Protocols. (CO2,L1)

3.(a) What are the differences between 4G and 5G Networks.(CO3,L1)

(or)

(b) List out the services of GSM. (CO3,L1)

4.(a) Explain Applications of MANETS. (CO4,L2)

(or)

(b) Explain MANETS briefly. (CO4,L2)

5.(a) Explain advantages of Wireless Sensor Networks. (CO5,L2)

(or)

(b) Explain IOT.(CO5,L2)

SECTION-B

Answer Five Questions Choosing One Question from each unit.

All Questions Carry Equal Marks. **(5×10=50Marks)**

6. (a) Explain about VAN and its working.(CO1,L2)

(or)

(b) Explain different Networks Topologies. (CO1,L2)

7. (a) Divide various Protocols in TCP/IP Protocol Stack. (CO2.L4)

(or)

(b) Differentiate IPV4 and IPV6. (CO2, L4)

8. (a) What is cellular network? Explain features of 1G, 2G and 3G Networks. (CO3,L1)

(or)

(b) What is GPS? Explain GPS Architecture. (CO3,L1)

9. (a) Explain in detail about MANETS.(CO4,L2)

(or)

(b) Explain Issues and Challenges of MANETS. (CO4,L2)

13. (a) Explain about Wireless Sensor Networks.(CO5,L5)

(or)

(b) Explain process of Integration of IOT with Wireless Sensor Networks. (CO5,L5

22OE303: UNIX PROGRAMMING

Course Name	UNIX Programming		L	T	P	C	CIA	SEE	TM
Course Code	22OE303		3	0	0	3	30	70	100
Year of Introduction:	Year of Offering: 2023	Year of Revision: No Revision			Percentage of Revision: Nil				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Descriptive and Purpose: UNIX is to provide simple, powerful tools that can be combined to perform complex tasks. It features a command-line interface that allows users to interact with the system through a series of commands, rather than through a graphical user interface (GUI).

Course Objectives: This course will help the students to learn about fundamental concepts of UNIX, UNIX File System, Shell Programming and Process Concepts.

Specific objectives include:
- To provide an understanding of the Basics of UNIX, Commands and Basic File System.
- To learn various Loops in Shell Programming
- To apply Filters.
- To learn Shell Programming.
- To provide understanding on Probability Distributions and Statistics using R.

Course Outcomes:
Upon successful completion of the course, the student will be able to:
CO1: Have a comprehensive understanding of Unix, including its history, components, basic commands, command substitution, and the ability to effectively use Unix for various tasks.
CO2: Possess a comprehensive knowledge of Unix file systems, including understanding file basics, directories, permissions, INodes, file attributes, and how to manipulate file permissions, ownership, and group associations effectively.
CO3: Proficient in using various Unix filters, including the Grep family, Sed, and AWK, to search, process, and manipulate text data, making you capable of working efficiently with Unix text files.
CO4: have a comprehensive understanding of shell programming in Unix, including variables, control structures, commands, and debugging techniques, enabling you to create and manage shell scripts effectively.
CO5: Possess a deep knowledge of Unix processes, including their types, creation, management, and job control, empowering you to efficiently work with and manipulate processes in a Unix environment.

SYLLABUS

UNIT-I (12 Hours)

Introduction to Unix: Brief History, What is Unix, Unix Components, Using Unix, Commands in Unix, Some Basic Commands, Command Substitution, Giving Multiple Commands.

The File System: The Basics of Files, What's in a File, Directories and File Names, Permissions, INodes, The Directory Hierarchy, File Attributes and Permissions, The File Command, Knowing the FileType, The Chmod Command, Changing File Permissions, The Chown Command, Changing the Owner of a File, The Chgrp Command, Changing the Group of a File.

UNIT-II (12 Hours)

Using the Shell: Command Line Structure, Met Characters, Relating New Commands, Command Arguments and Parameters, Program Output as Arguments, Shell Variables, More on I/O Redirection, Looping in Shell Programs.

UNIT-III (12 Hours)

Filters: The Grep Family, Other Filters, The Stream Editor Sed, The AWK Pattern Scanning and Processing Language, Good Files and Good Filters

UNIT-IV (12 Hours)

Shell Programming: Shell Variables, The Export Command, The Profile File a Script Run During Starting, The First Shell Script, The Read Command, Positional Parameters, The $? Variable, Knowing the Exit Status, More about the Set Command, The Exit Command, Branching Control Structures, Loop Control Structures, The Continue and Break Statement, The Expr Command: Performing Integer Arithmetic, Real Arithmetic in Shell Programs, The here Document(<<), The Sleep Command, Debugging Scripts, The Script Command, The Eval Command, The Exec Command.

UNIT-V (12 Hours)

The Process: The Meaning, Parent and Child Processes, Types of Processes, More about Foreground and Background Processes, Internal and External Commands, Process Creation, The Trap Command, The Stty Command, The Kill Command, Job Control.

Reference Text Books:

1. W.Kernighan & RobPike, The Unix Programming Environment by Brain, Pearson, 1st Edition, 1984
1. M.G.Venkatesh Murthy, Introduction to Unix Shell Programming, Pearson, 1st Edition, 2005
2. B.M.Harwani, Unix and Shell Programming, OXFORD University Press, 2013

PARVATHANENI BRAHMAYYA SIDDHARTHA COLLEGE OF ARTS & SCIENCE

(An Autonomous College in the jurisdiction of Krishna University)

Course Name: UNIX PROGRAMMING

Course Code: 22OE303, Third Semester

(w.e.f admitted batch 2023-24)

Time: 3 Hours **Max Marks: 70**

SECTION-A

Answer ALL questions **(5×4 = 20 Marks)**

1.(a) What is Shell? Explain the Types of Shells. (CO1,L1)

(or)

(b) State I/O re-direction with examples. (CO1,L1)

2.(a) Write File Permission commands with examples. (CO2,L1)

(or)

(b) Write short notes on Command Substitution with example. (CO2,L1)

3.(a) Write short note on Filters in UNIX with examples. (CO3,L1)

(or)

(b) State merits of AWK Scripting. (CO3,L1)

4. (a) Write short note on significance of Regular Expression with grep command. (CO4,L1)

(or)

(b) Write short note on significance of exit status in Shell Programming. (CO4,L1)

5. (a) Distinguish between Internal and External commands. (CO5,L4)

(or)

(b) Examine process of debugging a Shell Script. (CO5,L4)

SECTION-B

Answer Five Questions Choosing One Question from each unit.

All Questions Carry Equal Marks. **(5×10=50Marks)**

6.(a) Explain the concepts of Unix File System with neat diagram.(CO1,L2)

(or)

(b) Explain the chmod and chown and chgrp commands with examples. (CO1,L2)

7. (a) Make use of Loop Control in Shell Programming with example (CO2,L3)

(or)

(b) Make use of Shell Script that Backup Files in Directory to another Directory. (CO2,L3)

8. (a) Distinguish between sed and AWK. (CO3,L4)

(b) Examine grep command with examples. (CO3,L4)

(or)

(c) Test for awk script to process a text file with different delimiters. (CO3,L4)

9. (a) Explain Branch Control and Loop Control Statements in Unix Shell Programming. (CO4,L2)

(or)

(b) Explain the usage of following command with examples. (CO2,L2)

(i).eval (ii) exec (iii) set (iv) exit (v) expr

10. (a) Explain the types of process in unix environment with examples. (CO5,L5)

(or)

(b) Explain the creation process in unix environment and its significance. (CO5,L5)

(c) Explain the usage of following command with examples. (CO5,L5)

(i) trap (ii) kill (iii) stty

22OE304: POWER BI

Course Name	Power BI		L	T	P	C	CIA	SEE	TM
Course Code	22OE304		0	0	6	3	30	70	100
Year of Introduction: 2023	**Year of Offering:** 2023	**Year of Revision**: 2023			**Percentage of Revision:** 100				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose: The course is intended to cover, Introduction Power Pivot, Data Operations, Power Pivot & Data Operations, Power Pivot Model, and Power BI Environment.

Course Objective: The course aims to provide a comprehensive understanding of Power Pivot and Data Operations, enabling students to proficiently create, manipulate, and optimize Power Pivot models within the Power BI environment, fostering advanced data analysis and visualization skills.

Specific Objectives include:
- To understand Power Pivot.
- To know Data Operations.
- To implement Power Pivot & Data Operations.
- To use Power Pivot Model.
- To use Power BI Environment.

Course Outcome:

CO1: Upon completing this course, participants will gain expertise the utilization of Power Pivot and the xVelocity in-memory Analytics Engine for effective data exploration, model management, and advanced analysis through pivot tables.
CO2: Upon completing this course, students develop expertise in data operations by mastering the techniques to import data from relational databases, text files, data feeds, and OLAP cubes, enabling seamless integration and analysis of diverse data sources.
CO3: The Power Pivot & Data Operations course enables participants to proficiently discover, import, cleanse, merge, shape, filter, aggregate data from diverse sources, and insert calculated columns using Power Pivot, empowering them to efficiently analyze and manipulate data for strategic decision-making.
CO4: The Power Pivot Model course empowers participants to create sophisticated data models, establish relationships, implement star schemas, optimize data denormalization, and effectively utilize linked tables, enabling them to design advanced, efficient, and comprehensive data structures for enhanced analytical insights and reporting capabilities.
CO5: The Power BI course equips participants with the skills to navigate the Power BI environment, proficiently acquire, clean, and shape data, establish meaningful table relationships, integrate calculations and measures, and perform advanced time-based analysis, enabling them to create powerful, insightful, and visually compelling business intelligence solutions.

UNIT-I (12 Hours)

Introduction Power Pivot: Introduction of Pivot - Use Power Pivot - xVelocity in-memory Analytics Engine - Exploring the Data Model Management Interface - Analyzing Data using a Pivot Table.

UNIT-II (12 Hours)

Data Operations: Working with Data - Import data from Relational Databases - Import Data from Text Files - Import Data from a Data Feed - Import Data from an OLAP Cube.

UNIT-III (12 Hours)

Power Pivot & Data Operations: Data Munging - Discover and Import Data from Various Sources - Cleanse Data - Merge, Shape, and Filter Data - Group and Aggregate Data - Insert Calculated Columns.

UNIT-IV (12 Hours)

Power Pivot Model: Creating Data Model - Explain what a Data Model is - Create relationships between Tables in the Model - Create and use a Star Schema - Understand when and how to Denormalize the Data - Create and Use Linked Tables.

UNIT-V (12 Hours)

Power BI: Power BI Environment - Getting, Cleaning, and Shaping Data - Creating Table Relationships - Adding Calculations and Measures - Incorporating Time-Based Analysis.

Prescribed Text Books			
S.No	**Author**	**Title**	**Publisher**
1	Powell Brett	Power BI 2021 - Volume 3 (English, Paperback, F Silva Roger)	ISBN: 9798711316824
2	F Silva Roger	Mastering Microsoft Power BI	Publisher: Packt Publishing Limited ISBN: 9781788297233, 9781788297233
3	Hutchinson Jeff	Microsoft Power BI Desktop - Creating Visual Reports	ISBN: 9781081588908 Independently Published

Reference Text Book			
S.No	**Author**	**Title**	**Publisher**
1	Dan Clark	Beginning Power BI: A Practical Guide to Self-Service Data Analytics with Excel 2016 and Power BI Desktop Second Edition	A Press

Course Delivery method: Face-to-face
Course has focus on: Foundation
Websites of Interest:

1. https://books.google.co.in/books?id=Da8-DgAAQBAJ&newbks=0&printsec=frontcover&hl=en&source=newbks_fb&redir_esc=y#v=onepage&q&f=false

Co-curricular Activities: (Case Studies)

List of Experiments

1.Write the Procedure for preparing a Pivot in Excel and prepare a Dashboard using sample marketing data.
(a) Offline Data and Online Data. (CO1,L1)
(b) Online to Online using Google Forms. (CO1,L1)

2. Installation of Power BI and its procedure. (CO3, L1)

3. Explain the procedure in importing various format files in Power BI, write its observations. (CO3, L5)

4. Demonstrate Power BI Data Models (Schemas in Power BI). (CO2,L3)

5. How to edit data in Power BI when data is exported use few Data Cleaning Techniques (Munging). (CO3,L1)

6. Advance Data Cleaning Techniques, Data Munging and Data Collection and Collaboration Techniques. (CO5,L3)

7. Write the procedure in building an association (Power Query) identify various schemas in Power BI. (CO1,L4)

8. Create Data Visualization (Charts for a Sample Data) Constructions and Analysis.(CO4,L6)

9. Step in preparing a Dashboard for the organization. (CO5,L3)

10. Constructing Quick Measures and Dax Formulas.(CO5,L3)

(An Autonomous College in the jurisdiction of Krishna University)

Course Name: *Power BI*

Course Code: 22OE304

Course Type: Open Elective (Laboratory)

(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70**

SECTION-A

Answer any Two of the following questions **(2×35=70 Marks)**

1. Write the Procedure for preparing a Pivot in Excel and prepare a Dashboard using sample marketing data.
   (a) Offline Data and Online Data. (CO1,L1)
   (b) Online to Online using Google Forms. (CO1,L1)

2. (a) Create Data Visualization (Charts for a Sample Data) Constructions and Analysis.(CO4,L6)
   (b) Explain the procedure in importing various format files in Power BI, write its observations. (CO2, L5)

3.(a) How to edit data in Power BI when data is exported use few Data Cleaning Techniques (Munging). (CO3,L1)
   (b) Write the procedure in building an association (Power Query) identify various schemas in Power BI. (CO1,L4)

Evaluation criteria for Laboratory										
Record	Exercise 1(a)		Exercise 1(b)		Exercise 2(a)		Exercise 2(b)		VivaVoce	Total
10 Marks	Written Procedure	Execution	Written Procedure	Execution	Written Procedure	Execution	Written Procudure	Execution	10 Marks	70 Marks
	10 Marks	10 Marks	10 Marks	10 Marks	10 Marks	10 Marks	10 Marks	10 Marks		

22OE305: PYTHON PROGRAMMING

Course Name	Python Programming			L	T	P	C	CIA	SEE	TM
Course Code	22OE305			3	0	0	3	30	70	100
Year of Introduction: 2019	Year of Offering: 2023	Year of Revision: 2023		Percentage of Revision: Nil						
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks										

Course Description and Purpose: Python Programming is a course that illustrates basic concepts of Python programming, Decision Control Statements, Functions and Modules, Python Strings Revisited, Data Structures, Classes and Objects, Inheritance, and Operator Overloading.

Course Objectives: This course will help enable the students t o understand, learn and develop a various Decision Control Statements, Functions & Modules, Strings, Data Structures, Classes and Objects, Inheritance, and Operator Overloading.

Specific objectives include:
- To understand basics of *Python Programming*.
- To gain knowledge on *Decision Control Statements* and *Functions & Modules.*
- To gain knowledge on *Python Strings* and *Data Structures*.
- To gain knowledge on *Classes & Objects.*
- To apply Inheritance, *Operator Overloading* and *Error and Exception Handling.*

Course Learning Outcomes:
Upon successful completion of the course, the student will be able to:
CO1: Have a foundational understanding of Python programming, including its features, historical context, and future prospects, and will be able to write and execute basic Python programs, work with literal constants, variables, data types, input operations, comments, reserved words, indentation, operators, and expressions, including operations on strings and other data types, along with type conversion.
CO2: Proficiency in using decision control statements, including conditional branching, loop structures, nested loops, and related control statements like break, continue, pass, and the integration of the else statement with loops in Python for effective program control flow.
CO3: Possess a comprehensive understanding of Python string manipulation, including concatenation, formatting, and regular expressions, as well as proficiency in working with various data structures such as sequences (lists, tuples), sets, dictionaries, and functional programming concepts in Python, enabling them to manipulate data effectively in Python programs.
CO4: Have solid grasp of object-oriented programming concepts in Python, including classes, objects, class methods, instance variables, private data members, and the use of built-in class attributes, enabling them to design and work with Python classes effectively.
CO5: Understand the concepts of inheritance in Python, including various types of inheritance, abstract classes, and interfaces. Additionally, they will be proficient in error and exception handling, encompassing the identification and management of exceptions, both built-in and user-defined. Furthermore, students will have the capability to implement operator overloading in Python, recognizing its advantages and practical applications.

UNIT-I

Basics of Python Programming: Features of Python, History of Python, The Future of Python, Writing and Executing First Python Program, Literal Constants, Variables and Identifiers, Data Types, Input Operation, Comments, Reserved Words, Indentation, Operators and Expressions, Expressions in Python, Operations on Strings, Other Data Types, Type Conversion.

UNIT-II

Decision Control Statements: Conditional Branching Statements, Basic Loop Structures, Nested Loops, The break statement, The Continue Statement, The Pass Statement, The Else Statement used with Loops.
Functions and Modules: Function Definition, Function Call, Variable Scope and Lifetime, The Return Statement, More on Defining Functions, Recursive Functions, Modules, Packages in Python, Standard Library Modules.

UNIT-III

Python Strings Revisited: Concatenating, Appending and Multiplying Strings, String Formatting Operator, Built in String Methods and Functions, Comparing Strings, Regular Expressions.
Data Structures: Sequence, Lists, Functional Programming, Tuple, Sets, Dictionaries.

UNIT-IV

Classes and Objects: Classes and Objects, Class Method and self-Argument, Class variables and Object Variables, Public and Private Data Members, Private Methods, Calling a Class Method from Another Class Method, Built-in Class Attributes, Class Methods, Static Methods.

UNIT-V

Inheritance: Inheriting Classes in Python, Types of Inheritance, Abstract Classes and Interfaces.
Error and Exception Handling: Introduction to Errors and Exceptions, Handling Exceptions, Raising Exceptions, Built- in and User defined Exceptions
Operator Overloading: Concept of Operator Overloading, Advantage of Operator Overloading, Implementing Operator Overloading.

Text Book:

1. Reema Thareja, Python Programming Using Problem Solving Approach, Oxford University Press, June 2017.

Reference Books:

1. Vamsi Kurama, Python Programming, A Modern Approach, Pearson, 2017.
1. Wesley Chun, Core Python Programming, Prentice Hall, December 2000.

e-resources: https://www.w3schools.com/python/pandas/

PARVATHANENI BRAHMAYYA SIDDHARTHA COLLEGE OF ARTS & SCIENCE

(An Autonomous College in the jurisdiction of Krishna University)

Course Name: Python Programming

Course Code: 22OE305

(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70**

SECTION-A

Answer ALL questions **(5×4 = 20 Marks)**

1. (a) Explain *Future of Python* .(CO1,L2)

(or)

(b) Explain different *Data Types* in *Python.* (CO1,L2)

2. (a) What is *Recursive Function*? Explain with *example*.(CO2,L1)

(or)

(b) What are *break* and *continue* statements?(CO2,L1)

3. (a) What is *Appending* and *multiplying Strings*? (CO3,L1)

(or)

(b) Write in short about *Dictionaries.*(CO3,L1)

4. (a) What is *class method* and *self argument*? (CO4,L2)

(or)

(b) Differentiate *Class Variables* and *static variables*.(CO4,L2)

5. (a) Explain *Advantages of Operator Overloading.* (CO5,L2)

(or)

(b) What is *Exception Handling?* (CO5,L2)

SECTION-B

Answer Five Questions Choosing One Question from Each Unit.

All Questions Carry Equal Marks. **(5×10 = 50 Marks)**

6. (a) Explain the *features of Python Programming Language*.(CO1,L2)

(or)

(b) Explain various *Operators* in Python with examples.(CO1,L2)

7. (a) Apply *Different Loops* in Python with example. (CO2.L3)

(or)

(b) Apply *Modules Concept* in Python with examples. (CO2, L3)

8. (a) Explain *Built in String methods* with examples.(CO3,L1)

(or)

(b) Build the *List Data Structure* and their built in functions with examples. (CO3,L1)

9. (a) What are C*lasses* and *Objects* ? Illustrate classes and objects in python.(CO4,L2)

(or)

(b) Explain *Class Methods* and *Static Methods* with examples. (CO4,L2)

10. (a) Explain different *Types of Inheritance* with an example. (CO5,L5)

(or)

(b) Explain how to Implement *Operator Overloading* in Python. (CO5,L5)