Pimpri Chinchwad Education Trust's

Pimpri Chinchwad University

Sathe, Pune - 412106

PCET's Pimpri Chinchwad University

Learn | Grow | Achieve

Curriculum Structure

M.C.A.

(Revised 2024 Pattern)

School of Computer Applications

Effective from Academic Year 2024-25

Program Curriculum

Preamble:

At Pimpri Chinchwad University, we present the Master of Computer Application (MCA), a Post Graduate Program designed to equip students with a comprehensive understanding of Computer Science and Application. As aspiring professionals in the field of computing, we acknowledge the weight of responsibility that accompanies our education. Upholding the highest standards of integrity, professionalism, and ethical conduct is fundamental to our academic pursuits and beyond. We embrace the imperative of continuous learning and adaptability in an era marked by rapid technological advancement, pledging to proactively seek new knowledge and master emerging technologies.

The MCA program curriculum is designed to provide students with a strong foundation in computer science, programming languages, software engineering, database management systems, and computer networks. The program also includes courses on business management and soft skills to prepare students for a career in the IT industry

Overall, an MCA program aims to provide students with a well-rounded education that prepares them for a successful career in the IT industry and for further academic pursuits.

Vision and Mission of Program:

Vision:
To create computer application specialists who will benefit society, industry, and all stakeholders

Mission:
To provide people in the computer application sector with valuable academic, research, and employment prospects as well as social consciousness with ethical principles.

Program Outcomes:

Here are some possible Program Outcomes (POs) for a Master of Computer Application (MCA) program:

1. Computational Knowledge: Understand and apply mathematical foundation, computing, and domain knowledge for the conceptualization of computing models from defined problems.
2. Problem Analysis: Ability to identify, critically analyze, and formulate complex computing problems using fundamentals of computer science and application domains.
3. Design and Development of Solutions: Ability to transform complex business scenarios and contemporary issues into problems, investigate, understand, and propose integrated solutions using emerging technologies.
4. Conduct Investigations of Complex Computing Problems: Ability to devise and conduct experiments, interpret data, and provide well-informed conclusions.
5. Modern Tool Usage: Ability to select modern computing tools, skills, and techniques necessary for innovative software solutions
6. Professional Ethics: Ability to apply and commit professional ethics and cyber regulations in a global economic environment.
7. Life-long Learning: Recognize the need for and develop the ability to engage in continuous learning as a Computing professional.
8. Project Management: Ability to understand management and computing principles with computing knowledge to manage projects in multidisciplinary environments.
9. Communication Efficacy: Communicate effectively with the computing community as well as society by being able to comprehend effective documentation and presentations.
10. Societal & Environmental Concern: Ability to recognize economic, environmental, social, health, legal, and ethical issues involved in the use of computer technology and other consequential responsibilities relevant to professional practice.
11. Individual & Team Work: Ability to work as a member or leader in diverse teams in a multidisciplinary environment.
12. Innovation and Entrepreneurship: Identify opportunities, entrepreneurship vision, and use of innovative ideas to create value and wealth for the betterment of the individual and society.

Program Educational Objectives:

Here are some possible Program Educational Objectives (PEOs) for a Master of Computer Applications (MCA) program:

To prepare the youth to take up positions as system analysts, system engineers, software engineers, and Programmers.

1. To aim at developing systems thinking, abstract thinking, skills to analyze and synthesize, and skills to apply knowledge through extensive problem-solving sessions, hands-on practice under various hardware and software environments, and projects developed.
2. To prepare students with social interaction skills, communication skills, life skills, entrepreneurial skills, and research skills, which are necessary for career growth and for leading a quality life.

Program Specific Outcomes:

PSO1-- Comprehend and implement mathematical and industrial principles in computing methodologies to address real-time industrial issues.

PSO2:-Utilizing the most recent computer tools and technologies, analyze, design, develop, test, and maintain software applications.

PSO3: the capacity to employ computer technology and mathematical and computer science skills to solve business difficulties

INDEX

CURRICULUM FRAMEWORK

Sr. No.	Type of course	Abbreviations
1	Major	**MAJ**
2	Elective (Minor Stream and Vocational and Program Specific)	**MIN**
3	Open Electives	**OE**
4	Ability Enhancement Courses	**AEC**
5	Skill Enhancement Courses(MOOC)	**SEC**
6	Vocational Skill Course	**VSC**
7	Summer Internship and On Job Training	**OJT**
8	Project	**PROJ**
9	Field Project	**FP**
10	Indian Knowledge System	**IKS**
11	Co-Curriculum	**CC**
12	Community Engagement Program	**CEP**
13	Value Education Course	**VEC**

Sr. No.	Type of course	No. of Courses	Total Credits	
			No	%
1	Major	**15**	**35**	**48.4**
2	Elective (Minor Stream and Vocational and Program Specific)	**3**	**9**	**9.7**
3	Ability Enhancement Courses	**4**	**2**	**12.9**
4	Skill Enhancement Courses(MOOC)	**2**	**4**	**6.5**
5	Vocational Skill Course	**1**	**3**	**3.2**
6	Summer Internship and On Job Training	**1**	**14**	**3.2**
7	Field Project	**3**	**7**	**9.7**
9	Value Education Course	**2**	**6**	**6.5**
	Total	**31**	**80**	**100**

CREDIT DISTRIBUTION: SEMESTER WISE

Sr. No.	Type of course	No. of Credits and Semester				Total
		1	2	3	4	
1	Major	11	11	10	3	**35**
2	Elective (Minor Stream and Vocational and Program Specific)	3	3	3	-	**9**
3	Ability Enhancement Courses	-	2	-	-	**2**
4	Skill Enhancement Courses(MOOC)	-	2	2	-	**4**
5	Vocational Skill Course	-	-	-	3	**3**
6	Summer Internship and On Job Training	-	-	-	12	**12**
7	Field Project	3	2	2	-	**7**
8	Seminar / Workshop				2	**2**
9	Value Education Course (Audit Courses)	3	-	3	-	**6**
Total		20	20	20	20	**80**

COURSE CODE NOMENCLATURE

COURSE CODE NOMENCLATURE			
Sr No.	Course Code	Course Type	Course Name
1	PMC101	Python Programming	MAJM
2	PMC102	Python Programming Lab	MAJM
3	PMC103	Data Structures and Algorithms	MAJM
4	PMC104	Data Structures and Algorithms Lab	MAJM
5	PMC105A	Fundamentals Of Software Quality Assurance	MAJE
6	PMC105B	Object Oriented Software Engineering	MAJE
7	PMC106	Probability and Combinatory	BSC
8	PMCM101	**Programming Paradigm (MOOC)**	SEC
9	PMCM102	**Organizational Behaviour(MOOC)**	SEC
10	PMC107	Mini Project using Python / DSA	FP
11	PFL201A	Foreign Language-1:German	AEC
12	PFL201B	Foreign Language-2: Japanese	AEC
13	PMC109	Object Oriented Programming Using Java	MAJM
14	PMC110	Object Oriented Programming Using Java Lab	MAJM
15	PMC111	Big Data Analytics	MAJM
16	PMC112	Big Data Analytics Lab	MAJM
17	PMC113A	Computer Networks	MAJE
18	PMC113B	Network and Computer Security	MAJE
19	PMC114	Optimization Techniques	BSC

20	PMC115	Mini Project using Java / BDA	FP
21	PMCM103	Introduction to AI & ML(MOOC)	SEC
22	PMCM104	Web Application Security (MOOC)	SEC
23	PFL202A	Foreign Language-1: Japanese	AEC
24	PFL202B	Foreign Language-2: German	AEC
25	PDIEXMC101	Information security / MOOCs	VSC
26	PDIEXMC102	Project	VSC
27	PMC201	Cloud Computing	MAJM
28	PMC202	Cloud Computing Lab	MAJM
29	PMC203	Machine Learning Using Python	MAJM
30	PMC204	Machine Learning Using Python Lab	MAJM
31	PMC205A	Software Testing	MAJE
32	PMC205B	Software Project Management	MAJE
33	PMC206	Data Mining and Data Warehousing	SEC
34	PMC207	Research Methodology and IPR	VEC
35	PMCM105	Generative AI (MOOC)	VEC
36	PMC208	Mini project Using Python	FP
	SEMESTER-IV SCHEME A		
37	PMC209	Crypto and Blockchain	MAJM
38	PMC210	DevOps	VSC
39	PMC211	Seminar / Workshop	FP
40	PMC212	Major Project / Research Project / Internship	OJT
	SEMESTER-IV SCHEME B		
37	PMC209	Crypto and Blockchain MOOC	**SEC**

38	PMC210	DevOps MOOC	**SEC**
39	PMC211	Seminar/Workshop	FP
40	PMC212	Major Project / Research Project / Internship	OJT

PIMPRI CHINCHWAD UNIVERSITY, PUNE, MAHARASHTRA

SCHOOL OF COMPUTER APPLICATIONS

PROGRAM STRUCTURE

MASTER OF COMPUTER APPLICATIONS (M.C.A.) 2024 PATTERN

(Effective from the Academic Year (2024 - 2025)

SEMESTER I

COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME					ASSESSMENT SCHEME			
			TH	PR	TUT	CREDIT	HRS	CIA	ESA	PR /OR	TOTAL
PMC101	MAJM	Python Programming	3	-	-	3	3	40	60		100
PMC102	MAJM	Python Programming Lab	-	1	-	1	2	25		25	50
PMC103	MAJM	Data Structures and Algorithms	3	-	-	3	3	40	60		100
PMC104	MAJM	Data Structures and Algorithms Lab	-	1	-	1	2	25		25	50
PMC105	MAJE	Major Elective - I	3	-	-	3	3	40	60		100
PMC106	BSC	Probability and Combinatory	2	-	1	3	4	40	60		100
PMCM101	SEC	**Programming Paradigm MOOC**	2		-	2	2	25		25	50
PMCM102	SEC	**Organizational Behaviour(MOOC)**	2	-	-	2	2	25		25	50
PMC107	FP	Mini Project using Python / DSA	-	2	-	2	4	50		50	100
PFL201	AEC	Foreign Language - I	2	-	-	-	2	50			50
TOTAL			**17**	**4**	**1**	**20**	**27**	**360**	**240**	**150**	**750**
PMC105 MAJOR ELECTIVE - I											
PMC105A	MAJE	Fundamentals Of Software Quality Assurance	3	-	-	3	3	40	60		100
PMC105B	MAJE	Object Oriented Software Engineering	3	-	-	3	3	40	60		100
PFL201 FOREIGN LANGUAGE - I											
PFL201A	AEC	Foreign Language-1: German	2	-	-	-	2	50			50
PFL201B	AEC	Foreign Language-2: Japanese	2	-	-	-	2	50			50

SEMESTER: -II

COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME						ASSESSMENT SCHEME			
			TH	PR	TUT	CREDIT	HRS		CIA	ESA	PR/OR	TOTAL
PMC108	MAJM	Object Oriented Programming Using Java	3	-	-	3	3		40	60		100
PMC109	MAJM	Object Oriented Programming Using Java Lab	-	1	-	1	2		25		25	50
PMC110	MAJM	Big Data Analytics	3	-	-	3	3		40	60		100
PMC111	MAJM	Big Data Analytics Lab		1		1	2		25		25	50
PMC112	MAJE	Major Elective - II	3	-	-	3	3		40	60		100
PMC113	BSC	Optimization Techniques	2	-	1	3	4		40	60		100
PMC114	FP	Mini Project using Java / BDA	-	2	-	2	4		50	-	50	100
PMCM103	SEC	**Introduction to AI & ML(MOOC)**	-	-	-	2	2		25		25	50
PMCM104	SCE	**Web Application Security (MOOC)**	-	-	-	2	2		25		25	50
PFL202	AEC	Foreign Language - II	2	-	-	-	2		50			50
TOTAL			**17**	**4**	**1**	**20**	**27**		**360**	**240**	**150**	**750**
PMC112 MAJOR ELECTIVE - II												
PMC112A	MAJE	Computer Networks	3	-	-	3	3		40	60		100
PMC113B	MAJE	Network and Computer Security	3	-	-	3	3		40	60		100
PFL202 FOREIGN LANGUAGE - II												
PFL202A	AEC	Foreign Language-1: Japanese	2	-	-	-	2		50			50
PFL202B	AEC	Foreign Language-2: German	2	-	-	-	2		50			50

Exit Policy: PG Diploma in MCA: Students who opt to exit after completion of the first year and have scored the required credits offered by the school in the program structure will be awarded a PG Diploma in MCA, provided they must earn additional credits during the summer vacation of the first year

COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME						ASSESSMENT SCHEME			
			TH	PR	TUT	CREDIT	Hrs		CIA	ESA	PR/OR	TOTAL
PDIEXMC101	VSC	Information security / MOOCs	**2**	-	-	**2**	**2**		**50**	**-**	**-**	**50**
PDIEXMC102	VSC	Project	**-**	**4**	-	**4**	**8**		**50**	**-**	**50**	**100**

PIMPRI CHINCHWAD UNIVERSITY, PUNE, MAHARASHTRA

SCHOOL OF COMPUTER APPLICATIONS

PROGRAM STRUCTURE

MASTER OF COMPUTER APPLICATIONS (M.C.A.) REVISED 2024 PATTERN

(Effective from the Academic Year (2024 - 2025)

SEMESTER-III

COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME					ASSESSMENT SCHEME			
			TH	PR	TUT	CREDIT	HRS	CIA	ESA	PR / OR	TOTAL
PMC201	MAJM	Cloud Computing	3	-	-	3	3	40	60		100
PMC202	MAJM	Cloud Computing Lab	-	1	-	1	2	25		25	50
PMC203	MAJM	Machine Learning Using Python	3	-	-	3	3	40	60		100
PMC204	MAJM	Machine Learning Using Python Lab	-	1	-	1	2	25		25	50
PMC205	MAJE	Major Elective - III	3	-	-	3	3	40	60		100
PMC206	SEC	Data Mining and Data Warehousing	2	-	-	2	2	20	30		50
PMC207	VEC	Research Methodology and IPR	3	-	-	3	3	40	60		100
PMCM105	MOOC	**Generative AI (MOOC)**	2	-	-	2	-	25	-	25	50
PMC208	FP	Mini project Using Python	-	2	-	2	4	50	-	50	100
TOTAL			**16**	**4**	**0**	**20**	**22**	**305**	**270**	**125**	**700**
PMC205 MAJOR ELECTIVE - III											
PMC205A	MAJE	Software Testing	3	-	-	3	3	40	60		100
PMC205B	MAJE	Software Project Management	3	-	-	3	3	40	60		100

SEMESTER-IV SCHEME A											
COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME					ASSESSMENT SCHEME			
			TH	PR	TUT	CREDIT	HRS	CIA	ESA	PR / OR	TOTAL
PMC209	MAJM	Crypto and Blockchain	3	-		3	3	40	60		100
PMC210	VSC	DevOps	3	-		3	3	40	60		100
PMC211	FP	Seminar/Workshop				2	2	50			50
PMC212	OJT	Major Project / Research Project / Internship	-	12	-	12	24	250		250	500
TOTAL			**6**	**12**	**0**	**20**	**32**	**380**	**120**	**250**	**750**

SEMESTER-IV SCHEME B											
COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME					ASSESSMENT SCHEME			
			TH	PR	TUT	CREDIT	HRS	CIA	ESA	PR / OR	TOTAL
PMCM106	**MOOC**	IBM Data Science Professional Certificate	3	-		3	3	50		50	100
PMCM107	**MOOC**	Meta Front-End Developer Professional Certificate	3	-		3	3	50		50	100
PMC211	FP	Seminar/Workshop				2	2	50			50
PMC212	OJT	Major Project / Research Project / Internship	-	12	-	12	24	250		250	500
TOTAL			**6**	**12**	**0**	**20**	**32**	**400**	**-**	**350**	**750**

Note:

1. Scheme A – Regular Students (student should maintain a minimum attendance of 75%)
2. Scheme B – Students with Pre-Placement Offer (students should follow the activity schedule and report accordingly).

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MCA REVISED 2024 PATTERN

COURSE DETAILS

Semester - I

COURSE CURRICULUM

Course Contents and Syllabus:

Name of the Program:	**MCA**	**Semester : I**	**Level: PG**
Course Name	**Python Programming**	**Course Code and Course Type**	**PMC101 / MAJM**
Course Pattern	**Revised 2024**	**Version**	1.0

Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3	-	-	3	3	40	60	-

Prerequisite: Any Programming Language Basics, Basic Computer Skills

Course Objectives (CO):	The objectives of Python Programming are: 1. To comprehend the knowledge of Python, a script programming language. 2. To understand the flow of programming. 3. To apply and create different tools in Python. 4. To demonstrate knowledge of NumPy and Other libraries 5. To Design and implement file-handling concepts in Python.
Course Learning Outcomes (CLO):	Students will be able to: 1. To identify the basics of Python programming 2. To explain the control statements and functions with packages. 3. To comprehend the python programming strings and regular expressions 4. To apply knowledge of numpy and plotting tools in Python. 5. To analyse data by using file handling operations.

Details	**CLO**	**Hours**
UNIT I		
Introduction To Python: Script Model Programming, Understanding Python variables, basic Operators, Declaring and using Numeric data types: int, float, complex, using string data type and string operations, Defining list and list slicing, List manipulation using in build methods, Use of Tuple data type, Dictionary manipulation.	**CLO 1**	**9**
UNIT II		

Python Program Flow Control, Functions And Packages: Conditional blocks using if, else and elif, Simple for loops in python, For loop **using ranges, string, list and dictionaries, Use of while loops in python ,** Loop manipulation using pass, continue, break and else. Programming using Python conditional and loops block. Programming using string, list and dictionary in build functions. Organizing python codes using functions, Understanding Packages, Powerful Lambda function in Python Programming using functions, modules and external packages.	**CLO 2**	**9**
UNIT III		
Strings And Regular Expressions: Strings: Formatting, Comparison, Slicing, Splitting, Stripping, Negative indices, String functions. Regular expression: Matching the patterns, Search and replace.	**CLO3**	**9**
UNIT IV		
NumPy And Matplotlib: What is NumPy? How to install NumPy, Arrays, Array indexing, Array Vs Listing Data types, Array math, Broadcasting. Matplotlib -Plotting, subplots and images	**CLO4**	**9**
UNIT V		
File Handling With Python: Reading config files in Python, Writing log files in Python, Understanding read functions, read(), and readlines(). Understanding write functions, write(), and write lines (). Manipulating file pointer using seek. Programming using file operations	**CLO5**	**9**

Learning resources

Textbooks:

1. A Hands-On, Project-Based Introduction to Programming, 2nd Edition, No starch Press, 2019.
2. An Introduction to Computer Science using Python 3 by Jason Montojo, Jennifer Campbell, Paul Gries, The Pragmatic bookshelf-2013
3. James Payne, "Beginning Python: Using Python and Python 3.1, Wrox Publication

Reference Books:

1. Python Programming, McGraw Hill Education, Ashok and Amit Kamthane.
2. Python Programming by Adam Stewart.
3. Python programming by Krishna Rungta.

Online Resources and E-Learning Resources

1. https: and and www.w3schools.com and python and
2. https: and and nptel.ac.in and courses and 106 and 106 and 106106182 and
3. https: and and nptel.ac.in and courses and 106 and 106 and 106106145 and

COURSE CURRICULUM

Name of the Program:	**MCA**			**Semester : I**		**Level: PG**	
Course Name	**Python Programming Lab**			**Course Code and Course Type**		**PMC102 / MAJM**	
Course Pattern	**Revised 2024**			**Version**		1.0	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutoria**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
-	1	-	1	2	25	-	25
Prerequisite: Any Programming Language Basics, Basic Computer Skills							

Course Objectives (CO):	The objectives of Python Programming are: 1. To comprehend the knowledge of Python, a script programming language. 2. To understand the flow of programming. 3. To apply and create different tools in Python. 4. To demonstrate knowledge of NumPy and Other libraries 5. To Design and implement file-handling concepts in Python.
Course Learning Outcomes (CLO):	Students will be able to: 1. Identify the basics of Python programming 2. Explain the control statements and functions with packages. 3. Comprehend the python programming strings and regular expressions 4. Apply knowledge of numpy and plotting tools in Python. 5. Analyse data by using file handling operations.

Course Contents and Syllabus:
Practical plan

Sr No	Practical Title	Week No. / Turn 1	Details	CLO	Hours
1	Practical 1: Different ways to execute a Python Program.	Week 1	1. Demonstrate about Basics of Python Programming. 2. Demonstrate about fundamental Data types in Python Programming. (i.e., int, float, complex, bool and string types) 3. Demonstrate the working of following functions in Python. i) id ( ) ii) type ( ) iii) range ( )	CLO1	2
2	Overview on different Data types of Python	Week 2 and 3	a) Demonstrate the following Operators in Python with suitable examples. i) Arithmetic Operators ii) Relational Operators iii) Assignment Operator iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators	CLO1	4
3	Various Operators of Python programming.	Week 3 and 4	1. Write Python programs to demonstrate the following: i) input( ) ii) print( ) iii) 'sep' attribute iv) 'end' attribute v) replacement Operator ({ })	CLO2	4
			2. Demonstrate the following Conditional statements in Python with suitable examples. i) if statement ii) if else statement iii) if – elif – else statement		
		Week 4 and 5	3. Demonstrate the following Iterative statements in Python with suitable examples. i) while loop ii) for loop	CLO2	4
4.	Control statements of Python programming	Week 6	Write Python programs to print the following Patterns:	CLO 2	2

			i) A A B A B C A B C D A B C D E ii) * * * * * * * * * * * * * * *		
		Week7	iii) E E E E E E E E E D D D D D D D C C C C C B B B A iv) 4 4 3 4 3 2 4 3 2 1 4 3 2 1 0 4 3 2 1 4 3 2 4 3 4	CLO2	2
5	String data type	Week8	1. Write a Python program to demonstrate various ways of accessing the string. i) By using Indexing (Both Positive and Negative) ii) By using Slice Operator	CLO3	2
			2. Demonstrate the following functions and methods which operates on strings in Python with suitable examples: i) len( ) ii) strip( ) iii) rstrip( ) iv) lstrip( ) v) find( ) vi) rfind( ) vii) index( ) viii) rindex()ix) count( ) x) replace( ) xi) split( ) xii) join( ) xiii) upper( ) xiv) lower( ) xv) swapcase( ) xvi) title( ) xvii) capitalize( ) xviii) startswith() xix) endswith()		
6.	List data type	Week9	1. Demonstrate the different ways of creating list objects with suitable example programs. 2. Demonstrate the following functions and methods which operates on lists in Python with suitable examples: i) list( ) ii) len( ) iii) count( ) iv) index ( ) v) append( ) vi) insert( ) vii)	CLO3	2

			extend() viii) remove( ) ix) pop( ) x) reverse( ) xi) sort( ) xii) copy( ) xiii) clear( ) 3. Demonstrate the following with suitable example programs: i) List slicing ii) List Comprehensions		
7.	Tuple data type	Week 10 and 12	1. Demonstrate the different ways of creating tuple objects with suitable example programs 2. Demonstrate the following functions and methods which operates on tuples in Python with suitable examples: i) len( ) ii) count( ) iii) index( ) iv) sorted( ) v) min ( ) vi)max( ) vii) cmp( ) viii) reversed( ) 3. Demonstrate the different ways of creating set objects with suitable example programs	CLO3	4
8	Dictionary and Set	Week13	4. Demonstrate the following functions and methods which operates on sets in Python with suitable examples: i) add( ) ii) update( ) iii) copy( ) iv) pop( ) v) remove( ) vi)discard( ) vii) clear( ) viii) union() ix) intersection( ) x) difference( ) 5. Demonstrate the different ways of creating dictionary objects with suitable example programs. b) Demonstrate the following functions and methods which operates on dictionary in Python with suitable examples: i) dict( ) ii) len( ) iii) clear( ) iv) get( ) v) pop( ) vi)popitem( ) vii) keys( ) viii) values() ix) items( ) x) copy( ) xi) update( )	ClO3	2
9	programming Using Numpy	Week 14 and 15	1. Write a NumPy program to create a 3x4 matrix filled with values from 10 to 21 2. Write a NumPy program to compute the sum of all elements, the sum of each column and the sum of each row in a given array. 3. Write a NumPy program to create a 4x4 array with random values. Create an array from the said array swapping first and last rows.	CLO4	2
TOTAL					30

Learning resources

Textbooks:

1. Eric Matthes, Python Crash Course: A Hands-On, Project-Based Introduction to Programming, 2nd Edition, No starch Press, 2019.

Reference Books:

1. Python Programming, McGraw Hill Education, Ashok and Amit Kamthane.
2. Python Programming by Adam Stewart.

3. Python programming by Krishna Rungta.

Online Resources and E-Learning Resources

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3. https: and and nptel.ac.in and courses and 106 and 106 and 106106145 and

COURSE CURRICULUM

Name of the Program:	**MCA**			**Semester : I**		**Level: PG**	
Course Name	**Data Structure And Algorithms**			**Course Code and Course Type**		**PMC103 / MAJM**	
Course Pattern	**Revised 2024**			**Version**		1.0	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3	-	-	3	3	40	60	-
Prerequisite: Student should learn at least one programming language, such as C++, Java, or Python, Operating System							

Course Objectives (CO):	The objectives of Data Structure And Algorithms are: 1. To Comprehend Perform basic operations on Arrays 2. To identif and apply different Searching and Sorting methods. 3. To apply the different algorithms for Linked List, stack, queue using array techniques. 4. To Demonstrate and Implement basic operations on Linked List, stack, queue using Linked list techniques 5. To develop and evaluate the Tree to solve problems.
Course Learning Outcomes (CLO):	Students will be able to: 1. Identify the concepts like array, matrix, traversing, and indexing using sorting and searching techniques. 2. Explain the appropriate data structures like stack, queue as applied to the specified problem definition. 3. Apply the concepts of Linked Lists and it's applications on given data 4. Implement the knowledge of handle operations like searching, insertion, deletion, and traversing mechanisms on various data structures 5. Evaluate the non-linear data structures through Tree.

Course Contents and Syllabus:
Practical plan

Descriptors and Topics	CLO	Hours
UNIT I		
Introduction to Data Structures:-Introduction: Concept and Need of Data Structure, Definition Abstract Data Type,Types of Data Structures: (i) Linear Data Structures (ii) Non-Linear Data Structures,Operations on Data Structures: (i) Traversing (ii) Insertion (iii) Deletion	**CLO 1**	**9**
UNIT II		
Searching and Sorting :- Searching: Searching for an item in a data set using the following methods: (i) Linear Search (ii) Binary Search Sorting: Sorting of data set in an order using the following methods: (i) Bubble Sort (ii) Selection Sort (iii) Insertion Sort (iv) Quick Sort (v) Merge Sort	**CLO 2**	**9**
UNIT III		
Linked List;- Difference between Static and Dynamic Memory Allocation Introduction to Linked List, Terminologies: Node, Address, Pointer, Information field / Data field, Next pointer, Null Pointer, Empty List, Type of Lists: Linear List, Circular List, Representation of Doubly Linked List,Operations on a Singly Linked List: Creating a Linked List, Inserting a new node in a Linked List, Deleting a node from a Linked List, Searching a key in Linked List, Traversing a Singly Linked List,Applications of Linked List.	**CLO3**	**9**
UNIT IV		
Stack:-Introduction to Stack: Definition, Stack as an ADT, Operations on Stack-(Push, Pop), Stack Operation,Conditions – Stack Full / Stack Overflow, Stack Empty,/Stack Underflow,Stack Implementation using Array and representation using Linked List,Applications of Stack: Reversing a List, Polish Notations, Conversion of Infix to Postfix Expression, Evaluation of Prefix Expression. **Queue:** Queue as an ADT, Queue representation in memory using Array and representation using a Linked List,,Types of Queues: Linear Queue, Circular Queue, Concept of Priority Queue, Double-Ended Queue, Queue Operations: INSERT, DELETE, Queue Operation Conditions: Queue Full, Queue Empty. Applications of Queue.	**COL4**	**9**
UNIT V		
Tree;- Introduction to Trees Terminologies: Tree, Degree of a Node, Degree of a Tree, Level of a node, Leaf Node, Depth / Height of a Tree, In-Degree and Out- Degree, Path, Ancestor and Descendant Nodes, Tree Types and Traversal methods, Types of Trees: General Tree, Binary Tree, Binary Search Tree (BST). Binary Tree Traversal: In-Order Traversal, Preorder Traversal, and Post-Order Traversal. Expression Tree, Heap	**COL5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. Mark Allen Weiss, Data Structure and Algorithm Analysis in C++, 2014, 4th Edition, Pearson Education Limited.
2. An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill.
3. Data Structures using C & C++ -By Ten Baum Publisher – Prenctice-Hall International.

Reference Books:

1. AnanyLevitin, Introduction to design and analysis of algorithm, 2012, 3rd Edition, Addison Wesley.
2. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms,PaperBack, 2010, 3rd Edition, MIT Press.

Online Resources and E-Learning Resources

1. https: and and www.audisankara.ac.in and has and pdf and DATA%20STRUCTURE.pdf
2. https: and and github.com and Rustam-Z and data-structures-and-algorithms and tree and master and lecture%20notes
3. https: and and www.programiz.com and dsa and linked-list

COURSE CURRICULUM:

Name of the Program:	**MCA**	**Semester : I**	**Level: PG**
Course Name	**Data Structure And Algorithm Lab**	**Course Code and Course Type**	**PMC 104 / MAJM**
Course Pattern	**Revised 2024**	**Version**	1.0

Teaching Scheme				**Assessment Scheme**			
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal essment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
-	1	-	1	2	25	-	25

Prerequisite: Student should learn at least one programming language, such as C++, Java, or Python

Course Objectives (CO):	The objectives of (Name of course) are: 1. To Comprehend Perform basic operations on Arrays 2. To identif and apply different Searching and Sorting methods. 3. To apply the different algorithms for sorting and searching techniques. 4. To Demonstrate and Implement basic operations on Linked List, stack, queue. 5. To develop and evaluate the Tree to solve problems.
Course Learning Outcomes (CLO):	Students will be able to: 1. Identify the concepts like array, matrix, traversing, and indexing using sorting and searching techniques. 2. Explain the appropriate data structures like stack, queue as applied to the specified problem definition. 3. Apply the concepts of Linked Lists and it's applications on given data 4. Implement the knowledge of handle operations like searching, insertion, deletion, and traversing mechanisms on various data structures 5. Evaluate the non-linear data structures through Tree.

Course Contents and Syllabus:

Practical Plan

Practical No.	Practical Title	Week No. and Turn 1	Details	CLO	Hours
1	Write a C program to implement the following Searching operations	Week 1	1. Selection Search 2. Binary Search	CLO1	2
2	Write a C program to implement the following Sorting operations	Week1	1. Selection Sort 2. Bubble Sort	CLO1	2
3	Write a C program that Explain the STACK operations on Given Data.	Week3 and 4	1. Push() 2. pop()	CLO 2	4
4	Write program that implement all the operations on Queue with array representation	Week 5 and 6	1. Insert 2. Delete 3. Display	CLO2	4
5	Write programs to implement the following using an array representation .	Week7 and 8	1. Ascending Priority Queue 2. Descending Priority Queue	CLO2	4
6	Practical 1: Write C program that implement the Single Linked list applications	Week 9 and 10 Turn 1	1. Insert 2. Delete 3. Search 4. count 5. reverser 6. sorted linked list 7. Display	CLO4	4
7	Write C program that implement the Double Linked list applications	Week 11 and 12	1. Insert 2. Delete 3. Search 4. Display	CLO4	4
8	Write a C program to implement the following operations on Binary Tree	Week 13 and 14	1. Insert 2. Display	CLO5	4
9.	Write a 'C' Program to Implement BST (Binary Search Tree) and Traverse in In-Order.	Week 15		CLO5	2
Total Hours					30

Learning resources

Textbooks:

1. Mark Allen Weiss, Data Structure and Algorithm Analysis in C++, 2014, 4th Edition, Pearson Education Limited.
2. An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill.
3. Data Structures using C & C++ -By Ten Baum Publisher – Prenctice-Hall International.

Reference Books:

1. AnanyLevitin, Introduction to design and analysis of algorithm, 2012, 3rd Edition, Addison Wesley.
2. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms,PaperBack, 2010, 3rd Edition, MIT Press.

Online Resources and E-Learning Resources

1. https: and and www.audisankara.ac.in and has and pdf and DATA%20STRUCTURE.pdf
2. https: and and github.com and Rustam-Z and data-structures-and-algorithms and tree and master and lecture%20notes
3. https: and and www.programiz.com and dsa and linked-list

COURSE CURRICULUM

Name of the Program:	**MCA**			**Semester: 1**		**Level: PG**	
Course Name		**Fundamental Of Software Quality Assurance**		**Course Code and Course Type**		**PMC105 A / MAJE**	
Course Pattern		**Revised 2024**		**Version**		1.0	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3	-	-	3	3	40	60	-
Prerequisite: Software development Cycle, Project management							

Course Objectives (CO):	The objectives of fundamental of Software Quality Assurance are: 1. To recall and monitor the software development method and the final software developed. 2. To recognize the software project is implementing the standards and procedures set by the management 3. To analyse the notification of groups and individuals about its events and consequences. 4. To develop different types of reports. 5. To Design and create shortages in the product, process, or standards.
Course Learning Outcomes (CLO):	Students will be able to: 1. Identify business requirements and business processes using BPMN 2.0 standard encompassing Process Orchestrations and Choreographies. 2. Explain the set of component services with composite services creation and designing services to facilitate integration in IT infrastructure. 3. Apply knowledge of concepts, guidelines and technology for component orchestration to integrate a Component Design Solution in an Enterprise Component System in a societal context. 4. Analyse data well-formed specifications and reports for component service composition and delivery to the stakeholders as a part of the development team. 5. Evaluate the case studies and lessons learned with the utilization of Component-based development patterns and Frameworks knowledge towards planning and implementing complex business projects.

Course Contents and Syllabus:

Practical Plan

Descriptors and Topics	CLO	Hours
UNIT I		
Introduction To Organizational Behaviour: The software quality challenge, Meaning of software quality, Software quality factors , Software Quality Lessons Learned, The components of the software quality assurance system, Pre-project software quality components: Contract Review, Development and quality plans, SQA components in the project life cycle: Integrating quality activities in the project life cycle, Assuring the quality of software maintenance components, Assuring the quality of external participants' contributions, CASE tools, Software quality infrastructure components, Pareto Principles, Total Quality Management, Ishikawa's Seven Basic Tools	**CLO 1**	**9**
UNIT II		
Software Quality Assurance Management: Management components of software quality: Project progress control, Software quality metrics, Costs of software quality, Standards, certification and assessment: Quality management standards, SQA project process standards – IEEE software engineering standards, Management and its role in software quality assurance, The SQA unit and other actors in the SQA system, Inspection as an Up-Front Quality Technique, Software Audit Methods, Software Safety and Its Relation to Software Quality Assurance, SQA for Small Projects, Development Quality Assurance, Quality Management in IT, Introduction to ITIL, Software Quality Assurance Metrics, Software Benchmarks and Baselines	**CLO 2**	**9**
UNIT III		
Software Quality Assurance and Reliability: Software quality; Garvin's quality dimensions, McCall's quality factor, ISO 9126 quality factor; Software Quality Dilemma; Introduction to Capability Maturity Models (CMM and CMMI); Introduction to software reliability, reliability models and estimation., Quality tasks – SQA plan – Teams – Characteristics Implementation – Documentation– Reviews and Audits.	**CLO3**	**9**
UNIT IV		
Quality Control And Reliability: Tools for Quality – Ishikawa's basic tools – CASE tools Defect prevention and removal – Reliability models, Rayleigh model – Reliability growth models for quality assessment..	**CLO4**	**9**
UNIT V		
Software Quality Tools: Total Quality Management, product quality metrics, in-process quality metrics, software maintenance, Ishikawa 7 basic tools, checklist, Pareto diagrams, Histogram, Run Charts, Scatter Diagram, Control Charts, Cause Effect Diagram, Defect Removal Effectiveness and Process Maturity Level.	**CLO5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. "Organizational Behaviour: Improving Performance and Commitment in the Workplace" by Jason Colquitt, Jeffery LePine, and Michael Wesson.
2. Ronald E Walpole, Raymond H Myers, Sharon L Myers, and Keying E Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Delhi-9th edition, 2012.
3. "Organizational Behaviour" by Stephen P. Robbins and Timothy A. Judge.

Reference Books:

1. "Organizational Behaviour: Securing Competitive Advantage" by John A. Wagner III and John R. Hollenbeck.
2. "Organizational Behaviour: Science, The Real World, and You" by Debra L. Nelson and James Campbell Quick.

Online Resources and E-Learning Resources

1. https: and and www.altexsoft.com and whitepapers and quality-assurance-quality-control-and-testing-the-basics-of-software-quality-management and
2. https: and and www.academia.edu and 9760547 and LECTURE_NOTES_2_Software_Quality_Assurance
3. https: and and www.geeksforgeeks.org and software-engineering-software-quality-assurance and

COURSE CURRICULUM

Name of the Program:	**MCA**			**Semester: I**		**Level: PG**	
Course Name	**Object Oriented Software Engineering**			**Course Code and Course Type**		**PMC105B / MAJE**	
Course Pattern	**Revised 2024**			**Version**		1.0	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3	-	-	3	3	40	60	-
Prerequisite: Basic Computer Knowledge, basic OOPs Concepts							
Course Objectives (CO):	The objectives of fundamental of Software Quality Assurance are: 1. To recall Software Engineering Lifecycle Models 2. To Perform software requirements analysis 3. To understand software testing and maintenance approaches 4. To Design and create project management scheduling using advanced software engineering methodologies. 5. To Design object solutions with patterns and architectural layers.						
Course Learning Outcomes (CLO):	Students will be able to: 1. Identify differences between the structured paradigm and the object-oriented paradigm in software development 2. Explain the differences between the structured paradigm and the object-oriented paradigm in software development 3. Analyse knowledge of concepts, principles, and state-of-the-art methods in software architectures and their relationship to other areas of software engineering, specifically requirements, analysis and design, and implementation. 4. Analyse different testing methods with suitable case studies. 5. Design, manage, and implement a computer-based software system using the oops software engineering approach in a group setting						

Course Contents and Syllabus:

Descriptors and Topics		Hours
UNIT I		
Software Process And Agile Development: Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models ,Introduction to Agility-Agile process-Extreme programming-XP Process-Case Study.	**CLO 1**	**9**
UNIT II		
Requirements Analysis And Specification: Requirement analysis and specification , Requirements gathering and analysis , Software Requirement Specification , Formal system specification , Finite State Machines , Petrinets , Object modelling using UML , Use case Model , Class diagrams , Interaction diagrams , Activity diagrams , State chart diagrams , Functional modelling , Data Flow Diagram- CASE TOOLS.	**CLO 2**	**9**
UNIT III		
Software Design: Software design , Design process , Design concepts , Coupling , Cohesion , Functional independence , Design patterns , Model-view-controller , Publish-subscribe , Adapter , Command , Strategy , Observer , Proxy , Facade , Architectural styles , Layered , Client Server , Tiered Pipe and filter- User interface design-Case Study	**CLO3**	**9**
UNIT IV		
Software Testing And Maintenance: Testing , Unit testing , Black box testing, White box testing , Integration and System testing, Regression testing , Debugging , Program analysis , Symbolic execution , Model Checking-Case Study	**CLO4**	**9**
UNIT V		
Project Management: Software Project Management- Software Configuration Management , Project Scheduling- DevOps: Motivation-Cloud as a platform-Operations- Deployment Pipeline: Overall Architecture Building and Testing-Deployment- Tools- Case Study	**CLO5**	**9**
Total Hours		**45**

Learning resources
Textbooks:

1. Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and the Unified Process, 3rd Edition, Craig Larman, Prentice-Hall
2. Software Requirements, 2nd Edition, Karl E. Wiegers, Microsoft Press These two books are available in CSU Tech Books Online reference

Reference Books:

1. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010.
2. Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.
3. Rajib Mall, Fundamentals of Software Engineering, 3rd edition, PHI Learning Pvt. Ltd., 2009.

Online Resources

1.https: and and www.visual-paradigm.com and tutorials and

2. https: and and www.udemy.com and course and oo-se-java and ?couponCode=ST7MT41824

3 .https: and and uim.fei.stuba.sk and wp-content and uploads and 2018 and 02 and Object-oriented-Software-Engineering-3rd-Edition.pdf

COURSE CURRICULUM:

<table>
<tr><td colspan="2">Name of the Program:</td><td colspan="2">MCA</td><td colspan="2">Semester : I</td><td colspan="2">Level: PG</td></tr>
<tr><td colspan="2">Course Name</td><td colspan="2">Probability and Combinatory</td><td colspan="2">Course Code and Course Type</td><td colspan="2">PMC106 / BSC</td></tr>
<tr><td colspan="2">Course Pattern</td><td colspan="2">Revised 2024</td><td colspan="2">Version</td><td colspan="2">1.0</td></tr>
<tr><td colspan="4">Teaching Scheme</td><td colspan="4">Assessment Scheme</td></tr>
<tr><td>Theory</td><td>Practical</td><td>Tutorial</td><td>Total Credits</td><td>Hours</td><td>CIA (Continuous Internal Assessment)</td><td>ESA (End Semester Assessment)</td><td>Practical and Oral</td></tr>
<tr><td>2</td><td>-</td><td>1</td><td>3</td><td>3</td><td>40</td><td>60</td><td>-</td></tr>
<tr><td colspan="8">Prerequisite: Linear Algebra and Univariate Calculus is essential</td></tr>
<tr><td colspan="3">Course Objectives (CO):</td><td colspan="5">The objectives of (Name of course) are:
1. To comprehend graph theory and several concepts related to it. It enables to use the concept of trees to find solution of several problems related to computer applications.
2. To Identify the set theory and partially ordered sets to expand mathematical maturity.
3. To Apply the rules for appropriate principals of counting techniques to understand practical examples and interpret the associated operations and terminologies in context
4. To formulate problems precisely, solve the problems
5. To develop students' understanding of formal proof techniques and explain the reasoning clearly by using the probability and statistics methods.</td></tr>
<tr><td colspan="3">Course Learning Outcomes (CLO):</td><td colspan="5">Students will be able to:
1. Define & express the problems in graph theory sense and find the solution by using different algorithms.
2. Aapply the use of appropriate partial ordering and hesse diagrams to find minimal, maximal, lower upper bounds and greatest lower bounds.
3. Understand the use of appropriate principals of counting techniques to understand practical examples and solve then logically by
4. Reflect on the use of probability concepts for solving real life problems.
5. Become a capable to use measures of central tendency to solve different statistical problems.</td></tr>
</table>

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Combinatorial Structures: Graph theory basics: Basic terminology of graphs, simple graph, degree of a vertex, degree sequence of a graph, first fundamental theorem of graphs, incident matrix and adjacent matrix Trees: Trees and their properties, binary tree, complete binary tree, full binary tree, binary search tree	**CLO 1**	**9**
UNIT II		
Principles Of Counting: The Principle of Inclusion and Exclusion, Generalizing Inclusion – Exclusion Principles, Derangements – Nothing is in its Right Place, Rook Polynomials	**CLO 2**	**9**
UNIT III		
Combinatorial Analysis: Basic counting principles (multiplication rule, addition rule), permutations and combinations, permutations of n dissimilar objects taken r at a time (with and without repetitions), permutation of n objects not all of which are different, combination of n objects taken r at a time, Binomial and multinomial theorems and its applications	**CLO3**	**9**
UNIT IV		
Probability: Random experiment, sample space, events, axiomatic probability, algebra of events conditional probability, multiplication theorem of probability, independent events, bay's theorem	**CLO4**	**9**
UNIT V		
Probability Distribution: Probability density functions, cumulative distribution functions, expectation and variance, uniform and normal distributions, joint probability mass and density functions, marginal and conditional distributions, covariance and correlation	**CLO5**	**9**

Learning resources

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2014.
2. Ronald E Walpole, Raymond H Myers, Sharon L Myers, and Keying E Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Delhi-9th edition, 2012.
3. B S Grewal, "Higher Engineering Mathematics", 44th edition, Khanna Publishers.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44thEdition, 2010.
2. B S Grewal, Numerical methods in engineering and science, 10th Edition, Khanna publishers, 2016.
3. Kishor S Trivedi, "Probability and Statistics with reliability, Queuing and Computer Science Applications", John Wiley & Sons, 2ndedition, 2008.

Online Resources and E-Learning Resources

1. https: and and www.khanacademy.org and math and precalculus and x9e81a4f98389efdf:prob-comb
2. https: and and ocw.mit.edu and courses and 18-440-probability-and-random-variables-spring-2014 and pages and lecture-notes and

COURSE CURRICULUM:

Name of the Program:	**MCA**	**Semester: I**	**Level: PG**
Course Name	**Organizational Behaviour**	**Course Code and Course Type**	**PMC108 /VEC**
Course Pattern	**Revised 2024**	**Version**	1.0

Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3	-	-	3	3	40	60	-

Prerequisite: Basic Knowledge of Psychology, management, Sociology, And Economics

Course Objectives (CO):	The objectives of Organizational Behaviour are: 1. To recall the fundamental concepts and theories of organizational behaviour. 2. To recognize the knowledge of organizational behaviour to analyse real-world organizational challenges. 3. To apply critical thinking and problem-solving skills to address organizational behaviour issues. 4. To Enhance communication and interpersonal skills for effective organizational interactions 5. To analyse and recognize the importance of ethics and social responsibility in organizational behaviour.
Course Learning Outcomes (CLO):	Students will be able to: 1. Identify the different levels of analysis in organizational behaviour. 2. Apply the different factors that influence organizational climate and culture. 3. Understand the use of different concepts of organizational behaviour to solve problems in organizations. 4. Analyse the different factors that contribute to organizational effectiveness. 5. Create a new organizational culture that is more supportive of employee engagement to evaluate the effectiveness of different organizational behaviour interventions

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Fundamentals of Organizational Behaviour: Concept of Management, Nature of Management, What Managers Do - Managerial functions and roles, Levels of Management, Effective Management - Managerial skills and competencies, Characteristics of Quality Managers. Meaning of Organizational Behaviour, Contributing disciplines, Challenges and opportunities, Organizational Behaviour Models - Individual, Groups and Organizational.	**CLO 1**	**9**
UNIT II		
Individual Dynamics: Concept of Human Behaviour: Nature of People, Value of Person (Ethical Treatment). Personality: Definitions, Different types of Personality, Determinants of Personality - Matching Personality and Jobs; Perception: Definition, Factors influence perception, Person perception: Attribution theory, Errors, Shortcuts used in judgment, Importance of perception in Industry.	**CLO 2**	**9**
UNIT III		
Attitude & Learning: Attitude: Meaning, Characteristics, and components of Attitude, Attitude and Behaviour, Attitude Formation - Attitude, Job Satisfaction. Learning: Meaning, Characteristics, and Process of Learning. Theories of Learning: Classical Conditioning, Operant Conditioning. Learning and Organizational Behaviour Modification.	**CLO3**	**9**
UNIT IV		
Motivation And Group Dynamics: Nature of Motivation, Process of Motivation, Traditional & Contemporary theories on Motivation; Motivation application in Organization setup. Understanding the group behaviour, Types of Groups: Formal Group, Informal Group; Stages of group development. Group dynamics and Group cohesiveness. Group decision-making. Team: Types of Teams, Team Building and Managing Effective Team, Team Structure.	**CLO4**	**9**
UNIT V		
Interpersonal Dynamics & Organizational Dynamics: Module: 6 Interpersonal Dynamics 3 Sessions Communication – Symbols, Network, and Direction of Communication Flow, Barriers to Effective Communication, Interpersonal Communication; Interpersonal Conflicts & Negotiations. Organization Structure, Forms of Organization Structure; Organizational Climate, Organizational Culture: meaning, how employees learn organizational culture; Organizational Change: Concept, resistance to change, managing resistance to change; Leadership - Theories, Styles. Managing Stress: concept, causes of stress and coping strategies; Insights from Indian ethos.	**CLO5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. L.M. Prasad (2020), Principles and Practice of Management, 20th Edition, Sultan Chand & Sons, New Delhi.
2. Timothy A. Judge Stephen P. Robbins (2017), Organizational Behaviour. 17th Edition, Pearson Education Limited, Upper Saddle River.

Reference Books:

1. Harold Koontz, Heinz Weihrich, Mark V. Cannice (2020), Essentials of Management - An International, Innovation and Leadership Perspective, 11th Edition.
2. Udai Pareek and Sushama Khanna (2018), Understanding Organizational Behaviour (4th Edition), Oxford Publishing.

Online Resources and E-Learning Resources

1. https: and and www.slideshare.net and Ginugeorge1 and organisational-behaviour-eresource
2. https: and and www.geektonight.com and organisational-behaviour-notes-pdf and
3. https: and and www.easymanagementnotes.com and introduction-to-organizational-behaviour

COURSE CURRICULUM:-

Name of the Program:		**Foreign Language**		**Semester : I**		**Level: PG**	
Course Name		**German A1.1**		**Course Code and Course Type**		PFL201A /AEC	
Course Pattern		**Revised 2024**		**Version**		1.0	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
2	-	-	-	2	20	30	-
Prerequisite:							
Course Objectives (CO):				The objectives of (German A1.1) are: 1. To remember new words and their spellings. 2. To understand the new concepts. 3. To apply the basic vocab and grammar concepts. 4. To understand the German text. 5. To create basic sentences in German.			
Course Learning Outcomes (CLO):				Students will be able to: 1. Spell simple words in German 2. Can understand everyday expressions. 3. Able to frame simple sentences in German language. 4. Can introduce themselves and others. 5. Can answer questions about themselves.			

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Guten Tag : Speak about yourself and others, Speak about Countries and Languages Grammar – Sentence formation and verbs usage	**CLO 1**	**6**
UNIT II		
Freunde, Kollegen und Ich :-Speak about your Hobbys, To fix a meeting, Speak about work and Profession, To creat a profile on Internet Grammar – How to use 'The' in german, Singular and plural forms of Nouns	**CLO 2**	**6**
UNIT III		
In der Stadt:-To get to know about Cities and Places, how to find way and understand directions, learn international words Grammar – Negations (how to use NO in german), Definite articles, indefinite articles	**CLO3**	**6**
UNIT IV		
Guten Appetit:- To speak about food and food habits, to have a discussion about shopping Grammar – introduction of cases	**CLO4**	**6**
UNIT V		
Tag für Tag & Zeit mit Freunden Clock timings, To speak about family and friends, Daily routine To speak about free time activity, to understand the specific information from the text, to order and to pay in a restaurant Grammar – Possessivarticle, Modalverbs, use of on,at,from…till, Seprable verbs and past tence	**CLO5**	**6**
Total Hours		**30**

Learning resources

Textbooks:

1. Netzwerk A1, Ernst klett Verlag & Goyal Publishers & Distributors Pvt. Ltd.
2. Studio d A1, Cornelesen Verlag & Goyal Publishers & Distributors Pvt. Ltd.
3. Netzwerk Neu A1, Ernst klett Verlag & Goyal Publishers & Distributors Pvt. Ltd

Reference Books:

1. Hallo Deutsch A1,Ernst Klett Verlag, Goyal Publishers & Distributors Pvt. Ltd
2. Themen Aktuell 1, Hueber verlag
3. Maximal Ernst klett Verlag & Goyal Publishers & Distributors Pvt. Ltd.

Online Resources and E-Learning Resources:

1. https: and and youtube.com and @LearnGermanwithAnja?si=BkJYDPi7TS0fT4lr
2. https: and and youtube.com and @deutschlernenmitheidi?si=TkICIabzioaU0roZ
3. instagram.com and learngermanwithanja

COURSE CURRICULUM:-

Course Contents and Syllabus:

Name of the Program:	**MCA**	**Semester : I**	**Level: PG**
Course Name	Basic Japanese language skill	**Course Code and Course Type**	**PFL201B/ AEC**
Course Pattern	**Revised 2024**	**Version**	1.0

Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
2	--	--	2	30	50	--	--

Prerequisite: Desire to get acquainted with the Japanese language.

Course Objectives (CO):	The objectives of Basic Japanese language skill are: 1. To meet the needs of an ever growing industry, with respect to language support. 2. To get introduced to Japanese society and culture through language. 3. To acquire a competitive edge in career choices. 4. To participate effectively & responsibly in a multicultural world. 5. To enable learners to communicate effectively in the Japanese language.
Course Learning Outcomes (CLO):	After learning the course, the to: 1. Read and Write Hiragana script. 2. Write and Speak basic sentences. 3. Comprehend and speak about time, hobbies, likes and dislikes. 4. Write basic kanji. 5. Use the Hiragana script in discussion.

Descriptors and Topics	CLO	Hours
UNIT I		
Introduction to Japanese Language – Introduction of script, culture, History of script ,Speaking : Self introduction, listening : short video skit on self-introduction	**CLO 1**	**6**
UNIT II		
Introduction of Hiragana Script - Writing : Hiragana script, Speak : Basic sentences, General vocabulary : Months , Days of the week ,Basic numbers, colours	**CLO 2**	**6**
UNIT III		
Basic Sentence formation - Basic sentence structure : Affirmative and Negative , General vocabulary: about family,	**CLO 3**	**6**
UNIT IV		
Time and verbs – Speaking : Talking about routine, Writing: routine using verbs and time, reading : A clock	**CLO 4**	**6**
UNIT V		
Introduction of Katakana and basic kanji – Reading : English words, country names Writing : Basic Kanji	**CLO 5**	**6**
Total Hours		**30**

Learning resources

Textbook:

1. Minna no Nihongo , " Japanese for everyone" ,Elementary Main Textbook , Goyal Publishers & Distributors Pvt. Ltd.

Reference books:

1. **Shyoho Volume 1.**
2. **Genki Japan**
3. **Haru Vol. 1 & 2**

Online Resources and E-Learning Resources:

https: and and www.youtube.com and watch?v=shdlEapDsP4

https: and and youtu.be and K-nw5EUxDz0?feature=shared

https: and and youtu.be and o9sP-vaCEa0?si=l8yOvVKaItBQWXNu

https: and and youtu.be and JnoZE51WZg4?si=9uq68USOz5plBk2n

https: and and youtu.be and shdlEapDsP4?si=tC6RGaMtwDJgVu2d

https: and and youtu.be and 9paXgC2U8L0?si=btS1G4mvrkG5C9zi

1. Apps

A) Learn Japanese - Hiragana APP available on Google play.

Hiragana Pro

MCA REVISED 2024 PATTERN

COURSE DETAILS

Semester - II

Name of the Program:	MCA	Semester: II	Level: PG
Course Name	Object-Oriented Programming Using JAVA	Course Code and Course Type	PMC108 / MAJM
Course Pattern	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical and Oral
3	-	-	3	3	40	60	-

Prerequisite: Principles of object-oriented programming and its concepts.

Course Objectives (CO):	The objectives of Object-Oriented Programming Using JAVA are: 1. To recall and monitor object-oriented concepts such as data abstraction, encapsulation, inheritance, dynamic binding, and polymorphism. 2. To recognize inheritance and packages in program design. 3. To analyse programming insight using OOP constructs. 4. To explain advanced programming by using a collection framework. 5. To Design and create GUI programming with swing controls in various real-life applications.
Course Learning Outcomes (CLO):	Students will be able to: 1. Define different concepts of oops and java. 2. Apply the knowledge of design, develop, test, document and debug Java programs using object-oriented principles 3. Define understand inheritance with developing interfaces and packages 4. Study exception handling and multithreading and their applications in real-world problems. 5. Develop GUI programming using swing.

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Introduction & Concepts Of Classes And Objects: History of Java, Byte code, JVM, Java buzzwords, OOP principles, Data types, Variables, Scope and lifetime of variables, Operators, Control statements, Type conversion and casting, Arrays, Introducing methods, Method overloading, Constructors, Constructor overloading, Usage of static with data and method, Access control, this keyword, Garbage collection, String class, String Tokenizer.	**CLO 1**	**9**
UNIT II		
Inheritance & Packages: Inheritance basics, Types of inheritance, Member access rules, Usage of super keyword, Method overriding, Usage of final, Abstract classes, Interfaces - differences between abstract classes and interfaces, defining an interface, implementing an interface, applying interfaces, variables in interface and extending interfaces; Packages - defining, creating and accessing a package, importing packages, access control in packages.	**CLO 2**	**9**
UNIT III		
Exception Handling and Multithreading: Concepts of exception handling, Types of exceptions, Usage of try, catch, throw, throws, and finally keywords, Built-in exceptions, Creating user-defined exceptions; MULTITHREADING: Concepts of multithreading, Differences between process and thread, Thread life cycle, creating multiple threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter thread communication.	**CLO 3**	**9**
UNIT IV		
Collection Framework: Collections Overview, Collection Interfaces - List, Set, Map, List - Array List, Linked List, Vector, Set - HashSet, Tree Set, Map - Hash Table, HashMap, Accessing a collection via an Iterator, comparator, comparable.	**CLO 4**	**9**
UNIT V		
GUI Programming with Swing: Applets - Applet Class, Applet skeleton, Simple Applet; Delegation event model - Events, Event sources, Event Listeners, Event classes, handling mouse and keyboard events. EXPLORING SWING CONTROLS: JLabel and Image Icon, JText Field, JButton, JCheckBox, JRadioButton, JTabbed Pane, JList, JCombo Box.	**CLO 5**	**9**
Total Hours		**45**

Learning resources

TEXT BOOKS:

1. Herbert Schildt, "Java the complete reference", 9th edition, McGraw Hill, Education, 2014.
2. T. Budd, "Understanding Object-Oriented Programming with Java", updated edition, Pearson Education, 2000.

REFERENCE BOOKS:

1. J. Nino and F.A. Hosch,"An Introduction to programming and OO design using Java", 3rd edition, John Wiley & sons, 2008
2. P. Radha Krishna,"Object Oriented Programming through Java", 1st edition, Universities Press, 2007.
3. R. A. Johnson,"Java Programming and Object oriented Application Development", 1st edition, Cengage Learning, 2006.

Online Resources and E-Learning Resources

1.https: and and www.freecodecamp.org and news and object-oriented-programming-concepts-java and

2.https: and and www.w3schools.com and java and java_oop.asp

3.https: and and www.minds.co.za and wp-content and uploads and 2019 and 06 and object-oriented-programming-using-java.pdf

COURSE CURRICULUM

Name of the Program	**MCA**	**Semester : II**	**Level: PG**
Course Name	**Java Programming Lab**	**Course Code and Course Type**	**PMC 109/MAJM**
Course Pattern	**Revised 2024**	**Version**	1.0

Teaching Scheme				**Assessment Scheme**			
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
-	1	-	1	2	25	-	25

Prerequisite: Student should learn at least one programming language, such as C++, Java, or Python

Course Objectives (CO):	The objectives of Object-Oriented Programming Using JAVA are: 1. To recall and monitor object-oriented concepts such as data abstraction, encapsulation, inheritance, dynamic binding, and polymorphism. 2. To recognize inheritance and packages in program design. 3. To analyse programming insight using OOP constructs. 4. To explain advanced programming by using a collection framework. 5. To Design and create GUI programming with swing controls in various real-life applications.
Course Learning Outcomes (CLO):	Students will be able to: 1. Define different concepts of oops and java 2. Apply the knowledge of design, develop, test, document and debug Java programs using object-oriented principles 3. Define understand inheritance with developing interfaces and packages 4. Implement exception handling and multithreading and their applications in real-world problems. 5. Develop a connection framework and develop GUI programs using swing.

Course Contents and Syllabus:

Practical Plan

Practical No.	Practical Title	Week No and Turn 1	Details	CLO	Hours
1	.Program to define a structure of a basic JAVA program	Week 1 and Turn 1	WAP to demonstrate data types available in java	CLO1, CLO2	2
2	Program to define the data types, variable, operators, arrays and control structures.	Week 2	WAP to design a simple calculator using switch case statement	CLO1, CLO2	2
			WAP to print all prime numbers between 1 to 1000	CLO1, CLO2	
3		Week3	WAP to implement linear search in 1D array	CLO1, CLO2	2
			WAP to implement bubble sort in 1 D array	CLO1, CLO2	
4		Week 4	WAP to multiply 2 matrices in java	CLO1, CLO2	2
			WAP to implement recursion function in java	CLO1, CLO2	
			WAP to demonstrate some in-built functions on Strings	CLO1, CLO2	
5	Program to define class and constructors. Demonstrate constructors	Week5	WAP to demonstrate concept of Class, Object, and methods in java.	CLO 2	2
6	Program to define class, methods and objects. Demonstrate method overloading	Week6	WAP to demonstrate method overloading in java	CLO2	2
7	Program to define inheritance and show method overriding	Week7	WAP to demonstrate inheritance in java	CLO1, CLO 3	2
8	Program to demonstrate Packages.	Week8	WAP to demonstrate multiple inheritance using interface	CLO3	2
9	Program to demonstrate Exception Handling.	Week 9	WAP to demonstrate exception handling in java	CLO4	2

			Program to demonstrate Multithreading.	CLO3	2
10	Program on Collection Framework	Week11	Write a Java program to shuffle elements in an array list Write a Java program to test whether an array list is empty or not	CLO5	2
11	The objective of this problem is to create a student registration form using different swing components.	Week12	Write a Java program called SwingArithmetics that works as a simple calculator. Use default layout to arrange buttons for the digits and for the +, -,*, % and clear operations. Add a text field to display the result. Handle any possible exceptions such as divided by zero.	CLO5	2
12	The objective of this problem is to create a simple Graphical User Interface using Java Swing Components	Week13	Create a Java program that will work as a simple student registration form. Students need to use various swing components like JMenu, JButton, JRadioButton, JComboBox, JTable, JPasswordField, JTextField, JLabel to design the frames. Information about student entered in the student registration form must be displayed in the JTable.	CLO5	2
13	The objective of this session is to provide in depth knowledge about Java Swing components specially JMenu, Radio button, ComboBox, JTable and event handling in Swing components. The brief introduction of file reading and writing utilities are also given in the session.	Week 14 and 15	Create a Java program that will work as a simple employee management system where admin can login into the system and manage the employee information. The system has two frames one is login for Admin and other is to add and edit and delete employees' information. Admin can access the employee information	CLO5	4

			frame if he and she is authenticated. Students need to use various swing components like JMenu, JButton, JRadioButton, JComboBox, JTable, JPasswordField, JTextField, JLabel to design the frames. Information about employee must be displayed in the JTable. Contents of the JTable need to be saved in the .txt file and can load the contents to the JTable from the .txt file.		
Total Hours					30

Learning resources

TEXTBOOKS:

1. Herbert Schildt, "Java the complete reference", 9th edition, McGraw Hill, Education, 2014.
2. T. Budd, "Understanding Object-Oriented Programming with Java", updated edition, Pearson Education, 2000.

REFERENCE BOOKS:

1. J. Nino and F.A. Hosch,"An Introduction to programming and OO design using Java", 3rd edition, John Wiley & sons, 2008
2. P. Radha Krishna,"Object Oriented Programming through Java", 1st edition, Universities Press, 2007.
3. R. A. Johnson,"Java Programming and Object oriented Application Development", 1st edition, Cengage Learning, 2006.

Online Resources and E-Learning Resources

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2.https: and and www.w3schools.com and java and java_oop.asp

3.https: and and www.minds.co.za and wp-content and uploads and 2019 and 06 and object-oriented-programming-using-java.pdf

COURSE CURRICULUM:-

Name of the Program:	**MCA**		**Semester: II**		**Level: PG**	
Course Name	**Big Data analytics**		**Course Code and Course Type**		**PMC110 / MAJM**	
Course Pattern	**Revised 2024**		**Version**		1.0	
Teaching Scheme				**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3	-	-	3	3	40	60	-
Prerequisite: Data Analysts must Know various technical, mathematical, creative, and interpersonal skills							

Course Objectives (CO):	The objectives of fundamental of Big Data Analytics are: 1. To recall about accessing, storing, and manipulating huge data from different resources. 2. To recognize the working environment of Pig and Hive for processing the structured and unstructured data. 3. To recall the concepts of Apache Hive models and learn about different functions. 4. To differentiate the RDBMS and Hive architectures and implement queries to process the data using sqoop. 5. To analyze the knowledge on searching mechanisms using solr
Course Learning Outcomes (CLO):	Students will be able to: 1. Identify the usage of data on different big data ecosystems and also demonstrate the Pig architecture and evaluation of pig scripts. 2. Describe the Hive architecture and execute SQL queries on sample data sets. 3. Apply knowledge of the process of transferring data between different file systems and to execute operations using sqoop. 4. Understand the concepts of indexing and use these concepts in solr search engines. Also Implement and evaluate the data manipulation procedures using pig, hive, sqoop and solr. 5. Develop an application using different eco system tools by taking standard sample data set.

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Introduction: Big data- Concepts, Needs and Challenges of big data. Types and source of big data. Components of Hadoop Eco System- Data Access and storage, Data Intelligence, Data Integration, Data Serialization, Monitoring, Indexing.	**CLO 1**	**9**
UNIT II		
Apache Pig: Introduction, Parallel processing using Pig, Pig Architecture, Grunt, Pig Data Model-scalar and complex types. Pig Latin- Input and output, Relational operators, User defined functions. Working with scripts.	**CLO 2**	**9**
UNIT III		
Apache Hive Fundamentals & Advanced Concepts: Introduction-Hive modules, Data types and file formats, Hive QL-Data Definition and Data Manipulation, Hive QL queries, Hive QL views- reduce query complexity. Hive scripts. Hive QL Indexes-create, show, drop. Aggregate functions. Bucketing vs Partitioning	**CLO3**	**9**
UNIT IV		
Importing And Handling Relational Data In Hadoop Using Sqoop: Relational database management in Hadoop: Bi directional data transfer between Hadoop and external database. Import data- Transfer an entire table, import subset data, use different file format. Incremental import import new data, incrementally import data, preserving the value	**CLO4**	**9**
UNIT V		
Scoop And Solr: Export transfer data from Hadoop, update the data, update at the same time, and export a subset of columns. Hadoop ecosystem integration- import data to the hive, using partitioned hive tables, replace special delimiters. Introduction. Information retrieval search engine, categories of data, inverted index. Design- field attributes and types. Indexing- indexing tool. Indexing operations using CSV documents. Searching data-parameters, default query.	**CLO5**	**9**
Total Hours		**45**

Learning resources

Reference Books:

1.Alan Gates,Programming PigDataflowScriptingwithHadoop,O'ReillyMedia,Inc,2011.
2. Jason Rutherglen, Dean Wampler, Edward Caprialo, Programming Hive, O'ReillyMedia Inc,2012
3. Dikshant Shahi, Apache Solr: A Practical approach to enterprise search, Apress, 2015.

Online Resources and E-Learning Resources

1.https: and and www.slideshare.net and slideshow and big-data-lecture-notes and 58457761

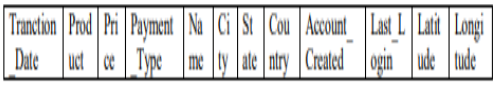
2. https: and and www.simplilearn.com and what-is-big-data-analytics-article3.

COURSE CURRICULUM:

<table>
<tr><td colspan="2">Name of the Program:</td><td colspan="2">MCA</td><td colspan="2">Semester: II</td><td colspan="2">Level: PG</td></tr>
<tr><td colspan="2">Course Name</td><td colspan="2">Big Data Analytics Lab</td><td colspan="2">Course Code and Course Type</td><td colspan="2">PMC11 / MAJM</td></tr>
<tr><td colspan="2">Course Pattern</td><td colspan="2">Revised 2024</td><td colspan="2">Version</td><td colspan="2">1.0</td></tr>
<tr><td colspan="4">Teaching Scheme</td><td colspan="4">Assessment Scheme</td></tr>
<tr><td>Theory</td><td>Practical</td><td>Tutorial</td><td>Total Credits</td><td>Hours</td><td>CIA (Continuous Internal Assessment)</td><td>ESA (End Semester Assessment)</td><td>Practical and Oral</td></tr>
<tr><td>-</td><td>1</td><td>-</td><td>1</td><td>2</td><td>25</td><td>-</td><td>25</td></tr>
<tr><td colspan="8">Prerequisite: Data Analysts must Know various technical, mathematical, creative, and interpersonal skills.</td></tr>
<tr><td colspan="3">Course Objectives (CO):</td><td colspan="5">The objectives of fundamental of Big Data Analytics are:
1. To recall about accessing, storing, and manipulating huge data from different resources.
2. To recognize the working environment of Pig and Hive for processing the structured and unstructured data.
3. To recall the concepts of Apache Hive models and learn about different functions.
4. To differentiate the RDBMS and Hive architectures and implement queries to process the data using sqoop.
5. To analyse the knowledge on searching mechanisms using solr</td></tr>
<tr><td colspan="3">Course Learning Outcomes (CLO):</td><td colspan="5">Students will be able to:
1. Identify the key issues in Big Data Management and experiment with the Hadoop framework.
2. Explain the structure and unstructured data by using nosql commands.
3. Apply knowledge of scientific computing algorithms for finding similar items and clustering by using Apache Hive
4. Test fundamental enabling techniques and scalable algorithms for data stream mining using sqoop
5. Develop problem-solving and critical thinking skills in fundamental enable techniques like Hadoop & mapreduce.</td></tr>
</table>

Course Contents and Syllabus:

Practical Plan

Practical No.	Practical Title	Week and Turn 1 & 2	Details	CLO	Hours
1	Practical 1: Big Data Management and experiment with the Hadoop framework	Week1 and Turn 1	Installation of Hadoop Framework, it's components and study the HADOOP ecosystem.	CLO1	2
2	Implement MapReduce programs in variety of applications	Week 2	Develop a MapReduce program to calculate the frequency of a given word in a given file.	CLO1, CLO2	2
			Write a program to implement a word count program using MapReduce	CLO1, CLO2	
3		Week 3	Develop a MapReduce program to find the maximum temperature in each year.	CLO1, CLO2	2
			Develop a MapReduce program to find the grades of students.	CLO1, CLO2	
4	Implement MapReduce programs in variety applications	Week 4 and 5	Develop a MapReduce to find the maximum electrical consumption in each year given electrical consumption for each month in each year	CLO2	4
			Experiment on Hadoop Map-Reduce and PySpark: -Implementing simple algorithms in Map-Reduce: Matrix multiplication.	CLO2	
5		Week6	Write queries to sort and aggregate the data in a table using HiveQL.	CLO3	2
			Develop a Java application to find the maximum temperature using Spark.		
6	Install and configure MongoDB and Cassandra and HBase and Hypertable to	Week 7	Develop a MapReduce program to find the number of products sold in each country by considering sales data containing fields like 	CLO3, CLO4	2

7	execute NoSQL Commands.	Week 8 and 9	Develop a MapReduce program to find the frequency of books published eachyear and find in which year maximum number of books were published usingthe following data.  	CLO4	4
8		Week 10 and 11	Implementing DGIM algorithm using any Programming Language and Implement Bloom Filter using any programming language	CLO4	4
9		Week 12 and 13	Implement and Perform Streaming Data Analysis using flume for data capture, PYSpark and HIVE for data analysis of twitter data, chat data, weblog analysis etc.	CLO4	4
10		Week 14 and 15	Implement any one Clustering algorithm (K-Means and CURE) using Map-Reduce	CLO5	4
Total Hours					30

Learning resources

Reference Books:

1. Alan Gates,Programming PigDataflowScriptingwithHadoop,O'ReillyMedia,Inc,2011.
2. Jason Rutherglen, Dean Wampler, Edward Caprialo, Programming Hive, O'ReillyMedia Inc,2012
3. Dikshant Shahi, Apache Solr: A Practical approach to enterprise search, Apress, 2015.

Online Resources and E-Learning Resources

1.https: and and www.slideshare.net and slideshow and big-data-lecture-notes and 58457761

2. https: and and www.simplilearn.com and what-is-big-data-analytics-article3.

COURSE CURRICULUM:

Name of the Program:	**MCA**			**Semester: II**		**Level: PG**	
Course Name		**Computer Networks**		**Course Code and Course Type**		**PMC112 A / MAJE**	
Course Pattern		**Revised 2024**		**Version**		1.0	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3	-	-	3	3	40	60	-
Prerequisite: Basic understanding of computer hardware and software, as well as a working knowledge of operating systems.							
Course Objectives (CO):				The objectives of Computer Networks are: 1. To recall and monitor the fundamental concepts of computer networking, protocols, architectures, and applications 2. To identify the design, implementation and performance perspective of ISO- OSI layered Architecture 3. To apply with the major issues of the layers of the model 4. To demonstrate the different types of network topologies and protocols. 4. Enumerate the layers of the OSI model and TCP and IP. Explain the function(s) of each layer. 5. To develop students' understanding of Identify the different types of network devices and their functions within a network		
Course Learning Outcomes (CLO):				Students will be able to: 1. Interpret the different building blocks of the Communication network and its architecture. 2. Apply different types of switching networks and analyze the performance of network 3. Understand and explain the Data Communications System and its components. By using different types of network topologies and protocols. 4. Enumerate the layers of the OSI model and TCP and IP. Explain the function(s) of each layer. 5. Identify the different types of network devices and their functions within a network		

Course Contents and Syllabus:

Descriptors and Topics	**CLO**	**Hours**
UNIT I		
Introduction: Definition and goals, Design issues, Network architecture-broadcast & point to point, Models-OSI reference & TCP and IP and their comparative study, Network classification-LAN, WAN & MAN, protocols & services, types of service-connection oriented and connectionless, different protocols. Transmission Media: Twisted Pair, Coaxial cable, Fiber optic cable, Wireless transmission, telephone	**CLO 1**	**9**

system, multiplexing, switching-circuit, packet & message switching, Virtual circuit switch. Network devices-repeater, bridge, router, gateways, network interface cards, cabling system		
UNIT II		
Wireless Transmission: Communication Satellites - Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues - Error Detection and Correction.	**CLO 2**	**9**
UNIT III		
Elementary Data Link Protocols : Framing, Error control-Bit Error, causes of error, control methods, Flow control: Stop & wait, sliding window concept, piggybacking. Local Area Network Technology: Protocols- Aloha, CSMA, CSMA and CD, Collision free protocols, IEEE 802 protocols, standard- topologies, cabling system, Network management, MAC addressing frame format. Ethernet.	**CLO3**	**9**
UNIT IV		
Network Layer : Introduction, features & design issues, Routing- different routing algorithms, congestion control, Internetworking- Concepts and architecture. Addressing-IP Addressing and subnet masking, IP protocols, Network Address Translation, Address resolution protocol (ARP).	**CLO4**	**9**
UNIT V		
Transport Layer: Introduction, design issues, Transport layer addressing, buffering, multiplexing, recovery, TCP and IP suit of protocols- TCP & UDP Network applications, Connection establishment, Connection release, TCP Header.	**CLO5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. A. S. Tanenbaum, "Computer Networks", Prentice-Hall of India 2008, 4th Edition3.

Reference Books:

1. RENCE BOOKS: 1. Stallings, "Data and Computer Communications", Pearson Education 2012, 7th Edition.
2. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill 2007, 4th Edition.
3. F. Halsall, "Data Communications, Computer Networks and Open Systems", Pearson Education 2008.

Online Resources and E-Learning Resources

1. NPTEL & MOOC courses titled Computer Networks https: and and nptel.ac.in and courses and 106106091 and
2. https: and and www.geeksforgeeks.org and last-minute-notes-computer-network and
3. https: and and kanchiuniv.ac.in and coursematerials and VINODKUMAR_COMPUTER_NETWORKS.pdf

COURSE CURRICULUM

Name of the Program:	**MCA**	**Semester: II**	**Level: PG**
Course Name	**Computer And Network Security**	**Course Code and Course Type**	**PMC112B / MAJE**
Course Pattern	**Revised 2024**	**Version**	1.0

Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3	-	-	3	3	40	60	-

Prerequisite: Understanding of operating systems, networking protocols, and a basic understanding of programming languages

Course Objectives (CO):	The objectives of Computer And Network Security are: 1. To Recall the Concept of Security needed in the Communication of data through computers and networks along with Various Possible Attacks 2. To Understand Various Encryption mechanisms for the secure transmission of data and management of key required for encryption 3. To analyse authentication requirements and study various authentication mechanisms 4. To explain network security concepts and study different intrusion detection and Biometric Security 5. To design Different applications like web security, firewall by using application layer
Course Learning Outcomes (CLO):	Students will be able to: 1. Define Interpret the different building blocks of the Computer network and its architecture. 2. Apply different types of switching networks and analyse the performance of network 3. Understand the knowledge of various database security and Software security. 4. Design subletting and analyse the performance of network layer, Construct and examine various biometric security concepts. 5. Understand the functionality of application layer and its associated protocols

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Introduction: Data Communication, Transmission Methodologies, Data Link Layer, Multiple Access & Local Area Networks, Connecting Devices and Backbone Networks, Network Layer and Transport Layer, Application Layer, Wireless networking, wireless LANS & PANS, ad-hoc wireless networks & security, wireless sensor networks, Cellular Mobile Wireless Networks, Evolution of Modern Mobile Wireless Communication System.	**CLO 1**	**9**
UNIT II		
Cryptography and Network Security : Introduction to the Concept of Security, Cryptographic Techniques, Computer-based Symmetric and Asymmetric Key Cryptographic Algorithms, Public Key Infrastructure (PKI), Internet Security Protocols, Network Security. **Public Key Cryptography:** Need and Principles of Public Key Cryptosystems, RSA Algorithm, Key Distribution and Management, Diffie-Hellman Key Exchange, Digital Signatures	**CLO 2**	**9**
UNIT III		
Database Security and Software Security: Data management technologies, Information security, Information Management Technologies, Security policies, Policy enforcement & related issues, Design principles, Multilevel relational data models, Security impact on database function, inference problem **Software Security :** Defining a discipline, A Risk Management Framework, Code review with a tools, Architectural risk analysis, Software penetrating testing, Risk Based security Testing, An Enterprise S and W security program, Security knowledge	**CLO3**	**9**
UNIT IV		
Intrusion detection And Biometric Security: Defining Intrusion Detection, Security concepts intrusion Detection concept, determining strategies for Intrusion Detection, Responses, Vulnerability Analysis, Credentialed approaches, Technical issues. Biometric Fundamentals, Types of Biometrics, Fingerprints and Hand Geometry, Facial and Voice Recognition, Iris and Retina scanning, Signature Recognition and Keystroke Dynamics, Behavioural and Esoteric Biometric Technologies, Issues Involving Biometrics, Privacy, Policy and Legal Concerns Raised by Biometrics.	**CLO4**	**9**
UNIT V		
Network Security And Application Layer:, Web Security, SSL, TLS, DNS, DDNS, TELNET, EMAIL, FTP, WWW, HTTP, SNMP, Bluetooth, Firewalls	**CLO5**	**9**
Total Hours		**45**

Learning resources

Text Books:

1. "Cryptography & Network Security", PHI William Stalling
2. "Cryptography & Network Security", Mc Graw Hill Atul Kahate
3. "Cryptography & Network Security", PHI 4 Forouzan Additional

References:

1. "Modern Cryptography, Theory & Practice", Pearson Education. Wenbo Mao
2. "An Introduction to Mathematical Cryptography", Springer. Hoffstein, Pipher, Silvermman.
3. "The Design of Rijndael", Springer. J. Daemen, V. Rijmen.

Online Resources and E-Learning Resources

1. https: and and www.javatpoint.com and computer-network-security
2. https: and and www.tndalu.ac.in and econtent and 9_Computer_Network_And_Network_Security.pdf.

COURSE CURRICULUM

Name of the Program:		**MCA**		**Semester : II**		**Level: PG**	
Course Name		**Optimization Techniques**		**Course Code and Course Type**		**PMC113 / BSC**	
Course Pattern		**Revised 2024**		**Version**		1.0	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
2	-	1	3	3	40	60	-
Prerequisite: Linear Algebra and Univariate Calculus is essential							
Course Objectives (CO):		The objectives of Optimization Techniques are: 1. To Understand the role and principles of optimization techniques in business world (Understand) 2. To Demonstrate specific optimization technique for effective decision making (Apply) 3. To Apply the optimization techniques in business environments (Apply) 4. To Illustrate and infer for the business scenario (Analyze) 5. To Analyze the optimization techniques in strategic planning for optimal gain. (Analyze)					
Course Learning Outcomes (CLO):		Students will be able to : 1. Understand the role and principles of optimization techniques in business world. 2. Demonstrate specific optimization technique for effective decision making 3. Apply the optimization techniques in business environments 4. Illustrate and infer for the business scenario 5. Analyze the optimization techniques in strategic planning for optimal gain.					

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Introduction of operation research: 1.1. Various definitions, statements of basic theorems and properties, Advantages and Limitations, 1.2. Application areas of Linear programming 1.3. Linear Programming – Concept 1.4. Simplex Method and Problems 1.5. Two Phase Simplex Method and problems,	**CLO 1**	**9**
UNIT II		
Sequential model and Duality:- 2.1 Processing n jobs through 2 machines 2.2 Processing n jobs through 3 machines 2.3 Processing n jobs through m machine Extra Readings: Processing of n jobs through m machines 2.4 Definition of the dual problem 2.5 Primal dual relationship	**CLO 2**	**9**
UNIT III		
Project Management: PERT and CPM :3.1 Basic differences between PERT and CPM. 3.2 Network diagram 3.3 Time estimates (Forward Pass Computation, Backward Pass Computation 3.4 Critical Path 3.5 Probability of meeting scheduled date of completion, 3.6 Calculation on CPM network. 3.7 Various floats for activities 3.8 Event Slack 3.9 Calculation on PERT network. 3.10 Application of schedule based on cost analysis and crashing	**CLO3**	**9**
UNIT IV		
Transportation Model : 4.1 Definition of the Transportation model 4.2 The Transportation algorithm **The Assignment Model :**4.3 The Hungarian method 4.4 Simplex explanation of the Hungarian method	**CLO4**	**9**
UNIT V:		
Decision Analysis :- 5.1 Introduction to Decision Analysis 5.2 Types of Decision-making environment 5.3 Decision making under uncertainty and under risk 5.4 Concept of Decision Tree Extra Readings: Decision models in Econometrics and computer science	**CLO5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. Gillet B.E. Introduction to Operation Research, Computer Oriented Algorithmic approach - Tata McGraw Hill Publising Co. Ltd. New Delhi
2. P.K. Gupta & D.S. Hira, "Operations Research", S.Chand & Co.
3. B S Grewal, "Higher Engineering Mathematics", 44th edition, Khanna Publishers.

Reference Books:

1. J.K. Sharma, "Operations Research: Theory and Applications", Mac Millan. .
2. Tata Hamdy, A "Operations Research - An Introduction", Fifth Edition, Prentice Hall of India Pvt. Ltd., New Delhi.
3. Taha H.A. "Operations Research an Introduction" McMillan Publication.

Online Resources and E,Learning Resources:

1. https: and and www.ieor.iitb.ac.in and files and optimization-notes.pdf
2. https: and and people.eecs.berkeley.edu and ~varaiya and Download and Varaiya-Optimization.pdf
3. https: and and sites.google.com and thapar.edu and meenakshirana and Current-Semester-2020 and optimization-techniques_

COURSE CURRICULUM

Course Name		**Japanese language skill - L2**		**Course Code and Course Type**		**PFL201B/ AEC**	
Course Pattern		**Revised 2024**		**Version**		1.0	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
2	--	--	2	2	20	30	--
Prerequisite: Desire to get acquainted with the Japanese language. Basic knowledge of Hiragana and Katakana.							
Course Objectives (CO):		The objectives of Basic Japanese language skill are: 1. To meet the needs of ever growing industry, with respect to language support. 2. To get introduced to Japanese society and culture through language. 3. To promote multilingualism in exposing students to different cultures 4. Fostering respect for linguistic diversity. 5. Learning additional language to develop a better memory, talent for problem solving, ability to concentrate.					
Course Learning Outcomes (CLO):		After learning the course: 1. Read & write words that have been borrowed from other language. 2. Comprehend and speak basic conversation with basic particles 3. Speak and write about Routine 4. Basic sentence patterns incorporated into short dialogues indicating how they are used in actual conversation. 5. To understand grammatical structure, and improve communication abilities					

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Katakana Script: Katakana Script and Writing Kanji	**CLO 1**	**6**
UNIT II		
System of demonstrative words : Minna no Nihongo lesson no. 1,2 & 3	**CLO 2**	**6**
UNIT III		
Minna no Nihongo lesson no 4 (Write and Speak basic sentences in correct tenses)	**CLO 3**	**6**
UNIT IV		
Reading : Basic conversation using particles Listening : conversation related to particles Speaking : Sentences about give, lend, teach, receive	**CLO 4**	**6**
UNIT V		
Tenses : Writing : Affirmative present ,past & future Negative present ,past,& future sentences Writing : About Routine	**CLO 5**	**6**
Total Hours		**30**

Learning resources

Textbooks:

2. Minna no Nihongo , " Japanese for everyone" ,Elementary Main Textbook , Goyal Publishers & Distributors Pvt. Ltd.

Reference books:

1. Shyoho Volume 1
2. Genki Japan
3. Haru Vol. 1 & 2

Online Resources and E-Learning Resources:

2. U Tube links

https: and and youtu.be and 1JephUxTHxg?si=ouCwTXZc_fYgY9Kh

https: and and youtu.be and 9EfbkBkF2ag?si=rLNzc55_REacMoGu

https: and and youtu.be and DpEolYasgyg?si=dya9ue-YMSHO3VOG

https: and and youtu.be and itccOS1_LSk?si=hvPqILKlviuncMvA

COURSE CURRICULUM:-

Name of the Program:	**MCA**	**Semester : II**	**Level: PG**
Course Name	**Information Security**	**Course Code and Course Type**	**PDIEXMC101 / VSC**
Course Pattern	**Revised 2024**	**Version**	1.0

Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
2	--	--	2	2	50	-	--

Prerequisite: Basic computer Knowledge, Introduction to Computer Information Systems

Course Objectives (CO):	The objectives of Basic Information Security are: 1. To Understand the concepts of Information Security, cryptography and its applications 2. To Familiarize various authentication and integrity techniques available 3. To Understand firewalls and intrusion detection systems. 4. To Familiarize relevant security parameters in the web, internet, database and operating systems 5. To appreciate the difficulties that arise when valuable information needs to be shared
Course Learning Outcomes (CLO):	After learning the course: 1. Discuss the requirement of information security , private and public key algorithms and to examine the mathematics of cryptography Understanding 2. Analyze authentication and integrity techniques available Analysing 3. Interpret the importance of firewalls and intrusion detection systems and signatures. Understanding 4. Relate to the security issues and technologies used in the web, internet, database and operating system 5. Examine and apply the fundamental techniques of computer security.

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Introduction : Introduction to Information Security, principles, services and attacks, functional requirements of security, current trends in security, Need for security, Security approaches **Database and OS Security**: Introduction to database, Security requirements of database, sensitive data, Database access control, inference, Security in operating systems	**CLO 1**	**6**
UNIT II		
Cryptography and Authentication: Cryptography: Concept: Symmetric and Asymmetric Cryptography. Mathematics of cryptography: Modular Arithmetic Additive Inverse, Multiplicative Inverse, Euclidean Algorithm and Extended Euclidean Algorithm. Stream Cipher and Block Cipher, Concept of Confusion and Diffusion. Modes of Operation of Block Cipher: ECB, CBC, OFB, CFB , DES, RSA, Numerical on RSA Authentication: Types of authentication, Biometric Authentication and Third Party Authentication using KDC and Kerberos Version 5, Mutual authentication ,reflection attack	**CLO 2**	**6**
UNIT III		
Digital certificates and integrity Digital Signature: Concept, Compare Digital Signature with Public Key Cryptography, Digital Signature Schema. Public Key Infrastructure (PKI): Private key management, Public Key Cryptography Standards (PKCS). Digital Certificate Creation Steps, X.509 Certificate, Certificate Revocation **Integrity:** Message Integrity, Hash functions Properties Algorithm: MDC, MAC, HMAC, MD5, SHA -512	**CLO 3**	**6**
UNIT IV		
Internet and web security: SSL, IPSec, Email Security- PGP, Email attacks Web services Security: web app versus web service concept, WS-Security, SOAP web service, SAML assertion, Browser attacks, web attacks targeting users, obtaining user or website data.	**CLO 4**	**6**
UNIT V		
Firewall and IDS Firewall: Introduction, Characteristic ,Types :Packet Filter, Stateful and Stateless Packet Filter, Attacks of Packet Filter, Circuit Level and Application Level Firewall, Bastion Host, Firewall Configurations. **Intrusion:** What is Intrusion, Intruders, Intrusion Detection, Behaviour of Authorized user and Intruder, Approaches for Intrusion Detection: Statistical Anomaly Detection and Rule based Detection. Audit Record and Audit Record Analysis.	**CLO 5**	**6**
Total Hours		**30**

Learning resources

Reference books:

1. AtulKahate, "Cryptography and Network Security", McGraw Hill
2. Kaufman C., Perlman R., and Speciner, "Network Security", Private Communication in a public world, 2nd ed., Prentice Hall PTR.,2002
3. Cryptography and Network Security, Behrouz A Forouzan

Online Resources and E-Learning Resources:

1. **https://link.springer.com/content/pdf/10.1007%2F978-1-4302-6383-8_16.pdf**
2. **docs.oracle.com/cd/B19306_01/server.102/b14220/security.htm 3**
3. **https://www.w3.org/Security/security-resource 4**
4. **https://www.sophos.com/en-us/labs/security-threat-report.aspx 5**
5. **https://www.tutorialspoint.com/cryptography/data_integrity_in_cryptography.htm 6**
6. **https://www.unf.edu/public/cop4610/ree/Notes/PPT/PPT8E/CH15-OS8e.pdf**

MCA REVISED 2024 PATTERN

COURSE DETAILS

Semester - III

COURSE CURRICULUM:-

<table>
<tr><td colspan="2">Name of the Program:</td><td colspan="2">MCA</td><td colspan="2">Semester: III</td><td colspan="2">Level: PG</td></tr>
<tr><td colspan="2">Course Name</td><td colspan="2">Cloud Computing</td><td colspan="2">Course Code and Course Type</td><td colspan="2">PMC201 /MAJM</td></tr>
<tr><td colspan="2">Course Pattern</td><td colspan="2">Revised 2024</td><td colspan="2">Version</td><td colspan="2">1.0</td></tr>
<tr><td colspan="5">Teaching Scheme</td><td colspan="3">Assessment Scheme</td></tr>
<tr><td>Theory</td><td>Practical</td><td>Tutorial</td><td>Total Credits</td><td>Hours</td><td>CIA (Continuous Internal Assessment)</td><td>ESA (End Semester Assessment)</td><td>Practical and Oral</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>40</td><td>60</td><td>-</td></tr>
<tr><td colspan="8">Prerequisite: Some skills related to basic concepts of an Operating System (OS) , Database</td></tr>
<tr><td colspan="3">Course Objectives (CO):</td><td colspan="5">The objectives of Cloud Computing are:
1. To recall fundamentals of cloud computing.
2. To learn and acquire good working knowledge of the essentials of Cloud Micro Services
3. To implement business specific cloud applications
4. To Demonstrate the use of CloudSim and GreenCloud
5. for modeling cloud environments.
6. To create and manage virtual machines using
7. VMware to understand cloud-based virtualization.</td></tr>
<tr><td colspan="3">Course Learning Outcomes (CLO):</td><td colspan="5">Students will be able to:
1. Identify the basics of cloud computing, cloud models and its applications.
2. Understand cloud application architectural styles and examine cloud-native approaches.
3. Analyse cloud architecture layers, service models, and deployment models to build applications.
4. Apply cloud simulators to simulate cloud environments and analyze performance.
5. Design and implement virtualization using VMware tools like workstation and managing VMs.</td></tr>
</table>

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Cloud Fundamentals: Cloud computing- Origin of Cloud Computing, Definition. Essential characteristics- On-demand self-service, Broad network access, Location independent resource pooling, Rapid elasticity, Measured service. Comparing cloud providers with traditional IT service providers. Roots of cloud computing, Application of Cloud Computing. Introduction to Cloud Platforms- AWS, Azure, GCP.	**CLO 1**	**9**
UNIT II		
Application Architectures: Architectural influences – High-performance computing, Utility and Grid computing, Cloud scenarios. Benefits: scalability, simplicity, vendor flexibility, security; Limitations: Sensitive information, Application development-security level of third party, Regularity issues- Government policies. Cloud Application Architecture Monolithic and Distributed, Micro Service fundamentals, Design Approach – Cloud Native Application – Application Integration Process. API fundamental – API Management	**CLO 2**	**9**
UNIT III		
Cloud Architecture- Layers and Models: Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption. Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing	**CLO3**	**9**
UNIT IV		
Cloud Simulators- CloudSim and GreenCloud: Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture User code, CloudSim, GridSim. Understanding Working platform for CloudSim, Introduction to GreenCloud	**CLO4**	**9**
UNIT V		
Introduction to VMWare Simulator: Basics of VMWare, advantages of VMware virtualization, using Vmware workstation, creating virtual machines-understanding virtual machines, creating a new virtual machine on local host, cloning virtual machines, virtualizing a physical machine, starting and stopping a virtual machine	**CLO5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing Principles and Paradigms, 1st Edition, Wiley, 2013. 71 CURRICULUM (2021 - 2022) B. Tech Computer Science and Engineering and Business Systems
2. Ronald Krutz and Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley, 2010.

Reference Books:

1. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, McGraw Hill, 2010.
2. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Helper, Cloud Computing For Dummies, Wiley, 2010.

Online Resources and E-Learning Resources

1.https://www.tutorialspoint.com and cloud_computing and cloud_computing_tutorial.pdf
2.https://www.geeksforgeeks.org and cloud-computing and
3.https://www.techtarget.com and searchcloudcomputing and definition and cloud-computing

COURSE CURRICULUM;-

Name of the Program:	**MCA**	**Semester : III**	**Level: PG**
Course Name	**Cloud Computing Lab**	**Course Code and Course Type**	**PMC202/ MAJM**
Course Pattern	**Revised 2024**	**Version**	1.0

Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
-	1	-	1	2	25	-	25

Prerequisite: Some skills related to basic concepts of an Operating System (OS) , Database

Course Objectives (CO):	The objectives of **Cloud Computing** Lab are: 1. To provide foundational understanding of cloud computing and AWS services. 2. To enable practical deployment and configuration of cloud resources using AWS. 3. To introduce monitoring and management tools available in AWS for resource optimization. 4. To familiarize students with AI-as-a-Service using AWS Rekognition and Polly. To encourage real-world application development using multiple AWS components.
Course Learning Outcomes (CLO):	Students will be able to: 1. Understand cloud fundamentals and deploy a basic cloud application using AWS. 2. Implement and manage core AWS services like EC2 and S3 for IaaS-based solutions. 3. Apply monitoring techniques using AWS CloudWatch and build simulated cloud apps. 4. Use AWS AI tools like Rekognition and Polly to process multimedia using cloud services and Create IAM. 5. Design, develop, and demonstrate a complete mini-project using integrated AWS services.

Course Contents and Syllabus:

Practical Plan

Sr. No	Practical Title	Week and Turn	Detailed	CLO	Hours
1	Study of Cloud Computing & Architecture	Week1	Develop Cloud Application using Amazon Cloud	CLO1	2
2		Week2	Study and implementation of Infrastructure as a Service.	CLO2	2
3		Week3	Implementation of Amazon cloud services.	CLO2	2
4	Use Case	Week4	Patient Health Monitoring using AWS	CLO3	2
5		Week5	Financial Trading Monitoring System using AWS	CLO3	2
6		Week6	Cloud Use case resource monitoring using AWS. (Monitoring via CloudWatch)	CLO3	2
7	AI on AWS	Week7 & Week8	Upload a sample image to S3, use AWS Rekognition to detect labels/faces in the image. Use AWS Polly to convert typed text into speech and download the audio output.	CLO4	4
8.	Creating and Managing IAM Users and Policies	Week9 & Week10	Define users, groups, and apply permission policies	CLO4	4
9	Introduction to AWS CLI	Week11	Use AWS Command Line Interface for launching and managing services	CLO4	2
10	Mini Project	Week 12-Week15	Design and develop custom Application.	CLO5	8
Total Hours					**30**

Learning resources

Textbooks:

1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing Principles and Paradigms, 1st Edition, Wiley, 2013. 71 CURRICULUM (2021 - 2022) B. Tech Computer Science and Engineering and Business Systems
2. Ronald Krutz and Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley, 2010.

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1. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, McGraw Hill, 2010.
2. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Helper, Cloud Computing For Dummies, Wiley, 2010.

Online Resources and E-Learning Resources:

1. www.geeksforgeeks.org and cloud-computing and
2. www.tutorialspoint.com and cloud_computing and cloud_computing_tutorial.pdf
3. www.techtarget.com and searchcloudcomputing and definition and cloud-computing

COURSE CURRICULUM:-

Name of the Program:	**MCA**			**Semester: III**		**Level: PG**	
Course Name		**Machine Learning using Python**		**Course Code and Course Type**		**PMC203 /MAJM**	
Course Pattern		**Revised 2024**		**Version**		1.0	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3	-	-	3	3	40	60	-
Prerequisite: Solid understanding of mathematics, statistics, programming, and data analysis.							
Course Objectives (CO):				The objectives of **Machine Learning** are: 1. To recall the ability to comprehend the concept of supervised and unsupervised learning techniques 2. To analyse, differentiate regression, classification and clustering techniques and to implement their algorithms. 3. To explain the performance of various machine learning techniques and to select appropriate features for training machine learning algorithms. 4. To Apply structured thinking to unstructured problems 5. To be able to evaluate the efficacy of a range of reinforcement learning methods.			
Course Learning Outcomes (CLO):				Students will be able to: 1. Understand basic mathematical and statistical tools required for engineering 2. Implement a bridge between the elementary statistical tools and probability theory 3. Ability to implement various data analytics techniques to visualize the data. 4. Implement an appropriate method based on the interpolation. 5. Apply machine learning algorithms to solve a given problem using Python programming.			

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Introduction to Data Science ;- What is Data Science and why it is important?, Role of Data Scientist and skills required, Data acquisition: sources of data, data formats, data cleaning, etc., Exploratory Data Analysis (EDA): statistical analysis, data visualization techniques, Introduction to libraries/tools: NumPy, Pandas, Matplotlib, Seaborn, etc	**CLO 1**	**9**
UNIT II		
Introduction to Data Cleaning, The importance of integrity of data, Regular Expressions, Tools and Techniques for Data Cleaning, Effective data cleaning techniques: Remove duplicates, Remove irrelevant data, Standardize capitalization, Convert data type, Clear formatting, Fix errors, Language translation, Handle missing values, Optimize the data-cleaning process, Data Cleaning using Python	**CLO 2**	**9**
UNIT III		
Fundamentals of Machine Learning :- Introduction to Machine Learning and its Importance Types of Machine Learning: Supervised, Unsupervised, and Reinforcement Learning, Basic concepts: features, labels, training data, etc., Popular Machine Learning algorithms: Linear Regression, Logistic Regression, Decision Trees, kNearest Neighbors, etc., Evaluation metrics for Machine Learning models: accuracy, precision, recall, F1-score, etc.	**CLO3**	**9**
UNIT IV		
Machine Learning Techniques :- Data preprocessing techniques handling missing data, feature scaling, feature encoding, etc., Model selection and hyperparameter tuning, Cross-validation techniques Ensemble methods: Bagging, Boosting, Random Forests, etc. Introduction to deep learning and neural networks	**CLO4**	**9**
UNIT V		
Advanced Topics and Applications;- Advanced Machine Learning techniques: Support Vector Machines (SVM), Neural Networks, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), etc., Natural Language Processing (NLP) and its applications, Introduction to Big Data technologies: Hadoop, Spark, etc., Case studies and real-world applications in various domains, Future trends and career prospects in AI, ML, and Data Science	**CLO5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Pearson, Third Edition, 2014.

2. Friedman Jerome, Trevor Hastie, and Robert Tibshirani. The Elements of Statistical Learning. Springer,Verlag, 2nd Edition, 2013.

Reference Books:

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.

2. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press, 2012.

Online Resources and E,Learning Resources

1.https: and and www.tutorialsduniya.com and notes and machine,learning,notes and

2.https: and and www.geeksforgeeks.org and machine,learning and

3.https: and and newtondesk.com and machine,learning,tutorial,handwritten,study,notes,pdf and

COURSE CURRICULUM:-

Name of the Program:	**MCA**	**Semester : III**	**Level: PG**
Course Name	**Machine Learning Using Python LAB**	**Course Code and Course Type**	**PMC204 /MAJM**
Course Pattern	**Revised 2024**	**Version**	1.0

Teaching Scheme				**Assessment Scheme**			
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
-	1	-	1	2	25	-	25

Prerequisite: Solid understanding of mathematics, statistics, programming, and data analysis.

Course Objectives (CO):	The objectives of **Machine Learning Lab** are: 1. To recall the ability to comprehend the concept of supervised and unsupervised learning techniques 2. To analyse, differentiate regression, classification and clustering techniques and to implement their algorithms. 3. To explain the performance of various machine learning techniques and to select appropriate features for training machine learning algorithms. 4. To apply structured thinking to unstructured problems 5. To be able to evaluate the efficacy of a range of reinforcement learning methods.
Course Learning Outcomes (CLO):	Students will be able to: 1. Solve the given problem based on statistical techniques using Python -Programming. 2. Implement statistical methods using Python -Programming. 3. Understand principles of probability, one must solve given problem. 4. Implement appropriate method based on the interpolation. 5. Apply sampling methods to solve a given problem using Python -Programming.

Course Contents and Syllabus:
Practical Plan

Practical No.	Week No. and Turn 1	Practical Title	CLO	Hours
1	Week 1	Load a dataset (e.g., Iris dataset, Titanic dataset) into Python using Pandas. Explore the dataset by: · Displaying the first few rows. · Checking for missing values. · Calculating summary statistics. · Visualizing distributions of numerical variables.	CLO2	2
2	Week 2	Perform data preprocessing tasks such as: · Handling missing values (e.g., imputation, deletion). · Encoding categorical variables (e.g., one-hot encoding, label encoding). · Scaling numerical features (e.g., standardization, normalization).	CLO2	2
4	Week 3	Implement a supervised learning algorithm (e.g., decision tree classifier, logistic regression) using Scikit-learn. Train the model on a training set and evaluate its performance on a test set using appropriate metrics (e.g., accuracy, precision, recall, F1-score).	CLO2	2
5	Week 4	Experiment with different hyperparameters of the supervised learning model (e.g., max_depth for decision trees, C for logistic regression) and observe how they affect model performance.	CLO2	2
6	Week 5	Apply an unsupervised learning algorithm (e.g., K-means clustering, hierarchical clustering) to a dataset. Explore the resulting clusters and interpret the findings.	CLO2	2
7	Week 6	Use dimensionality reduction techniques (e.g., Principal Component Analysis, t-SNE) to visualize high-dimensional data in two or three dimensions. Discuss the insights gained from the visualization.	CLO2	2
8	Week 7	Split a dataset into training and testing sets using cross-validation techniques (e.g., k-fold crossvalidation, stratified cross-validation). Train a machine learning model on multiple folds and compute the average performance metrics	CLO3	2
9	Week 8	Perform model selection by comparing the performance of multiple algorithms (e.g., decision tree, random forest, support vector machine) on a given dataset. Choose the best-performing model based on evaluation metrics.	CLO3	2

10	**Week 9**	Explore ensemble learning techniques (e.g., bagging, boosting) by implementing ensemble models such as Random Forest or Gradient Boosting Machines. Compare the performance of ensemble models with individual base models.	**CLO3**	**2**
11	**Week 10**	Implement a neural network model using TensorFlow or PyTorch. Design the architecture of the neural network (e.g., number of layers, activation functions) and train the model on a dataset. Evaluate the performance of the neural network on a test set.	**CLO4**	**2**
12	**Week 11**	Choose a real-world dataset related to a specific domain (e.g., healthcare, finance, retail). Apply appropriate machine learning techniques to solve a relevant problem, such as predicting customer churn, diagnosing diseases, or forecasting stock prices.	**CLO4**	**2**
13	**Week 12**	Present the results of your analysis in a clear and interpretable manner, using data visualization techniques (e.g., plots, charts) to communicate insights to stakeholders.	**CLO4**	**2**
14	**Week 13**	Load a dataset using Pandas and perform basic data exploration tasks such as checking for missing values and visualizing data distributions	**CLO4**	**2**
15	**Week 14**	Preprocess the data by handling missing values, encoding categorical variables, and scaling numerical features.	**CLO4**	**2**
16	**Week 15**	For relevant datasets make prediction models for the following 1. Naïve Bayes Classifier	**CLO4**	**2**
17	**Week 16**	2. Simple Linear Regression multiple linear regression	**CLO5**	**2**
18	**Week 17**	3. Polynomial Regression	**CLO5**	**2**
19	**Week 18**	4. Lasso and Ridge Regression	**CLO5**	**2**
20	**Week 19**	5. Logistic regression	**CLO5**	**2**
21	**Week 21**	6. Artificial Neural Network	**CLO5**	**2**
22	**Week 22**	7. k-NN classifier	**CLO5**	**2**

23	**Week 23**	8. Decision tree classification	**CLO5**	**2**
24	**Week 24**	9. SVM classification	**CLO5**	**2**
25	**Week 25**	10. K-Means Clustering	**CLO5**	**2**
26	**Week 26**	11. Hierarchical Clustering	**CLO5**	**2**

Learning resources

Textbooks:

1. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Pearson, Third Edition, 2014.

2. Friedman Jerome, Trevor Hastie, and Robert Tibshirani. The Elements of Statistical Learning. Springer-Verlag, 2nd Edition, 2013.

Reference Books:

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.

2. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press, 2012.

Online Resources and E-Learning Resources

1. Data sets can be taken from standard repositories (https: and and archive.ics.uci.edu and ml and datasets.html) or constructed by the students.
2. https: and and www.tutorialsduniya.com and notes and machine,learning,notes and
3. https: and and www.geeksforgeeks.org and machine,learning and
4. https: and and newtondesk.com and machine,learning,tutorial,handwritten,study,notes,pdf

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COURSE CURRICULUM

Name of the Program:	**MCA**			**Semester: III**		**Level: PG**	
Course Name		**Software Testing**		**Course Code and Course Type**		**PMC205 A / MAJE**	
Course Pattern		**Revised 2024**		**Version**		1.0	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3	-	-	3	3	40	60	-
Prerequisite: would include knowledge of Programming languages, Database concepts, Project life cycle, Testing concepts, testing types							
Course Objectives (CO):				The objectives of Software Testing are: 1. To recall the knowledge of software testing techniques 2. To understand how testing methods can be used as an effective tool in quality assurance of software. 3. To analyse skills to design test case plans for testing software. 4. To Understand the knowledge of the latest testing methods 5. To Develop the basic application of techniques used to identify useful ideas for tests		
Course Learning Outcomes (CLO):				Students will be able to: 1. Identify various software testing methods and strategies. 2. Understand a variety of software metrics, and identify defects and manage those defects for improvement in quality for given software. 3. Design test cases and test plans, review reports of testing for qualitative software. 4. Analyse different functional methods for software 5. Create the latest testing methods used in the software industries.		

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Introduction to Software Testing: Basics of Software Testing , faults, errors and failures, Testing objectives:-Principles of testing Testing and debugging, Testing metrics and measurements ,Verification and Validation :- Testing Life Cycle Measurement Theory, Software Measurement and Models, Measurement Scales, Classification of Software Measures, Measurement Framework, Theory of Program Testing, Graph Theory for Testers, Software Complexity, Measuring Internal Product Attributes: Size, Measuring Internal Product Attributes : Structure, Halstead's Software Science, Product Quality Metrics, In-Process Quality Metrics, Software Reliability: Measurement and Prediction.	**CLO 1**	**9**
UNIT II		
Software Testing Strategies & Techniques: Testability - Characteristics lead to testable software. Test characteristics Test Case Design for Desktop, Mobile, and Web application using Excel White Box Testing - Basis path testing, Control Structure Testing. Black Box Testing- Boundary Value Analysis, Equivalence partitioning. Differences between BBT & WBT	**CLO 2**	**9**
UNIT III		
Levels of Testing: A Strategic Approach to Software Testing Test strategies for conventional Software Unit testing Integration testing , Top-Down, Bottom-up integration System Testing , Acceptance, performance, regression, Load and Stress testing, Security testing, Internationalization testing. Alpha, Beta Testing Usability and accessibility testing Configuration, compatibility testing.	**CLO3**	**9**
UNIT IV		
Functional Testing: Test Plan, Test Management, Test Execution and Reporting, Test Specialist Skills, Tester's Workbench and Tool Categories, Test Maturity Model and Test Process Assessment, Debugging & Root Cause Analysis, Software Items, Component & Units, Test Bed, Traceability and Testability, Attributes of Testable Requirements, Test Matrix, Types of Testing Documentation, Verification Testing, Validation Testing, Integration Testing, System and Acceptance Testing, GUI Testing, Regression Testing, Selection, Minimization and Prioritization of Test Cases for Regression Testing, Creating Test Cases from Requirements and Use cases, Software Defects: Origins of Defects, Defect Classes, Defect Repository and Test Design, Defect Repository	**CLO4**	**9**
UNIT V		
Higher Order Testing: Object Oriented Testing, Specification Based Testing, Performance Testing, Ad-hoc Testing, Usability and Accessibility Testing, Risk-based Testing, Exploratory Testing, Scenario-	**ClO5**	**9**

based Testing, Random Testing Compatibility Testing, User Documentation Testing, Client, Server System Testing, RAD Testing, Configuration Testing, Testing internal Controls, Multiplatform Environment Testing, Security Testing, Web-based System Testing, Reliability Testing, Efficiency Testing, Maintainability Testing, Portability Testing, Introduction to Performance Testing, Application Performance Testing, Process of Performance Testing, Effective Root-Cause analysis, Testing VS Test Automation, Tool evaluation and selection, Automation team roles, Architectures, Planning and implementing test automation process		
Total Hours		**45**

Learning resources

Textbooks:

1. Effective Methods of Software Testing, William E Perry, 3rd Edition, Wiley Publishing Inc
2. Managing the Testing Process: Practical Tools and Techniques for Managing Hardware and Software Testing, Rex Black, Microsoft Press, 1999

Reference Books:

1. Software Engineering , A Practitioner's Approach, Roger S. Pressman, 7 thEdition, Tata McGraw Hill, 20
2. Effective Methods of Software Testing, William E Perry, 3rd Edition, Wiley Publishing Inc
3. Managing the Testing Process: Practical Tools and Techniques for Managing Hardware and Software Testing, Rex Black, Microsoft Press, 1999

Online Resources and E-Learning Resources

1. https: and and www.guru99.com and software-testing.html
2. https: and and www.softwaretestingmaterial.com and testng-tutorial and
3. https: and and www.softwaretestinghelp.com and manual-testing-tutorial-1 and

COURSE CURRICULUM

Name of the Program:	**MCA**		**Semester : III**		**Level: PG**		
Course Name	**Software Project Management**		**Course Code and Course Type**		**PMC205B /MAJE**		
Course Pattern	**Revised 2024**		**Version**		**1.0**		
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3	-	-	3	3	40	60	-
Prerequisite: Soft skills Leadership, Team Management, Communication							
Course Objectives (CO):	The objectives of Software Project Management are: 1. To recall the fundamental concepts of Software development process. 2. To Evaluate project estimation and evaluation techniques to real world problem 3. To Apply Key project management system techniques like PERT,CRM 4. To analyse the project's current status, and risks using earned value data. 5. To develop the software development lifecycle model recommended for the project, along with the strengths and weaknesses model						
Course Learning Outcomes (CLO):	Students will be able to: 1. Understand the knowledge of the fundamental elements and concepts related to Project Management activities and types of software projects.. 2. Identify project risk, monitor and track project deadlines 3. Schedule the activities of the project to get a critical path. 4. Apply different techniques in monitoring and control of project 5. Evaluate Work in teams to evaluate the different modes of communication among people.						

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Introduction: Programming in the small vs. programming in the large; software project failures and importance of software quality and timely availability; of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline, Software Engineering Historical Development from Jackson Structured Programming to Agile Development. Use and apply Visualization techniques for planning the activities related to Software projects.	**CLO 1**	**9**
UNIT II		
Project Evaluation And Activity Planning: Step-wise approach for planning the software project, Product break down structure for identifying the project activities, Strategic Assessment, Technical Assessment, Cost Benefit Evaluation Techniques, Risk Evaluation Objectives, Project Schedule, Activity-based approach, Product-based approach, Hybrid approach Sequencing and Scheduling Activities, Network Planning Models, Forward Pass, Backward Pass, Scheduling, PERT techniques, CRM.	**CLO 2**	**9**
UNIT III		
Risk Management And Monitoring: Nature Of Risk,Types Of Risk, Managing Risk, Software project risk and strategies to reduce the risk, PERT using three estimates, Creating Framework , Collecting The Data , Visualizing Progress , Cost Monitoring	**CLO3**	**9**
UNIT IV		
Control And Organizing Teams: Creating Framework,Decision making,cost Monitoring,Change Control ,Managing Contracts ,Introduction ,Types Of Contract,Contract Management., Introduction,Understanding Behaviour,Organizational Behaviour: A Background ,Selecting The Right Person For The Job ,Working in group, Decision Making, Leadership.	**CLO4**	**9**
UNIT V		
Project Management: Team structure , Project tracking - Managing the contract , change control , Team management , Communication , Software Configuration Management.	**CLO5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. Mike Cotterell, Bob Hughes, Rajib Mall , Software Project Management, 2011, 5 THEdition, Tata McGraw,Hill.
2. Roger S. Pressman, Software engineering: a practitioner's approach, Palgrave macmillan, 7th Edition, 2017.

Reference Books:

1. Greg Horine,Project Management Absolute Beginner's Guide, 2012, 3 rd Edition, Que Publishing
2. The Essentials of Modern Software Engineering: Free the Practices from the Method Prisons, Ivar Jacobson, Harold "Bud" Lawson, Pan,Wei Ng, Paul E. McMahon and Michael Goedicke

Online Resources and E,Learning Resources

1. https: and and ocw.mit.edu and courses and esd-36-system-project-management-fall-2012 and pages and lecture-notes and
2. https: and and ocw.mit.edu and courses and esd-36-system-project-management-fall-2012 and resources and mitesd_36f12_lec04 and
3. https: and and www.manage.gov.in and studymaterial and PM.pdf

COURSE CURRICULUM

Name of the Program:	**MCA**			**Semester : III**		**Level: PG**	
Course Name		**Data Mining And Data Warehousing**		**Course Code and Course Type**		**PMC 206 / SEC**	
Course Pattern		**Revised 2024**		**Version**		1.0	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
2	-	-	2	2	20	30	-

Prerequisite: Basic understanding of Statistics, Database Knowledge, and Basic programming language.

Course Objectives (CO):	The objectives of Data Mining And Data Warehousing are: 1. To recall the principles of Data warehousing and Data Mining 2. To recognize the Data warehouse architecture and its Implementation. 3. To analyse the Architecture of a Data Mining system 4. To evaluate various Data pre-processing Methods. 5. To discover interesting patterns from large amounts of data to analyse for predictions and classification.
Course Learning Outcomes (CLO):	Students will be able to: 1. Identify the scope and necessity of Data Mining & Warehousing for the society 2. Describe the designing of Data Warehousing so that it can be able to solve the root problems. 3. Understand various tools of Data Mining and their techniques to solve the real time problems. . 4. Develop the ability to design various algorithms based on data mining tools. 5. Develop further interest in research and design of new Data Mining techniques.

Course Contents and Syllabus:

Descriptors and Topics	**CLO**	**Hours**
UNIT I		
Data Warehousing and Business Analysis: Data warehousing Components, Building a Data warehouse, Data Warehouse Architecture, DBMS Schemas for Decision Support, Data Extraction, Clean-up, and Transformation Tools, Online Analytical Processing (OLAP), OLAP and Multidimensional Data Analysis.	**CLO 1**	**6**
UNIT II		
Data Mining: Data Mining Functionalities , Data Pre-processing , Data Cleaning , Data Integration and Transformation , Data Reduction , Data Discretization and Concept Hierarchy Generation- Architecture of A Typical Data Mining Systems- Classification Of Data Mining Systems.	**CLO 2**	**6**
UNIT III		
Association & Classification: Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods , Mining Various Kinds of Association	**CLO3**	**6**

Rules Issues Regarding Classification and Prediction , Classification by Decision Tree Introduction , Bayesian Classification , Rule Based Classification , Support Vector Machines, Lazy Learners , Other Classification Methods		
UNIT IV		
Cluster Analysis: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical methods, Density-Based Methods , Grid-Based Methods , Outlier Analysis.	**CLO4**	**6**
UNIT V		
Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.	**CLO5**	**6**
Total Hours		**30**

Learning resources

Textbooks:

1. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, third edition ,2013 Pang-Ning Tan,Michael Steinbach, Anuj Karpatne, Vipin Kumar
2. Introduction to Data Mining, second edition, Pearson, 2019

Reference Books:

1. Ian.H.Witten, Eibe Frank and Mark.A.Hall, Data Mining:Practical Machine Learning Tools and Techniques,third edition , 2017
2. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw Hill Edition, Tenth Reprint, 2008.
3. Hand, D., Mannila, H. and Smyth, P. Principles of Data Mining, MIT Press: Massachusets. third edition, Pearson, 2013

Online Resources and E-Learning Resources

1.https: and and dl.ebooksworld.ir and motoman and Cambridge.University.Press.Data.Mining.and.Data.Warehousing.www.EBooksWorld.ir.pdf

2.https: and and harshityadav95.medium.com and data-mining-and-data-warehousing-8068df0798

COURSE CURRICULUM

Course Contents and Syllabus:

Name of the Program:	**MCA**			**Semester : III**		**Level: PG**	
Course Name		**Research Methodology IPR**		**Course Code and Course Type**		**PMC207 / VEC**	
Course Pattern		**Revised 2024**		**Version**		1.0	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3	-	-	3	3	40	60	-
Prerequisite: student must research sense, Knowledge About hypothesis and research topic demand							
Course Objectives (CO):				The objectives of Research Methodology are: 1. Understand the foundational principles of research, its process, and problem formulation. 2. Identify, review, and critique relevant literature and employ appropriate measurement and data techniques. 3. Design appropriate sampling methods and differentiate between research designs. 4. Perform hypothesis testing and analyze data using suitable statistical methods. 5. Compose a research report or paper integrating ethical standards, referencing norms, and academic rigor.			
Course Learning Outcomes (CLO):				Students will be able to: 1. Define and explain key concepts and methodologies of research and articulate research problems. 2. Analyse and summarize literature reviews, data types, and appropriate data collection techniques. 3. Design suitable sampling strategies and apply research designs for various problem scenarios. 4. Examine and apply hypothesis testing methods using appropriate statistical tools. 5. Develop a complete research report including all standard components using proper academic writing and citation styles.			

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Introduction to Research Methodology: Introduction- Definition, Significance of Research. Objectives of Research. Types of Research. Research Methods versus Methodology. Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. Research in Computer Applications. **Defining the Research Problem**: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.	**CLO 1**	**9**
UNIT II		
Reviewing The Literature: Concept & use of Literature Review, Review of the literature, Searching the existing literature, Reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed. **Measurement and Scaling**: Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Techniques. **Data Collection**: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.	**CLO 2**	**9**
UNIT III		
Research & Sample Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs. Design of sample surveys: Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.	**CLO 3**	**9**
UNIT IV		
Testing Of Hypotheses & Analysis: Hypothesis: Basic Concepts, Formation. Testing of Hypotheses: Test Statistics and Critical Region, Critical Value and Decision Rule. Procedure for Hypothesis Testing. Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances. Level of Significance, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. Chi-square Test.	**CLO 4**	**9**
UNIT V		
Report writing: Meaning and types of research reports, significance of report writing. Structure and components of a research paper: Title Page, Abstract, Introduction, review of literature, Methodology, Results, Discussion and Conclusion, References. Guidelines for writing an effective research paper. Citation styles (APA/MLA/Chicago) Plagiarism and ethical considerations in research writing.	**CLO 5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. Research Methodology: Methods and Techniques C.R. Kothari, Gaurav Garg New Age international 4th Edition, 2018
2. Research Methodology a step-by step guide for beginners. (For the topic Reviewing the literature under module 2) Ranjit Kumar SAGE Publications Ltd 3rd Edition, 2011
3. Study Material (For the topic Intellectual Property under module 5) Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013

Reference Books:

1. Research Methods: the concise knowledge base Trochim Atomic Dog Publishing 2005
2. Business Research Methods, William G. Zimkmund, CENGAGE Learning
3. Conducting Research Literature Reviews: From the Internet to Paper Fink A Sage Publications 2009

Online Resources and E-Learning Resources

1. https: and and onlinecourses.swayam2.ac.in and ntr24_ed08 and preview
2. https: and and nptel.ac.in and courses and 106 and 105 and 106105077 and

MCA REVISED 2024 PATTERN

COURSE DETAILS

Semester - IV

COURSE CURRICULUM

Course Contents and Syllabus:

Name of the Program:	**MCA**			**Semester : IV**		**Level: PG**	
Course Name	**Crypto And Blockchain**			**Course Code and Course Type**		**PMC209 / MAJM**	
Course Pattern	**Revised 2024**			**Version**		1.0	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3	-	-	3	3	40	60	-
Prerequisite: Good knowledge of Information technologies, Information security, and computer science.							
Course Objectives (CO):	The objectives of Crypto and Blockchain are: 1. To recall building blocks of Blockchain. 2. To recognize the significance of Distributed Ledger Technology and Smart Contract. 3. To evaluate applications of Blockchain in real world scenarios and their impacts. 4. To explain cryptographic building blocks and reason about their security 5. To exploit applications of Blockchain in real world sceneries						
Course Learning Outcomes (CLO):	Students will be able to: 1. Identify Block chain ecosystem and its services in real world sceneries 2. Apply and Analyse the primitives of the distributed computing and cryptography related to block chain 3. Design and Demonstrate end-to-end decentralized applications 4. Explore the concepts of Bitcoin and their usage. 5. Explain Privacy, Security issues of block Chain						

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys. Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.	**CLO 1**	**9**
UNIT II		
Cryptocurrency Regulation: : Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain. Decentralization and Cryptography	**CLO 2**	**9**
UNIT III		
Bitcoin and Alternative Coins A: Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash	**CLO3**	**9**
UNIT IV		
Bit Coin and Crypto currency: What is Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree	**CLO4**	**9**
UNIT V		
Privacy, Security issues in Blockchain: Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks	**CLO5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. Mastering Block chain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017

Reference Books:

1. Narayanan, Bonneau, Felten, Miller and Goldfeder, "Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction", Princeton University Press.
2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.
3. Imran Bashir, "Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing

Online Resources and E-Learning Resources

1. https: and and documents1.worldbank.org and curated and en and 293821525702130886 and pdf and Cryptocurrencies-and-blockchain.pdf
2. https: and and freecomputerbooks.com and Blockchain-and-Crypto-Currency.html
3. https: and and www.oreilly.com and library and view and hands-on-smart-contract and 9781492086116 and ch01.html

COURSE CURRICULUM

Name of the Program:	**MCA**	**Semester : IV**	**Level: PG**
Course Name	**DevOps**	**Course Code and Course Type**	**PMC210 / VSC**
Course Pattern	**Revised 2024**	**Version**	1.0

Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical and Oral**
3	-	-	3	3	40	60	-

Prerequisite: Basic Understanding of Software Development, Operating Systems and Networking, Security and Compliance, Programming Languages.

Course Objectives (CO):	The objectives of DevOps are: 1. To describe the evolution of technology & timeline. 2. To explain Introduction to various Devops platforms 3. Todemonstrate the building components / blocks of Devops and gain an insight of the Devops Architecture. (Understand) . 4. To apply the knowledge gain about Devops approach across various domains (Apply) 5. To build DevOps application (Apply)
Course Learning Outcomes (CLO):	Students will be able to: 1. Understand the fundamental concepts of devops 2. Link the background of devops with other technologies 3. Comprehend the concept of continuous integration and continuous delivery 4. Compare various stages of continuous deployment and test strategies 5. Justify the importance of monitoring system and reliability engineering

Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
CI & CD, Organizing For Devops,, Measuring Devops(Vanity metrics vs. Actionable metrics), Comparison of DevOps to Site Reliability Engineering, Organizational Impact of DevOps, Agile Roles and the Need for Training, Working Agile	**CLO 1**	**9**
UNIT II		
Agile Development and Scrum:- Scrum , The 3 Roles of Scrum, Organizational impact of Agile, Mistaking Iterative Development for Agile , Kanban and Agile Planning Tools, framework for applying Agile, Sprint Planning	**CLO 2**	**9**
UNIT III		
Introduction to Containers w/ Docker, Kubernetes & OpenShift:- ,:- Introduction to Containers, Introduction to Docker, Docker Objects, Docker Architecture, Introduction to Kubernetes, Kubernetes Architecture, ReplicaSet, Autoscaling, Introduction to Red Hat OpenShift	**CLO3**	**9**
UNIT IV		
Application Development using Microservices and Serverless :- Twelve-Factor App Methodology, Twelve-Factor App Methodology, Making API Requests using CURL and Postman, The Serverless Framework, IBM Cloud Code Engine, Building Container Images for Microservices, Deploying and Running Applications,	**CLO4**	**9**
UNIT V		
Introduction to Test and Behavior Driven Development:- Testing Levels and Release Cycle, TDD and BDD, Anatomy of a Test Case, Writing Test Assertions , Factories and Fakes, Mocking with Patch, Behavior Driven Development, BDD Workflow and Gherkin Syntax, Writing Feature Files,	**CLO5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. DevOps for Developers: Michael Hüttermann
2. DevOps: A Software Architect's Perspective: Ingo M. Weber, Len Bass, and Liming Zhu
3. Building a DevOps Culture: Jennifer Davis, Katherine Daniels. Publisher: O'Reilly
4. Practical DevOps: Joakim Veronal
5. DevOps for Dummies: Gene Kim, Kevin Behr, George, Publisher: John Wiley & Sons

Web Reference:

1. https://devops.com/
2. https://devopsinstitute.com/
3. https://aws.amazon.com/devops/
4. https://www.guru99.com/devops-tutorial.html
5. https://www.edureka.co/blog/maven-tutorial/
6. https://www.chef.io/configuration-management/
7. https://www.edureka.co/blog/devops-tutorial
8. https: and and www.javatpoint.com and kubernetes
9. https: and and www.javatpoint.com and docker-tutorial
10. https: and and www.javatpoint.com and jenkins
11. https: and and www.javatpoint.com and jenkinss
12. https: and and www.javatpoint.com and ansible
13. https: and and www.javatpoint.com and selenium-tutorial
14. https: and and prometheus.io and docs and introduction and overview and
15. https: and and www.javatpoint.com and jira-tutorial
16. https: and and www.geeksforgeeks.org and what-is-elastic-stack-and-elasticsearch and