



PCET's  
Pimpri  
Chinchwad  
University, Pune

Learn | Grow | Achieve

Pimpri Chinchwad Education Trust's  
**Pimpri Chinchwad University**

**SCHOOL OF ENGINEERING AND  
TECHNOLOGY**

(Established under Maharashtra Act No V of 2023)  
Sate, Pune - 412 106. Maharashtra, India

**M.C.A.**  
**(2024 PATTERN)**



**EFFECTIVE FROM 2024-25 ACADEMIC YEAR**

Pimpri Chinchwad Education Trust's  
**Pimpri Chinchwad University**  
Sathe, Pune - 412106



PCET's  
**Pimpri  
Chinchwad  
University**

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### **Curriculum Structure**

**M.C.A.**

**(2024 Pattern)**

**School of Engineering & Technology**



**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.

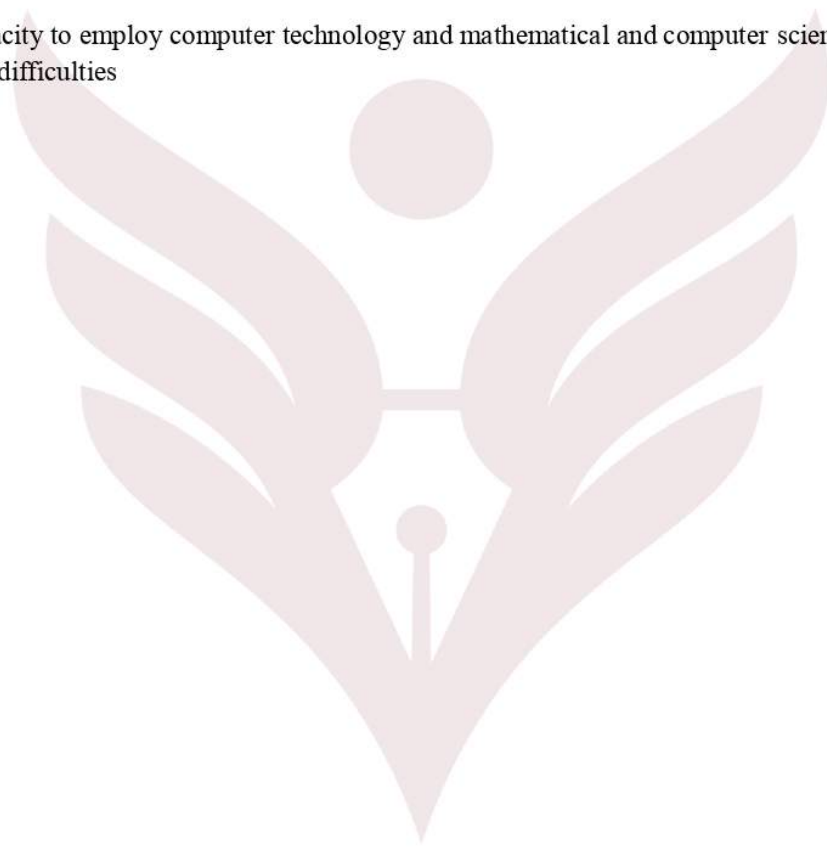


**Program Specific Outcomes:**

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



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## CURRICULUM FRAMEWORK

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

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	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
	<b>Total</b>	<b>31</b>	<b>80</b>	<b>100</b>

#### 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	-	2	2	-	4
5	Vocational Skill Course	-	-	-	3	3
6	Summer Internship and On Job Training	-	-	-	14	14
7	Field Project	3	2	2	-	7
9	Value Education Course (Audit Courses)	3	-	3	-	6
<b>Total</b>		<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>80</b>

## 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	PEG101	Professional Writing & Communication	AEC
9	PMC107	Mini Project using Python and DSA	FP
10	PMC108	Organizational Behaviour	VEC
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	Introduction to AI & ML	SEC
21	PMC116	Mini Project using Java and BDA	FP

22	PMC117	Entrepreneurship Development	AEC
23	PFL202A	Foreign Language-1: Japanese	AEC
24	PFL202B	Foreign Language-2: German	AEC
25	PMC201	Cloud Computing	MAJM
26	PMC202	Cloud Computing Lab	MAJM
27	PMC203	Machine Learning Using Python	MAJM
28	PMC204	Machine Learning Using Python Lab	MAJM
29	PMC205A	Software Testing	MAJE
30	PMC205B	Software Project Management	MAJE
31	PMC206	Data Mining and Data Warehousing	SEC
32	PMC207	Research Methodology and IPR	VEC
33	PMC208	Mini project Using Python	FP
34	PMC209	Crypto and Blockchain	MAJM
35	PMC210	DevOps	VSC
36	PMC211	Major Project and Research Project and Internship	FP
37	PDIEXMC101	Information Security / MOOCs	VSC
38	PDIEXMC102	Project	VSC



# MINOR COURSES

## ***Minor Course Curriculum***

### **Preamble:**

The Minor Courses offered at Pimpri Chinchwad University are designed to equip students with practical skills and diverse perspectives to thrive in the modern world. Through minors focused on data analysis, environmental sustainability, digital media, and cyber-security, students gain experience and interdisciplinary knowledge. These minors encourage versatility, adaptability, and the ability to leverage technology to solve complex problems. Students explore subjects outside their primary focus, develop complementary abilities, and gain a deeper appreciation for diverse cultures and perspectives.

### ***Vision:***

To be a leading university inspiring academic and personal growth and transforming lives

### ***Mission:***

- To foster academic excellence, innovation and social responsibility by providing a holistic and inclusive learning ecosystem.
- To prepare students to be responsible ethical global citizens and leaders through industry-relevant curriculum, international exposure and skill development.
- To imbibe research and entrepreneurship aptitude among students
- To help and facilitate the students Learn, Grow, and achieve their full potential.

### **Program Outcomes**

#### **Programme Outcomes (POs):**

**PO 1:** Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2:** Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3:** Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4:** Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5:** Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

**PO6:** The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7:** Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8:** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9:** Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10:** Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11:** Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12:** Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## List of Minor Courses

### Web Development (WD)

Offering School: School of Engineering & Technology (ET)

Course Code	Name of Course	Teaching Scheme			Evaluation Scheme	
		Sem	Credits	Hours	CIA	ESA
UETWD101	WD Minor1: Introduction of HTML	# II/ *IV	2	2	20	30
UETWD102	WD Minor2: Getting started with JavaScript	# III/ *V	2	2	20	30
UETWD103	WD Minor3: Server-side Programming with Node.js	# IV/*VI	2	2	20	30
UETWD104	WD Minor4: Front-end Development with React & Type Script	# V/*VII	2	2	20	30
UETWD105	WD Minor5: back-end frameworks - Django, Ruby on Rails,	# VI/*VIII	2	2	20	30

### Robotics Process Automation (RP)

Offering School: School of Engineering & Technology (ET)

Course Code	Name of Course	Teaching Scheme			Evaluation Scheme	
		Sem	Credits	Hours	CIA	ESA
UETRP101	RP Minor1: Basics of Robotics Process Automation	# II/ *IV	2	2	20	30
UETRP102	RP Minor2: Fundamentals of RPA Business Analysis	# III/ *V	2	2	20	30
UETRP103	RP Minor3: Automation Techniques in RPA	# IV/*VI	2	2	20	30
UETRP104	RP Minor4: Future of RPA with Business Automation	# V/*VII	2	2	20	30
UETRP105	RP Minor5: RPA Tool	# VI/*VIII	2	2	20	30

### Artificial intelligence & Machine Learning (ML)

Offering School: School of Engineering & Technology (ET)

Sr.no	Name of Course	Teaching Scheme			Evaluation Scheme	
		Sem	Credits	Hours	CIA	ESA
UETML101	ML Minor1: Artificial Intelligence	# II/ *IV	2	2	20	30
UETML102	ML Minor2: Machine Learning	# III/ *V	2	2	20	30
UETML103	ML Minor3: Natural Language Processing	# IV/*VI	2	2	20	30
UETML104	ML Minor4: Optimization Techniques	# V/*VII	2	2	20	30

**Data Science (DS)**

Offering School: School of Engineering & Technology (ET)

Sr.no	Name of Course	Teaching Scheme			Evaluation Scheme	
		Sem	Credits	Hours	CIA	ESA
UETDS101	DS Minor1: Applied Data Science With Python	# II/ *IV	2	2	20	30
UETDS102	DS Minor2: Data Visualization With Tableau	# III/ *V	2	2	20	30
UETDS103	DS Minor3: Business Analytics	# IV/*VI	2	2	20	30
UETDS104	DS Minor4: Data Analytics	# V/*VII	2	2	20	30
UETDS105	DS Minor5: Generative AI	# VI/*VIII	2	2	20	30

**Media Communications**

Offering School: School of media and communications studies

Course Code	Name of Course	Teaching Scheme			Evaluation Scheme	
		Sem	Credits	Hours	CIA	ESA
UMSMM101	MM Minor1: Literary Study	# II/ *IV	2	2	20	30
UMSMM102	MM Minor2: Digital Media Production	# III/ *V	2	2	20	30
UMSMM103	MM Minor3: Photography	# IV/*VI	2	2	20	30
UMSMM104	MM Minor4: Performing Arts - Theater	# V/*VII	2	2	20	30
UMSMM105	MM Minor5: Film Studies	# VI/*VIII	2	2	20	30

**Psychology (PSY)**

Offering School: School of science

Course Code	Name of Course	Teaching Scheme			Evaluation Scheme	
		Sem	Credits	Hours	CIA	ESA
USCPSY101	PSY Minor1: Introductory Psychology	# II/ *IV	2	2	20	30
USCPSY102	PSY Minor2: Foundations of Social Psychology	# III/ *V	2	2	20	30
USCPSY103	PSY Minor3: Theories of Personality Development	# IV/*VI	2	2	20	30
USCPSY104	PSY Minor4: Industrial Psychology	# V/*VII	2	2	20	30
USCPSY105	PSY Minor5: Mindfulness and Mental Health	# VI/*VIII	2	2	20	30

**Nutrition (NUT)**

Offering School: School of science

Course Code	Name of Course	Teaching Scheme			Evaluation Scheme	
		Sem	Credits	Hours	CIA	ESA
USCNUT101	NUT Minor1: Human Nutrition	# II/ *IV	2	2	20	30
USCNUT102	NUT Minor2: Lifestyle Management	# III/ *V	2	2	20	30
USCNUT103	NUT Minor3: Introduction to Weight Management	# IV/*VI	2	2	20	30
USCNUT104	NUT Minor4: Food Quality and Management	# V/*VII	2	2	20	30
USCNUT105	NUT Minor5: Novel Foods and Application	# VI/*VIII	2	2	20	30

**Design Thinking and Methodologies (DM)**

Offering School: Pune Design School (SD)

Course Code	Name of Course	Teaching Scheme			Evaluation Scheme	
		Sem	Credits	Hours	CIA	ESA
USDDM101	DM Minor1: Design Thinking	# II/ *IV	2	2	20	30
USDDM102	DM Minor2: Brand Identity Design	# III/ *V	2	2	20	30
USDDM103	DM Minor3: Digital tools for 2D design	# IV/*VI	2	2	20	30
USDDM104	DM Minor4: Physical model making/ Prototyping	# V/*VII	2	2	20	30

USDDM105	DM Minor5: Digital Tools for 3D design	# VI/*VIII	2	2	20	30
<b>Economics &amp; Finance (FE)</b>						
Offering School: School of Management (SM)						
Course Code	Name of Course	Teaching Scheme			Evaluation Scheme	
		Sem	Credits	Hours	CIA	ESA
USMFE101	FE Minor1: Micro-economics	# II/ *IV	2	2	20	30
USMFE102	FE Minor2: Fundamentals of Accounting	# III/ *V	2	2	20	30
USMFE103	FE Minor3: Principles of Finance	# IV/*VI	2	2	20	30
USMFE104	FE Minor4: Cost and Management Accounting	# V/*VII	2	2	20	30
USMFE105	FE Minor5: Macro economics	# VI/*VIII	2	2	20	30
<b>Entrepreneurship and Innovations (EI)</b>						
Offering School: School of Management (SM)						
Course Code	Name of Course	Teaching Scheme			Evaluation Scheme	
		Sem	Credits	Hours	CIA	ESA
USMEI101	EI Minor1: Entrepreneurship-New venture Development	# II/ *IV	2	2	20	30
USMEI102	EI Minor2: Rural Entrepreneurship	# III/ *V	2	2	20	30
USMEI103	EI Minor3: Design Thinking	# IV/*VI	2	2	20	30
USMEI104	EI Minor4: Institutional and Legal framework for Startups and small Businesses	# V/*VII	2	2	20	30
USMEI105	EI Minor5: Managing creativity and learning organizations	# VI/*VIII	2	2	20	30
<b>Drugs &amp; Healthcare (DH)</b>						
Offering School: School of Pharmacy (SP)						
Course Code	Name of Course	Teaching Scheme			Evaluation Scheme	
		Sem	Credits	Hours	CIA	ESA
USPDH101	DH Minor1: Health and hygiene	# II/ *IV	2	2	20	30
USPDH102	DH Minor2: Know your drugs	# III/ *V	2	2	20	30

USPDH103	DH Minor3: Complementary and alternative medicine	# IV/*VI	2	2	20	30
USPDH104	DH Minor4: Drug Discovery	# V/*VII	2	2	20	30
USPDH105	DH Minor5: Forensic Science	# VI/*VIII	2	2	20	30

### Software Application Design and Development (AD)

Offering School: School of Engineering and Technology (Computer Applications)

Course Code	Name of Course	Teaching Scheme			Evaluation Scheme	
		Sem	Credits	Hours	CIA	ESA
UETAD101	AD Minor1: System Analysis and Design	# II/ *IV	2	2	20	30
UETAD102	AD Minor2: User Experience and Design	# III/ *V	2	2	20	30
UETAD103	AD Minor3: Introduction to GitHub.	# IV/*VI	2	2	20	30
UETAD104	AD Minor4: Introduction to Gaming Applications.	# V/*VII	2	2	20	30
UETAD105	AD Minor5: Mobile Application Development	# VI/*VIII	2	2	20	30

### Cyber Security (CS)

Offering School: School of Engineering and Technology (Computer Applications)

Course Code	Name of Course	Teaching Scheme			Evaluation Scheme	
		Sem	Credits	Hours	CIA	ESA
UETCS101	CS Minor1: Cyber Ethics, Cyber Law and Cyber Policy	# II/ *IV	2	2	20	30
UETCS102	CS Minor2: Introduction to Cryptography	# III/ *V	2	2	20	30
UETCS103	CS Minor3: Social Media Security.	# IV/*VI	2	2	20	30
UETCS104	CS Minor4: Introduction to Block Chain.	# V/*VII	2	2	20	30
UETCS105	CS Minor5: Data Security & Privacy.	# VI/*VIII	2	2	20	30

### English Literature (E)

Offering School: School of Liberal Arts (SL)

Course Code	Name of Course	Teaching Scheme			Evaluation Scheme	
		Sem	Credits	Hours	CIA	ESA

USLAE101	E Minor1: English for Competitive Examinations-I	# II/ *IV	2	2	20	30
USLAE102	E Minor2: English for Competitive Examinations-II	# III/ *V	2	2	20	30
USLAE103	E Minor3: English for Competitive Examinations-III	# IV/*VI	2	2	20	30
USLAE104	E Minor4: English for Competitive Examinations-IV	# V/*VII	2	2	20	30
USLAE105	E Minor5: English for Competitive Examinations-V	# VI/*VIII	2	2	20	30

English (E)						
Offering School: School of Liberal Arts (SL)						
Course Code	Name of Course	Teaching Scheme			Evaluation Scheme	
		Sem	Credits	Hours	CIA	ESA
USLAM101	Learning English With Shakespeare-Romeo and Juliet (Minor-I)	# II/ *IV	2	2	40	30
USLAM102	Learning English With Shakespeare-Hamlet (Minor-II)	# III/ *V	2	2	40	30

**\* : Courses offered for B Tech, B Design**

**#: Courses offered for B Sc, BBA, Media, and Management & Liberal Arts**

**Course Nomenclature**

Course Title	Course Code	Name of Course
Web Development (WD)	UETWD101	WD Minor1: Introduction of HTML
	UETWD102	WD Minor2: Getting started with JavaScript
Robotics Process Automation (RP)	UETRP101	RP Minor1: Basics of Robotics Process Automation
	UETRP102	RP Minor2: Fundamentals of RPA Business Analysis
Artificial Intelligence & Machine Learning (AIML)	UETML101	ML Minor1: Artificial Intelligence
	UETML102	ML Minor2: Machine Learning
Data Science (DS)	UETDS101	DS Minor1: Applied Data Science With Python
	UETDS102	DS Minor2: Data Visualization With Tableau
Media Communications (MM)	UMSMM101	MM Minor1: Literary Study
	UMSMM102	MM Minor2: Digital Media Production
Psychology (PSY)	USCPSY101	PSY Minor1: Introductory Psychology
	USCPSY102	PSY Minor2: Foundations of Social Psychology
Nutrition (NUT)	USCNUT101	NUT Minor1: Human Nutrition
	USCNUT102	NUT Minor2: Lifestyle Management
Design Thinking Methodologies (DM)	USDDM101	DM Minor1: Design Thinking
	USDDM102	DM Minor2: Brand Identity Design
Economics and Finance (FE)	USMFE101	FE Minor1: Micro-economics
	USMFE102	FE Minor2: Fundamentals of Accounting
Entrepreneurship and Innovations (EI)	USMEI101	EI Minor1: Entrepreneurship-New venture Development
	USMEI102	EI Minor2: Rural Entrepreneurship
Drugs and Healthcare (DH)	USPDH101	DH Minor1: Health and hygiene
	USPDH102	DH Minor2: Know your drugs
Software Application Design and Development (AD)	UETAD101	AD Minor1: System Analysis and Design
	UETAD102	AD Minor2: User Experience and Design



Cyber Security (CS)	UETCS101	CS Minor1: Cyber Ethics, Cyber Law and Cyber Policy
	UETCS102	CS Minor2: Introduction to Cryptography
English Literature (EL )	USLAE101	E Minor1: English for Competitive Examinations-I
	USLAE102	E Minor2: English for Competitive Examinations-II
English (E)	USLAM101	E Minor 1: Learning English With Shakespeare-Romeo and Juliet
	USLAM102	E Minor2 Learning English With Shakespeare-Hamlet (Minor-II)



**PIMPRI CHINCHWAD UNIVERSITY, PUNE, MAHARASHTRA**  
**SCHOOL OF ENGINEERING & TECHNOLOGY**  
**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
PEG101	AEC	Professional Writing & Communication	2		-	-	2	50			50
PMC107	FP	Mini Project using Python / DSA	-	2	-	3	4	50		50	100
PMC108	VEC	Organizational Behaviour	3	-	-	3	3	40	60		100
PFL201	AEC	Foreign Language - I	2	-	-	-	2	50			50
<b>TOTAL</b>			<b>18</b>	<b>4</b>	<b>1</b>	<b>20</b>	<b>28</b>	<b>400</b>	<b>300</b>	<b>100</b>	<b>800</b>

**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
PMC109	MAJM	Object Oriented Programming Using Java	3	-	-	3	3	40	60		100
PMC110	MAJM	Object Oriented Programming Using Java Lab	-	1	-	1	2	25		25	50
PMC111	MAJM	Big Data Analytics	3	-	-	3	3	40	60		100
PMC112	MAJM	Big Data Analytics Lab		1		1	2	25		25	50
PMC113	MAJE	Major Elective - II	3	-	-	3	3	40	60		100
PMC114	BSC	Optimization Techniques	2	-	1	3	4	40	60		100
PMC115	SEC	Introduction to AI & ML	2	-	-	2	2	20	30		50
PMC116	FP	Mini Project using Java / BDA	-	2	-	2	4	50		50	100
PMC117	AEC	Entrepreneurship Development	2	-	-	2	2	20	30		50
PFL202	AEC	Foreign Language - II	2	-	-	-	2	50			50
<b>TOTAL</b>			<b>17</b>	<b>4</b>	<b>1</b>	<b>20</b>	<b>27</b>	<b>350</b>	<b>300</b>	<b>100</b>	<b>750</b>
<b>PMC113 MAJOR ELECTIVE - II</b>											
PMC113A	MAJE	Computer Networks	3	-	-	3	3	40	60		100
PMC113B	MAJE	Network and Computer Security	3	-	-	3	3	40	60		100
<b>PFL202 FOREIGN LANGUAGE - II</b>											
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 ENGINEERING & TECHNOLOGY**

**PROGRAM STRUCTURE**

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

**(Effective from the Academic Year (2024 - 2025))**

**SEMESTER-III**

COURSE CODE	COURSE TYPE	COURSE NAME	TEACHING SCHEME					ASSESSMENT SCHEME			
			T H	P R	TU T	CREDI T	HR S	CI A	ES A	PR / OR	TOTA L
PMC201	MAJM	Cloud Computing	3	-	-	3	3	40	60		100
PMC202	MAJM	Cloud Computing Lab	-	2	-	2	4	25		25	50
PMC203	MAJM	Machine Learning Using Python	3	-	-	3	3	40	60		100
PMC204	MAJM	Machine Learning Using Python Lab	-	2	-	2	4	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
PMC208	FP	Mini project Using Python	-	2	-	2	4	50		50	100
<b>TOTAL</b>			<b>14</b>	<b>6</b>	<b>0</b>	<b>20</b>	<b>26</b>	<b>280</b>	<b>270</b>	<b>100</b>	<b>650</b>
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											
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	Major Project / Research Project / Internship	-	14	-	14	24	250		250	500
TOTAL			6	14	0	20	30	330	120	250	700

## 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		2024		Version		1.0	
Teaching Scheme					Assessment Scheme		
Theor y	Practical	Tutoria l	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.			

<b>Details</b>	<b>CLO</b>	<b>Hours</b>
<b>UNIT I</b>		
<b>Introduction To Python:</b> 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	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		
<b>Python Program Flow Control, Functions And Packages:</b> Conditional blocks using if, else and elif, Simple for loops in python, For loop <b>using ranges, string, list and dictionaries, Use of while loops in python</b> , 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.	<b>CLO 2</b>	<b>9</b>
<b>UNIT III</b>		

<b>Strings And Regular Expressions:</b> Strings: Formatting, Comparison, Slicing, Splitting, Stripping, Negative indices, String functions. Regular expression: Matching the patterns, Search and replace.	<b>CLO3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>NumPy And Matplotlib:</b> What is NumPy? How to install NumPy, Arrays, Array indexing, Array Vs Listing Data types, Array math, Broadcasting. Matplotlib -Plotting, subplots and images	<b>CLO4</b>	<b>9</b>
<b>UNIT V</b>		
<b>File Handling With Python:</b> 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	<b>CLO5</b>	<b>9</b>

### 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.w3schools.com/python/> and
2. <https://and.and.nptel.ac.in/courses/and106/and106/and106106182/> and
3. <https://and.and.nptel.ac.in/courses/and106/and106/and106106145/> and

## COURSE CURRICULUM

### Course Contents and Syllabus:

Name of the Program:		MCA		Semester : I		Level: PG	
Course Name		Python Programming Lab		Course Code and Course Type		PMC102 / MAJM	
Course Pattern		2024		Version		1.0	
Teaching Scheme				Assessment Scheme			
Theor y	Practica l	Tutoria l	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. 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.			

### 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 ( { } ) 2. Demonstrate the following Conditional statements in Python with suitable examples. i) if statement ii) if else statement iii) if – elif – else statement	CLO2	4
		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

			<p>i)</p> <pre>       A      AB     ABC    ABCD   ABCDE </pre> <p>ii)</p> <pre>   *****    *****     *****      *****       ***** </pre>		
		Week7	<p>iii)</p> <pre> EEEEEEEEEE DDDDDDDD CCCCC BBB A </pre> <p>iv)</p> <pre>       4      43     432    4321   43210  43210  4321  432  43  4 </pre>	CLO2	2
5	String data type	Week8	<p>1. Write a Python program to demonstrate various ways of accessing the string.</p> <p>i) By using Indexing (Both Positive and Negative)</p> <p>ii) By using Slice Operator</p> <p>2. Demonstrate the following functions and methods which operates on strings in Python with suitable examples:</p> <p>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( )</p>	CLO3	2
6.	List data type	Week9	<p>1. Demonstrate the different ways of creating list objects with suitable example programs.</p> <p>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) extend( ) viii) remove( ) ix) pop( ) x) reverse( ) xi) sort( ) xii) copy( ) xiii) clear( )</p>	CLO3	2

			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	Week 13	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
<b>TOTAL</b>					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**

1. <https://and.and/www.w3schools.com/python/> and
2. <https://and.and/nptel.ac.in/courses/106/106/106106182/> and
3. <https://and.and/nptel.ac.in/courses/106/106/106106145/> 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		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 basic techniques of algorithm analysis 2. To identify the factors implementation of linked list, Stack, Queue data structures. 3. To apply the different algorithms for sorting and searching techniques. 4. To Demonstrate and create tree structure 5. To develop and evaluate the graph algorithms on real life applications.			
Course Learning Outcomes (CLO):				Students will be able to: 1. To identify the time and space complexities of various algorithms. 2. To explain the appropriate data structures like linked list, stack, queue as applied to the specified problem definition. 3. To apply the concepts of trees on given data 4. To apply knowledge of handle operations like searching, insertion, deletion, and traversing mechanisms on various data structures 5. To evaluate the linear and non-linear data structures through graph theory.			

## Course Contents and Syllabus:

### Practical plan

Descriptors and Topics	CLO	Hours
<b>UNIT I</b>		
<b>Introduction To Algorithm Analysis:</b> Introduction, Need of Data Structure, Definitions - Data and information, Data type, Data object, ADT, Data Structure, Types of Data Structures, Algorithm analysis, Space and time complexity, Graphical understanding of the relation between different functions of n, examples of linear loop, logarithmic, quadratic loop etc., Best, Worst, Average case analysis, Asymptotic notations (Big O, Omega $\Omega$ , Theta ), Problems on time complexity calculation.	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		
<b>Fundamental Data Structures – List, Stacks, And Queues:</b> List ADT, Singly-linked lists, Doubly Linked lists, and Circular Linked Lists – Stack ADT, Implementation of Stacks and Applications. Queue ADT, Implementation of Queue and Applications.	<b>CLO 2</b>	<b>9</b>
<b>UNIT III</b>		
<b>Trees:</b> Tree ADT, Binary tree, Search Tree ADT, Tree Traversals, AVL tree, Splay tree	<b>CLO3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>Sorting And Searching:</b> Insertion Sort, Selection, heap sort and Merge sort. Linear time sorting – bucket and radix sort. Linear search and binary search.	<b>COL4</b>	<b>9</b>
<b>UNIT V</b>		
<b>Graph Algorithms:</b> The Graph ADT, Representation of adjacency list and matrix, Graph traversals – Depth First Search and Breadth First Search implementation. Shortest path – weighted graphs – Dijkstra's algorithm. Minimum spanning tree – Prims and Kruskal's algorithm.	<b>COL5</b>	<b>9</b>
<b>Total Hours</b>		<b>45</b>

### 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 – Prentice-Hall International.

#### **Reference Books:**

1. AnyLevitin, 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.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		2024		Version		1.0	
Teaching Scheme				Assessment Scheme			
Theor y	Practica l	Tuto rial	Total Credits	Hours	CIA (Continuou s 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 basic techniques of algorithm analysis 2. To identify the factors implementation of linked list, Stack, Queue data structures. 3. To apply the different algorithms for sorting and searching techniques. 4. To Demonstrate and create tree structure 5. To develop and evaluate the graph algorithms on real life applications.			
Course Learning Outcomes (CLO):				Students will be able to: 1. To identify the time and space complexities of various algorithms. 2. To explain the appropriate data structures like linked list, stack, queue as applied to the specified problem definition. 3. To apply the concepts of trees on given data 4. To apply knowledge of handle operations like searching, insertion, deletion, and traversing mechanisms on various data structures 5. To evaluate the linear and non-linear data structures through graph theory.			

## Course Contents and Syllabus:

### Practical Plan

Practical No.	Practical Title	Week No. and Turn	Details	CLO	Hours
1	Practical 1: Write C program that implement the Single Linked list applications	Week 1 and 2 Turn 1	1. Insert 2. Delete 3. Search 4. Display	CLO1	4
2	Write C program that implement the Double Linked list applications	Week 2 and 3	1. Insert 2. Delete 3. Search 4. Display	CLO2	4
3	Write a C program that converts the given expression from Infix to prefix using templates.	Week 4 and 5	1. $(A+B) * (C+D)$ 2. $((A \text{ and } B)*C-(D-E))*(F+G)$	CLO 2	4
4	Write program that implement all the operations on DE Queue with array representation with templates	Week 6 and 7	1. Insert 2. Delete 3. Display	CLO2	4
5	Write programs to implement the following using an array representation with templates.	Week 8 and 9	1. Ascending Priority Queue 2. Descending Priority Queue	CLO2	4
6	Write a C program to implement the following operations on Binary Tree	Week 10 and 11	1. Insert 2. Display	CLO3	4
7	Write a C program to implement the following Searching operations	Week 12	1. Selection Search 2. Binary Search	CLO4	2
8	Write a C program to implement the following Sorting operations	Week 13	1. Selection Sort 2. Bubble Sort	CLO4	2
8.	Write a C program to implement the following operations on Graph	Week 14 and 15	Create BFS and DFS Traversing Display Nodes By BFS and DFS Traversing	CLO5	2
<b>Total Hours</b>					<b>30</b>

### **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 – Prentice-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://www.audisankara.ac.in> and [has and pdf and DATA%20STRUCTURE.pdf](#)
2. <https://github.com/Rustam-Z/data-structures-and-algorithms> and [tree and master and lecture%20notes](#)
3. <https://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		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. To identify business requirements and business processes using BPMN 2.0 standard encompassing Process Orchestrations and Choreographies. 2. To explain the set of component services with composite services creation and designing services to facilitate integration in IT infrastructure. 3. To 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. To analyse data well-formed specifications and reports for component service composition and delivery to the stakeholders as a part of the development team. 5. To 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
<b>UNIT I</b>		
<b>Introduction To Organizational Behaviour:</b> 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	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		
<b>Software Quality Assurance Management:</b> 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	<b>CLO 2</b>	<b>9</b>
<b>UNIT III</b>		
<b>Software Quality Assurance and Reliability:</b> 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.	<b>CLO3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>Quality Control And Reliability:</b> Tools for Quality – Ishikawa's basic tools – CASE tools Defect prevention and removal – Reliability models, Rayleigh model – Reliability growth models for quality assessment..	<b>CLO4</b>	<b>9</b>
<b>UNIT V</b>		
<b>Software Quality Tools:</b> 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.	<b>CLO5</b>	<b>9</b>
<b>Total Hours</b>		<b>45</b>

### **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-9<sup>th</sup> 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://www.altexsoft.com/whitepapers/quality-assurance-quality-control-and-testing-the-basics-of-software-quality-management/> and
2. [https://www.academia.edu/9760547/LECTURE\\_NOTES\\_2\\_Software\\_Quality\\_Assurance](https://www.academia.edu/9760547/LECTURE_NOTES_2_Software_Quality_Assurance)
3. <https://www.geeksforgeeks.org/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		2024		Version		1.0	
Teaching Scheme					Assessment Scheme		
Theor y	Practic al	Tutoria l	Total Credits	Hou rs	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. To identify differences between the structured paradigm and the object-oriented paradigm in software development 2. To Explain the differences between the structured paradigm and the object-oriented paradigm in software development 3. To 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. To Analyse different testing methods with suitable case studies. 5. To be able to design, manage, and implement a computer-based software system using the oops software engineering approach in a group setting			

### **Course Contents and Syllabus:**

<b>Descriptors and Topics</b>		<b>Hours</b>
<b>UNIT I</b>		
<b>Software Process And Agile Development:</b> Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models ,Introduction to Agility-Agile process-Extreme programming-XP Process-Case Study.	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		
<b>Requirements Analysis And Specification:</b> 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	<b>CLO 2</b>	<b>9</b>

diagrams , Activity diagrams , State chart diagrams , Functional modelling , Data Flow Diagram- CASE TOOLS.		
<b>UNIT III</b>		
<b>Software Design:</b> 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	<b>CLO3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>Software Testing And Maintenance:</b> Testing , Unit testing , Black box testing, White box testing , Integration and System testing, Regression testing , Debugging , Program analysis , Symbolic execution , Model Checking-Case Study	<b>CLO4</b>	<b>9</b>
<b>UNIT V</b>		
<b>Project Management:</b> 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	<b>CLO5</b>	<b>9</b>
<b>Total Hours</b>		<b>45</b>

### 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://www.visual-paradigm.com> and [tutorials and](#)
2. <https://www.udemy.com/course/oo-se-java/?couponCode=ST7MT41824>
3. <https://uim.fei.stuba.sk/wp-content/uploads/2018/02/Object-oriented-Software-Engineering-3rd-Edition.pdf>

### COURSE CURRICULUM:

Name of the Program:		MCA		Semester : I		Level: PG	
Course Name		Probability and Combinatory		Course Code and Course Type		PMC106 / BSC	
Course Pattern		2024		Version		1.0	
Teaching Scheme				Assessment Scheme			
Theor y	Practica l	Tutori al	Tota l Cred its	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 (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.			
Course Learning Outcomes (CLO):				Students will be able to: 1. To define & express the problems in graph theory sense and find the solution by using different algorithms. 2. To apply the use of appropriate partial ordering and hesse diagrams to find minimal, maximal, lower upper bounds and greatest lower bounds. 3. To understand the use of appropriate principals of counting techniques to understand practical examples and solve then logically by 4. To reflect on the use of probability concepts for solving real life problems. 5. To become a capable to use measures of central tendency to solve different statistical problems.			

## Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
<b>UNIT I</b>		
<b>Combinatorial Structures: Graph theory basics:</b> 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 <b>Trees:</b> Trees and their properties, binary tree, complete binary tree, full binary tree, binary search tree	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		
<b>Principles Of Counting:</b> The Principle of Inclusion and Exclusion, Generalizing Inclusion – Exclusion Principles, Derangements – Nothing is in its Right Place, Rook Polynomials	<b>CLO 2</b>	<b>9</b>
<b>UNIT III</b>		
<b>Combinatorial Analysis:</b> 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	<b>CLO3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>Probability:</b> Random experiment, sample space, events, axiomatic probability, algebra of events conditional probability, multiplication theorem of probability, independent events, bay's theorem	<b>CLO4</b>	<b>9</b>
<b>UNIT V</b>		
<b>Probability Distribution:</b> 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	<b>CLO5</b>	<b>9</b>

### 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, 44th Edition, 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, 2nd edition, 2008.

#### Online Resources and E-Learning Resources

1. <https://www.khanacademy.org/math/precalculus/a9e81a4f98389efdf:prob-comb>
2. <https://ocw.mit.edu/courses/18-440-probability-and-random-variables-spring-2014/lecture-notes/>

## COURSE CURRICULUM

Name of the Program:		MCA		Semester : I		Level: PG	
Course Name		Professional Writing for Communication		Course Code and Course Type		PEG101 /AEC	
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
2	-	-	2	4	50	-	-
Prerequisite: General Communication Knowledge							
Course Objectives (CO):					The objectives of (Name of course) are: 1. Utilize business writing skills and exposure in various dimensions of professional settings. 2. Develop understanding of effective business writing for workplace communication. 3. Use and analyse various formats of official communication. 4. Utilize presentation skills and strategies for exposure in various dimensions. 5. Apply nonverbal communication effectively		
Course Learning Outcomes (CLO):					Students will be able to: 1. Recognize and rectify common grammatical mistakes, both in one's own writing and in the writing of others, fostering improved proofreading and editing capabilities. 2. Apply the different writing styles like descriptive, argumentative etc for developing good technical documents for presentations or disseminating technical documents. 3. Tailor writing to suit specific audiences, considering tone, language, and generic formats and templates of technical writing. 4. Apply critical thinking skills to analyse data and draw meaningful conclusions. 5. Deliver oral and written presentations with confidence and clarity.		

### Course Contents and Syllabus:

#### Practical Plan

Activity Number	Activity Title	Week No and Turn 1	Details	CLO	Hours
1	<b>An Introduction to vowel and consonant sound</b>	Week 1	<b>An Introduction to vowel and consonant sound</b> In the section of Communication Lab, we introduce English vowels and consonants through focused sessions, where students will be introduced with different symbols and their sounds of English vowels and consonants. In the lab activity, we will also engage them in interactive drills and exercises to improve their articulation.	CLO 1	2
		Week 2	Students will also practice in interactive drills and exercises to improve their articulation.		2
2	<b>Stress &amp; Intonation</b>	Week 3	Activity of stress and intonation for proper pronunciation	CLO 2	2
		Week 4	Use of short sentences or phrases representing different emotions in certain contexts, and instruct them to experiment with variations in stress and intonation to convey diverse meanings		2
		Week 5	Practice session		2
3	<b>Debate</b>	Week-6	The faculty will discuss the Do's and Don'ts of debate.	CLO 3	2
		Week-7	Conduct debate thorough research and prepare well-supported arguments. At the end, a question answer session will be conducted to ensure participation of audience		2
4.	<b>PPT Presentation</b>	Week-8	Prepare an effective PowerPoint presentation (PPT).	CLO 4	2
		Week-9	Students will be asked to give a presentation in the communication lab. To bind up the lab, a session of peer feedback is scheduled to ensure advice of students to bring refinement in PPT.		2
		Week 10	cont. presentation activity.		2
		Week11	The faculty will guide on structuring their speech, and emphasizing delivery techniques like eye contact and body Language		2

		Week12	schedule practice sessions with feedback to help participants build confidence and improve their public speaking skills		2
		Week13	Students will be provided with the information about the job or situation for which they are interviewing		2
		Week14	Conduction of mock interview in a communication lab involves simulating a real-life interview scenario to help participants practice and enhance their interview skills.		2
		Week15	Internal viva will be conducted in last lab		2
Total Hours					30

### **Learning resources**

#### **Textbooks:**

1. Michelle Carey, Moira McFadden Lanyi, Deirdre Longo, Eric Radzinski, Shannon Rouiller, Elizabeth Wilde, Handbook of Technical Writing, Twelfth edition (June 15, 2020) by Bedford and St. Martin's
2. Allan Pease and Barbara, (2023), The Definitive Book of Body Language, Bantam Dell Pub Group, ISBN-13 978-0553383966

#### **Reference Books:**

1. J S Nesfield, English Grammar: Composition and Usage
2. Muralikrishna and S. Mishra, Communication Skills

#### **Online Resources and E-Learning Resources**

1. [https://and.andr.search.yahoo.com/\\_ylt=AwrKEZx9Xx9mjNYIqt67HAX.;\\_ylu=Y29sbwNzZzMEcG9zAzIEdnRpZAMEc2VjA3NyandRV=2andRE=1713360894andRO=10andRU=https%3a%2f%2fwww.edx.org%2flearn%2fprofessional-writingandRK=2andRS=qRX78Ztn7.G7y8mX2MzVb5hwDsk-](https://and.andr.search.yahoo.com/_ylt=AwrKEZx9Xx9mjNYIqt67HAX.;_ylu=Y29sbwNzZzMEcG9zAzIEdnRpZAMEc2VjA3NyandRV=2andRE=1713360894andRO=10andRU=https%3a%2f%2fwww.edx.org%2flearn%2fprofessional-writingandRK=2andRS=qRX78Ztn7.G7y8mX2MzVb5hwDsk-)
2. [www.edx.org/learn/professional-writing](https://www.edx.org/learn/professional-writing)

## COURSE CURRICULUM

Name of the Program:		MCA		Semester: I		Level: PG	
Course Name		Organizational Behaviour		Course Code and Course Type		PMC108 /VEC	
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: 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. To identify the different levels of analysis in organizational behaviour. 2. To apply the different factors that influence organizational climate and culture. 3. To understand the use of different concepts of organizational behaviour to solve problems in organizations. 4. To analyse the different factors that contribute to organizational effectiveness. 5. To 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
<b>UNIT I</b>		
<b>Fundamentals of Organizational Behaviour:</b> 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.	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		
<b>Individual Dynamics:</b> 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.	<b>CLO 2</b>	<b>9</b>
<b>UNIT III</b>		
<b>Attitude &amp; Learning:</b> 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.	<b>CLO3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>Motivation And Group Dynamics:</b> 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.	<b>CLO4</b>	<b>9</b>
<b>UNIT V</b>		
<b>Interpersonal Dynamics &amp; Organizational Dynamics:</b> 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.	<b>CLO5</b>	<b>9</b>
<b>Total Hours</b>		<b>45</b>

### **Learning resources**

#### **Textbooks:**

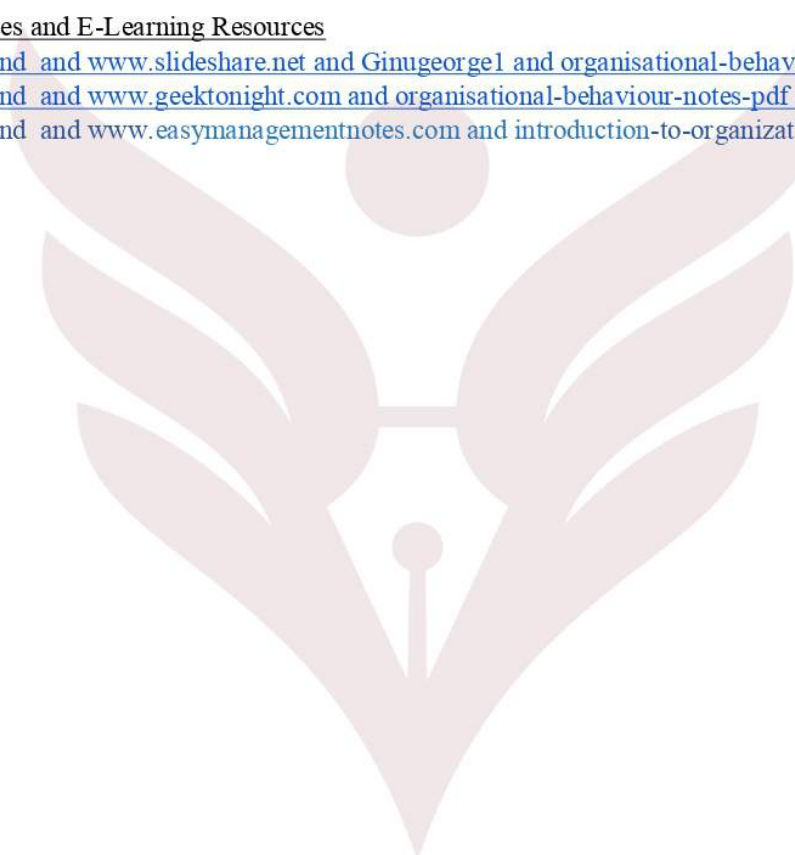
1. L.M. Prasad (2020), Principles and Practice of Management, 20th Edition, Sultan Chand & Sons, New Delhi.
2. Timothy A. Judge Stephen P. Robbins (2017), Organizational Behaviour. 17th Edition, Pearson Education Limited, Upper Saddle River.

#### **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](https://and.andwww.slideshare.net) and [Ginugeorge1 and organisational-behaviour-eresource](https://and.andwww.geektonight.com)
2. [https://and and www.geektonight.com](https://and.andwww.geektonight.com) and [organisational-behaviour-notes-pdf](https://and.andwww.easymanagementnotes.com) and
3. [https://and and www.easymanagementnotes.com](https://and.andwww.easymanagementnotes.com) and [introduction-to-organizational-behaviour](https://and.andwww.easymanagementnotes.com)



## COURSE CURRICULUM

### Course Contents and Syllabus:

Name of the Program:		Foreign Language		Semester : I		Level: PG	
Course Name		German A1.1		Course Code and Course Type		PFL201A /AEC	
Course Pattern		2024		Version		1.0	
Teaching Scheme					Assessment Scheme		
Theor y	Practica l	Tutoria l	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.			
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						CLO5	6

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		
<b>Total Hours</b>		<b>30</b>

**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.andyoutube.com/and/@LearnGermanwithAnja?si=BkJYDPi7TS0fT4lr>
2. <https://and.andyoutube.com/and/@deutschlernenmitheidi?si=TkIClabzioaU0roZ>
3. [instagram.com/learngermanwithanja](https://instagram.com/learngermanwithanja)

## COURSE CURRICULUM

### Course Contents and Syllabus:

<b>Name of the Program:</b>		<b>MCA</b>		<b>Semester : I</b>		<b>Level: PG</b>	
<b>Course Name</b>		Basic Japanese language skill		<b>Course Code and Course Type</b>		<b>PFL201B/ AEC</b>	
<b>Course Pattern</b>		<b>2024</b>		<b>Version</b>		1.0	
<b>Teaching Scheme</b>					<b>Assessment Scheme</b>		
<b>Theor y</b>	<b>Practica l</b>	<b>Tutoria l</b>	<b>Total Credits</b>	<b>Hours</b>	<b>CIA (Continuous Internal Assessment)</b>	<b>ESA (End Semester Assessment )</b>	<b>Practical and Oral</b>
2	--	--	2	30	50	--	--
<b>Prerequisite:</b> 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
<b>UNIT I</b>		
<b>Introduction to Japanese Language –</b> Introduction of script, culture, History of script ,Speaking : Self introduction, listening : short video skit on self-introduction	<b>CLO 1</b>	<b>6</b>
<b>UNIT II</b>		
<b>Introduction of Hiragana Script –</b> Writing : Hiragana script, Speak : Basic sentences, General vocabulary : Months , Days of the week ,Basic numbers, colours	<b>CLO 2</b>	<b>6</b>
<b>UNIT III</b>		
<b>Basic Sentence formation –</b> Basic sentence structure : Affirmative and Negative , General vocabulary: about family,	<b>CLO 3</b>	<b>6</b>

<b>UNIT IV</b>		
<b>Time and verbs –</b> Speaking : Talking about routine, Writing: routine using verbs and time, reading : A clock	<b>CLO 4</b>	<b>6</b>
<b>UNIT V</b>		
<b>Introduction of Katakana and basic kanji –</b> Reading : English words, country names Writing : Basic Kanji	<b>CLO 5</b>	<b>6</b>
<b>Total Hours</b>		<b>30</b>

### 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/watch?v=shdlEapDsP4>
- <https://and.and/youtu.be/K-nw5EUxDz0?feature=shared>
- <https://and.and/youtu.be/o9sP-vaCEa0?si=l8yOvVKaItBQWXNu>
- <https://and.and/youtu.be/JnoZE51WZg4?si=9uq68USOz5plBk2n>
- <https://and.and/youtu.be/shdlEapDsP4?si=tC6RGaMtwDJgVu2d>
- <https://and.and/youtu.be/9paXgC2U8L0?si=btS1G4mvrkG5C9zi>

#### 1. Apps

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

#### Hiragana Pro



## END SEMISTER I



## COURSE CURRICULUM

Descriptors and Topics					CLO	Hours
<b>UNIT I</b>						
<b>Introduction &amp; Concepts Of Classes And Objects:</b> History of Java, Byte code, Keywords, Object-Oriented Data Types, Variables, Scope and Lifetime of variables, Operators, Program Elements, Type Conversion and casting, Arrays, Introducing methods, Method overloading, Constructors, Constructor overloading, Course Pattern with 2024 and method, Access control, this keyword, Garbage Collecting Scheme, class, String Tokenizer.					<b>CLO 1</b> <b>MAJM</b>	<b>9</b>
<b>UNIT II</b>						
<b>Inheritance &amp; Packages:</b> Inheritance basics, Types of inheritance, Member access rules, Usage of super keyword, Method overriding, Abstract classes, Interfaces - differences between abstract classes and interfaces, defining					<b>CLO 2</b> <b>Oral</b>	
<b>Prerequisite:</b> Principles of object-oriented programming and its concepts, an interface, implementing an interface, applying interfaces, variables in interface						-
<b>Course Objectives (CO):</b> The objectives of Object-Oriented Programming Using and extending interfaces; Packages - defining, creating and accessing a package, importing packages, access control in packages. To recall and monitor object-oriented concepts such						
<b>UNIT III</b>						
<b>Exception Handling and Multithreading:</b> dynamic binding and polymorphism, Types of exceptions, Usage of try, catch, throw, To recognize inheritance and packages in program design, Built-in exceptions, Creating user-defined exceptions, To analyze programming insight using OOP					<b>CLO 3</b>	<b>9</b>
<b>MULTITHREADING:</b> Concepts of multithreading, To differentiate between process and thread, Thread life cycle, creating multiple threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter thread communication. To explain advanced programming by using a collection framework.						
<b>UNIT IV</b>						
<b>Collection Framework:</b> Collections Overview, controls in various real-life applications, Map, List - Array List, Linked List, Vector, Set, HashSet, Tree Set, Map - Hash Table, HashMap, Accessing a collection via an Iterator, Comparator, Comparable.					<b>CLO 4</b>	<b>9</b>
<b>UNIT V</b>						
<b>GUI Programming with Swing: Applets</b> - Applet, Class, Applet skeleton, Simple Applet; Delegation event model - Events, Event sources, Event Listeners, Event classes, handling mouse and keyboard events. To define understand inheritance with developing interfaces and packages					<b>CLO 5</b>	<b>9</b>
<b>EXPLORING SWING CONTROLS:</b> JLabel and Image Icon, JTextField, JButton, JCheckBox, JRadioButton, JTabbed Pane, JList, JScrollbar.						
<b>Total Hours</b>						<b>45</b>

### Course Contents and Syllabus:

### **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.freecodecamp.org/news/object-oriented-programming-concepts-java/> and
2. [https://and.and.w3schools.com/java/java\\_oop.asp](https://and.and.w3schools.com/java/java_oop.asp)
3. <https://and.and.minds.co.za/wp-content/uploads/2019/06/object-oriented-programming-using-java.pdf>

## COURSE CURRICULUM

### Course Contents and Syllabus: Practical Plan

		MCA		Semester : II		Level: PG	
Course Name		Object-Oriented Programming Using JAVA Lab		Course Code and Course Type		PMC 110 /MAJM	
Course Pattern		2024		Version		1.0	
Teaching Scheme				Assessment Scheme			
Theor y	Practica l	Tuto rial	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. To define different concepts of oops and java  2. To apply the knowledge of design, develop, test, document and debug Java programs using object-oriented principles  3. To define understand inheritance with developing interfaces and packages  4. To study exception handling and multithreading and their applications in real-world problems.  5. Students will develop a connection framework and develop GUI programs using swing.			

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	CLO5	2
			Write a Java program to test whether an array list is empty or not		
11	The objective of this problem is to create a student registration form	Week12	Write a Java program called SwingArithmetics that works as a simple	CLO5	2

	using different swing components.		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.		
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, JPasswordField, 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 frame if he and she is authenticated. Students need to use various swing components like JMenu, JButton, JRadioButton, JComboBox, JTable, JPasswordField, JPasswordField, 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.	CLO5	4
<b>Total Hours</b>					<b>30</b>

### **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**

1. <https://www.freecodecamp.org> and [news and object-oriented-programming-concepts-java](https://news.object-oriented-programming-concepts-java) and
2. <https://www.w3schools.com> and [java](https://www.w3schools.com/java) and [java\\_oop.asp](https://www.w3schools.com/java_oop.asp)
3. <https://www.minds.co.za> and [wp-content and uploads and 2019 and 06 and object-oriented-programming-using-java.pdf](https://www.minds.co.za/wp-content/uploads/2019/06/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		PMC111 / MAJM	
Course Pattern		2024		Version		1.0	
Teaching Scheme					Assessment Scheme		
Theor y	Practica l	Tutoria l	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. To identify the usage of data on different big data ecosystems and also demonstrate the Pig architecture and evaluation of pig scripts. 2. To describe the Hive architecture and execute SQL queries on sample data sets. 3. To apply knowledge of the process of transferring data between different file systems and to execute operations using sqoop. 4. To 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. To develop an application using different eco system tools by taking standard sample data set.			

### **Course Contents and Syllabus:**

Descriptors and Topics		Hours
<b>UNIT I</b>		
<b>Introduction:</b> 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.	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		
<b>Apache Pig:</b> 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.	<b>CLO 2</b>	<b>9</b>
<b>UNIT III</b>		
<b>Apache Hive Fundamentals &amp; Advanced Concepts:</b> 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	<b>CLO3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>Importing And Handling Relational Data In Hadoop Using Sqoop:</b> 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	<b>CLO4</b>	<b>9</b>
<b>UNIT V</b>		
<b>Scoop And Solr:</b> 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.	<b>CLO5</b>	<b>9</b>
Total Hours		<b>45</b>

### Learning resources

#### Reference Books:

1. Alan Gates, Programming Pig Dataflow Scripting with Hadoop, O'Reilly Media, Inc, 2011.
2. Jason Rutherglen, Dean Wampler, Edward Capriolo, Programming Hive, O'Reilly Media 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		Big Data Analytics Lab		Course Code and Course Type		PMC112 / MAJM	
Course Pattern		2024		Version		1.0	
Teaching Scheme				Assessment Scheme			
Theor y	Practica l	Tuto rial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical and Oral
-	1	-	1	2	25	-	25
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 analyse the knowledge on searching mechanisms using solr			
Course Learning Outcomes (CLO):				Students will be able to: 1. To identify the key issues in Big Data Management and experiment with the Hadoop framework. 2. To explain the structure and unstructured data by using nosql commands. 3. To apply knowledge of scientific computing algorithms for finding similar items and clustering by using Apache Hive 4. To Test fundamental enabling techniques and scalable algorithms for data stream mining using sqoop 5. To develop problem-solving and critical thinking skills in fundamental enable techniques like Hadoop & mapreduce.			



## 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 execute	Week 7	Develop a MapReduce program to find the number of products sold in each country by considering sales data containing fields like <table><tr><td>Transaction Date</td><td>Product</td><td>Price</td><td>Payment Type</td><td>Name</td><td>City</td><td>State</td><td>Country</td><td>Account Created</td><td>Last Login</td><td>Latitude</td><td>Longitude</td></tr></table>	Transaction Date	Product	Price	Payment Type	Name	City	State	Country	Account Created	Last Login	Latitude	Longitude	CLO3, CLO4	2
Transaction Date		Product	Price	Payment Type	Name	City	State	Country	Account Created	Last Login	Latitude	Longitude					
7	NoSQL Commands.	Week 8 and 9	Develop a MapReduce program to find the frequency of books published each year and find in which year maximum number of books were published using the following data. <table><tr><td>Title</td><td>Author</td><td>Published year</td><td>Author country</td><td>Language</td><td>No of pages</td></tr></table>	Title	Author	Published year	Author country	Language	No of pages	CLO4	4						
Title	Author	Published year	Author country	Language	No of pages												
8		Week 10 and 11	Implementing DGIM algorithm using any Programming Language and Implement	CLO4	4												



			Bloom Filter using any programming language		
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 Pig Dataflow Scripting with Hadoop, O'Reilly Media, Inc, 2011.
2. Jason Rutherglen, Dean Wampler, Edward Capriolo, Programming Hive, O'Reilly Media Inc, 2012
3. Dikshant Shahi, Apache Solr: A Practical approach to enterprise search, Apress, 2015.

#### **Online Resources and E-Learning Resources**

1. <https://www.slideshare.net> and [www.slideshare.net](http://www.slideshare.net/big-data-lecture-notes) and [big-data-lecture-notes](http://www.slideshare.net/big-data-lecture-notes) and 58457761
2. <https://www.simplilearn.com> and [what-is-big-data-analytics-article3](http://www.simplilearn.com/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		PMC113 A / MAJE	
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: 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. To interpret the different building blocks of the Communication network and its architecture. 2. To apply different types of switching networks and analyze the performance of network 3. To Understand and explain the Data Communications System and its components. By using different types of network topologies and protocols. 4. To enumerate the layers of the OSI model and TCP and IP. Explain the function(s) of each layer. 5. To Identify the different types of network devices and their functions within a network			

### **Course Contents and Syllabus:**

<b>Descriptors and Topics</b>	<b>CLO</b>	<b>Hours</b>
<b>UNIT I</b>		
<b>Introduction:</b> 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 system, multiplexing, switching-circuit, packet & message switching, Virtual circuit switch. Network devices-repeater, bridge, router, gateways, network interface cards, cabling system	<b>CLO 1</b>	<b>9</b>



UNIT II		
<b>Wireless Transmission:</b> Communication Satellites - Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues - Error Detection and Correction.	<b>CLO 2</b>	<b>9</b>
UNIT III		
<b>Elementary Data Link Protocols :</b> 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.	<b>CLO3</b>	<b>9</b>
UNIT IV		
<b>Network Layer :</b> 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).	<b>CLO4</b>	<b>9</b>
UNIT V		
<b>Transport Layer:</b> 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.	<b>CLO5</b>	<b>9</b>
<b>Total Hours</b>		<b>45</b>

### Learning resources

#### Textbooks:

1. A. S. Tanenbaum, "Computer Networks", Prentice-Hall of India 2008, 4th Edition<sup>3</sup>.

#### 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.nptel.ac.in/courses/and/106106091> and
2. <https://and.geeksforgeeks.org/and/last-minute-notes-computer-network/> and
3. [https://and.kanchiuniv.ac.in/coursematerials/VINODKUMAR\\_COMPUTER\\_NETWORKS.pdf](https://and.kanchiuniv.ac.in/coursematerials/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		PMC113B / MAJE	
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: 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. To define Interpret the different building blocks of the Computer network and its architecture. 2. To apply different types of switching networks and analyse the performance of network 3. To understand the knowledge of various database security and Software security. 4. To Design subletting and analyse the performance of network layer, Construct and examine various biometric security concepts. 5. To Understand the functionality of application layer and its associated protocols			

### Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
<b>UNIT I</b>		
<b>Introduction:</b> 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.	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		
<b>Cryptography and Network Security :</b> 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. <b>Public Key Cryptography:</b> Need and Principles of Public Key Cryptosystems, RSA Algorithm, Key Distribution and Management, Diffie-Hellman Key Exchange, Digital Signatures	<b>CLO 2</b>	<b>9</b>
<b>UNIT III</b>		
<b>Database Security and Software Security:</b> 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 <b>Software Security :</b> 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	<b>CLO3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>Intrusion detection And Biometric Security:</b> 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.	<b>CLO4</b>	<b>9</b>
<b>UNIT V</b>		
<b>Network Security And Application Layer:</b> , Web Security, SSL, TLS, DNS, DDNS, TELNET, EMAIL, FTP, WWW, HTTP, SNMP, Bluetooth, Firewalls	<b>CLO5</b>	<b>9</b>
<b>Total Hours</b>		<b>45</b>



### **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](http://www.javatpoint.com) and [computer-network-security](http://computer-network-security)
2. <https://and> and [www.tndalu.ac.in](http://www.tndalu.ac.in) and [econtent](http://econtent) and [9\\_Computer\\_Network\\_And\\_Network\\_Security.pdf](http://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		PMC114 / BSC	
Course Pattern		2024		Version		1.0	
Teaching Scheme					Assessment Scheme		
Theor y	Practica l	Tutoria l	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 formulate problems precisely, solve the problems, apply optimization techniques and explain the reasoning for real-life problems 2. To analyse characteristics of a general linear programming problem. 3. To apply basic concepts of mathematics to formulate an optimization problem. 4. To analyse various methods of solving the unconstrained minimization problem. 5. To appreciate a variety of performance measures for various optimization problems.			
Course Learning Outcomes (CLO):				Students will be able to : 1. To understand the linear programming 2. To capable to understand the optimality principle 3. To apply and to use appropriate techniques of project management origin and use of pert and cpm 4. To explain how to use queuing system and queuing models for different problems 5. To able to understand and solve inventory problems with different types of models			

### Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
UNIT I		
<b>Introduction of operation research:</b> Basic Concepts, Bellman's optimality principles, Dynamics programming approach in decision making problems, optimal subdivision problem. Sequencing Models: Sequencing problem, Johnson's Algorithm for processing n jobs through 2 machines, Algorithm for processing n jobs through 3 or more machines, Processing 2 jobs through n machines.	<b>CLO 1</b>	<b>9</b>
UNIT II		
<b>Dynamic Programming:</b> Basic Concepts, Bellman's optimality principles, Dynamics programming approach in decision making problems, optimal subdivision problem. Sequencing Models: Sequencing problem, Johnson's Algorithm for processing n jobs through 2 machines, Algorithm for processing n jobs through 3 or more machines, Processing 2 jobs through n machines.	<b>CLO 2</b>	<b>9</b>
UNIT III		
<b>Project Management:</b> PERT and CPM : Project management origin and use of PERT, origin and use of CPM, Applications of PERT and CPM, Project Network, Diagram representation, Critical path calculation by network analysis and critical path method (CPM), Determination of floats, Construction of time chart and resource labelling, Project cost curve and crashing in project management, Project Evaluation and review Technique (PERT).	<b>CLO3</b>	<b>9</b>
UNIT IV		
<b>Queuing Models:</b> Essential features of queuing systems, operating haracteristics of queuing system, probability distribution in queuing systems, classification of queuing models, solution of queuing M and M and 1 : and FCFS, M and M and 1 : N and FCFS, M and M and S : and FCFS, M and M and S : N and FCFS	<b>CLO4</b>	<b>9</b>
UNIT V:		
<b>Inventory Models:</b> Introduction to the inventory problem, Deterministic Models, The classical EOQ (Economic Order Quantity) model, Inventory models with deterministic demands (no shortage & shortage allowed), Inventory models with probabilistic demand, multi item deterministic models	<b>CLO5</b>	<b>9</b>
<b>Total Hours</b>		<b>45</b>

### **Learning resources**

#### **Textbooks:**

1. Gillet B.E. Introduction to Operation Research, Computer Oriented Algorithmic approach - Tata McGraw Hill Publishing 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/files/and/optimization-notes.pdf>
2. <https://and.and/people.eecs.berkeley.edu/~varaiya/Download/and/Varaiya-Optimization.pdf>
3. [https://and.and/sites.google.com/thapar.edu/and/meenakshirana/and/Current-Semester-2020/and/optimization-techniques\\_](https://and.and/sites.google.com/thapar.edu/and/meenakshirana/and/Current-Semester-2020/and/optimization-techniques_)

## COURSE CURRICULUM

Name of the Program:		MCA		Semester: II		Level: PG	
Course Name		Foundations of Artificial Intelligence And Machine Learning		Course Code and Course Type		PMC115 / SEC	
Course Pattern		2024		Version		1.0	
Teaching Scheme				Assessment Scheme			
Theor y	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical and Oral
2	,	,	2	2	20	30	,
Prerequisite: Good catch on statistics, linear algebra, matrix, calculus, probability, programming languages, and data modelling.							
Course Objectives (CO):				The objectives of (Name of course) are: 1. To recall basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning. 2. To apply the basic knowledge representation, problem solving, and learning methods of Artificial Intelligence 3. To analyse and assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving particular engineering problems 4. Acquire theoretical knowledge on setting hypothesis for pattern recognition. 5. Apply suitable machine learning techniques for data handling and to gain knowledge from it.			
Course Learning Outcomes (CLO):				Students will be able to: 1. To identify and characterize different types of AI environments 2. To apply different searching algorithms and heuristic methodologies to reach the goal in state, space problems. 3. To understand the knowledge of Recognize the characteristics of machine learning strategies. 4. To explain various supervised learning methods to appropriate problems. 5. To Design and Create more than one technique to enhance the performance of learning			

### Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
<b>UNIT I</b>		
<b>Introduction:</b> Definitions, Importance of AI, Evolution of AI, Applications of AI, Classification of AI systems concerning environment, Intelligent Agents, Different types of agents Expert Systems- Stages in the development of an Expert Systems, Difficulties in Developing Expert Systems-Applications of Expert Systems	<b>CLO 1</b>	<b>6</b>
<b>UNIT II</b>		
<b>Problem, Solving: Problem, solving</b> by Search, Problem space, State space, Blind Search, Types, Performance measurement, Informed search strategies, Heuristic functions, Local search strategies, Hill climbing, simulated annealing.	<b>CLO 2</b>	<b>6</b>
<b>UNIT III</b>		
<b>Knowledge Representation And 5 Hours Reasoning:</b> Logical systems – Knowledge, Based systems, Propositional Logic, Constraints, Predicate Logic – First Order Logic, Inference in First, Order Logic, Ontological Representations and applications Knowledge representation and reasoning through logic	<b>CLO3</b>	<b>6</b>
<b>UNIT IV</b>		
<b>Introduction To Machine Learning:</b> Introduction, Examples of various Learning Paradigms, Perspectives and Issues, Version Spaces, Finite and Infinite Hypothesis Spaces, PAC Learning, VC Dimension.	<b>CLO4</b>	<b>6</b>
<b>UNIT V</b>		
<b>Supervised Learning Algorithms:</b> Learning a Class from Examples, Linear, Nonlinear, Multiclass and Multi label classification, Decision Trees: ID3, Classification and Regression Trees (CART), Regression: Linear Regression, Multiple Linear Regression, Logistic Regression.	<b>CLO5</b>	<b>6</b>
<b>Total Hours</b>		<b>30</b>

### Learning resources

#### **Text Books:**

1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 4th edition, Prentice Hall, 2020.

#### **References:**

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", SecondEdition, Pearson Education
2. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence : a logical approach", Oxford University Press.
3. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problemsolving", Fourth Edition, Pearson Education.

#### **Online Resources and ELearning Resources**

1. [https://and and www.routledge.com](https://and.and.routledge.com) and rsc and downloads and [AI\\_FreeBook.pdf](#)
2. [https://and and www.techtarget.com](https://and.and.techtarget.com) and [searchenterpriseai](#) and [definition and AI.Artificial.Intelligence](#)
3. [https://and and www.geeksforgeeks.org](https://and.and.geeksforgeeks.org) and [artificial.intelligence,an,introduction and](#)

## COURSE CURRICULUM

### Course Contents and Syllabus:

Name of the Program:		MCA		Semester: II		Level: PG	
Course Name		Entrepreneurship Development		Course Code and Course Type		PMC117 /AEC	
Course Pattern		2024		Version		1.0	
Teaching Scheme					Assessment Scheme		
Theor y	Practica l	Tutoria l	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical and Oral
2	-	-	2	2	20	30	-
<b>Prerequisite:</b> An entrepreneur is required to respond appropriately to the market and he and she is also required to understand the business needs.							
Course Objectives (CO):				The objectives of Entrepreneurship Development are: 1. To recall and to motivate the students and to help them inculcate an entrepreneurial mindset 2. To learn what entrepreneurship is all about and how it has impacted the world and their country 3. To analyse to some of the major traits and the DNA of an entrepreneur, and be allowed to internalize and assess their strengths and identify gaps that need to be addressed to become a successful entrepreneur 4. To Organize interaction with successful entrepreneurs 5. Students know the processes in the form of differences between small and large firms, and the economic environment.			
Course Learning Outcomes (CLO):				Students will be able to: 1. To identify awareness about entrepreneurship and successful entrepreneurs 2. To Develop an entrepreneurial mind-set by learning key skills such as design, personal selling, and communication 3. To Understand the DNA of an entrepreneur and assess their strengths and weaknesses from an entrepreneurial perspective 4. To get acquainted with communication involved in organizations 5. Students have knowledge about key debates around entrepreneurship and small businesses.			

<b>Descriptors and Topics</b>	<b>CLO</b>	<b>Hours</b>
<b>UNIT I</b>		
<b>Introduction to Entrepreneurship:</b> Meaning and concept of entrepreneurship, the history of entrepreneurship development, role of entrepreneurship in economic development, Myths about entrepreneurs, agencies in entrepreneurship management and future of entrepreneurship types of entrepreneurs.	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		

<b>The Entrepreneur:</b> Why to become entrepreneur, the skills and traits required to be an entrepreneur, Creative and Design Thinking, the entrepreneurial decision process, skill gap analysis, and role models, mentors and support system (institutional infrastructure), entrepreneurial success stories.	<b>CLO 2</b>	<b>9</b>
<b>UNIT III</b>		
<b>E-Cell:</b> Meaning and concept of E-cells, advantages to joining E-cell, the significance of Ecell, various activities conducted by E-cell <b>Communication:</b> Importance of communication, barriers, and gateways o communication, listening to people, the power of talk, personal selling, risk taking & resilience, negotiation	<b>CLO3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>Communication:</b> Importance of communication, barriers and gateways to communication, listening to people, the power of talk, personal selling, risk taking & resilience, negotiation	<b>CLO4</b>	<b>9</b>
<b>UNIT V</b>		
<b>Introduction to various forms of business organization:</b> Introduction to various forms of business organization (sole proprietorship, partnership, corporations, Limited Liability Company), emerging trends (technopreneurs, entrepreneurs, arbitrageurs, womenpreneurs, portfolio entrepreneurship and franchising), mission, vision and strategy formulation	<b>CLO5</b>	<b>9</b>
Total Hours		<b>45</b>

### Learning resources

#### **Text Books:**

1. Entrepreneurship Development, B. V. Srinivas Murthy, Dr. M. M. Munshi, Prakash Pinto
2. Introduction to Entrepreneurship Development, by Abhik Kumar Mukherjee, Shaunak Roy
3. Textbook of Entrepreneurship Development and Business Management (Hardcover, L. L. Somani)

#### **References:**

1. Entrepreneurship: Creating and Leading an Entrepreneurial Organization, Arya Kumar, Pearson
2. Handbook on Entrepreneurship Development, BS Rathore and JS Saini, Aapga Publications Panchkula
3. Women Entrepreneurs: Opportunities, Performance, Problems, SK Dhameja, Deep and Deep Publications, Jaipur

#### **Online Resources and E-Learning Resources**

1. [https: and and www.tutorialsduniya.com and notes and entrepreneurship-development-notes and](https://and. and www.tutorialsduniya.com and notes and entrepreneurship-development-notes and)
2. [https: and and gitam.ac.in and wp-content and uploads and 2024 and 03 and ED-NOTES-MBA-2nd-Semester.pdf](https://and and gitam.ac.in and wp-content and uploads and 2024 and 03 and ED-NOTES-MBA-2nd-Semester.pdf)
3. [https: and and mlritm.ac.in and assets and img and ENTREPRENUARSHIP%20DEVELOPMENT.pdf](https://and and mlritm.ac.in and assets and img and ENTREPRENUARSHIP%20DEVELOPMENT.pdf)

## COURSE CURRICULUM

### Course Contents and Syllabus:

<b>Name of the Program:</b>		<b>Foreign Language</b>		<b>Semester : II</b>		<b>Level: PG</b>	
<b>Course Name</b>		<b>German A1.2</b>		<b>Course Code and Course Type</b>		<b>PFL 202 A/ AEC</b>	
<b>Course Pattern</b>		<b>2024</b>		<b>Version</b>		<b>1.0</b>	
<b>Teaching Scheme</b>					<b>Assessment Scheme</b>		
<b>Theor y</b>	<b>Practica l</b>	<b>Tutoria l</b>	<b>Total Credits</b>	<b>Hours</b>	<b>CIA (Continuous Internal Assessment)</b>	<b>ESA (End Semester Assessment )</b>	<b>Practical and Oral</b>
2	-	-	-	2	20	30	-
<b>Prerequisite:</b> Can understand and use familiar, everyday expressions and very simple sentences aimed at satisfying specific needs.							
Course Objectives (CO):				The objectives of (German A1.2) are: 1. To get along with a basic vocab. 2. To understand German day to day culture. 3. Can communicate in routine situations. 4. To be able to have a direct exchange of information about familiar matters. 5. To describe own surroundings.			
Course Learning Outcomes (CLO):				Students will be able to: 1. Communicate in the areas of immediate importance. 2. Able to frame simple sentences in formal conversation. 3. Translate simple sentences from English to the German language and vice-versa. 4. Construct a dialogue, in the German language, for basic human interactions in a social context. 5. Take part in an interaction relating to basic conversation			

<b>Descriptors and Topics</b>	<b>CLO</b>	<b>Hours</b>
<b>UNIT I</b>		
<b>Kontakte</b> planning of letter writing, ramification of Letter, ,writing and understanding, discussion about language learning, find information from texts, understand conversations on various topics, texts related to office life Grammar – Usage of Articles and Prepositions	<b>CLO 1</b>	<b>6</b>
<b>UNIT II</b>		
<b>MeineWohnung</b> Understand home advertisements, describe house, how to reply invitations, how to express ‘likes and dislikes’, speak about different forms of living, how to write a text on house	<b>CLO 2</b>	<b>6</b>

Grammar – Adjectives		
<b>UNIT III</b>		
<b>Alles Arbeit?</b> Talk about daily routine, talk about past, understand job advertisements, understand blogs on jobs, express opinions about jobs, prepare telephonic dialogues, speak about jobs Grammar – Past tense, Sentence connectors	<b>CLO3</b>	<b>6</b>
<b>UNIT IV</b>		
<b>Kleidung und Mode</b> Speak about cloths and shopping, lead a discussion during cloths shopping, discussion in departmental store, understand and research information about Berlin Grammar – Separable and non-separable verbs	<b>CLO4</b>	<b>6</b>
<b>UNIT V</b>		
<b>Gesund und munter &amp; Ab in den Urlaub</b> Learn body parts, Health related dialogue, City orientation, Travel reports, discussion regarding different travel destinations and weather Grammar – Imperative, Time adverbs	<b>CLO5</b>	<b>6</b>
<b>Total Hours</b>		<b>30</b>

### Learning resources

#### Textbooks:

4. Netzwerk A1, Ernst klett Verlag & Goyal Publishers & Distributors Pvt. Ltd.
5. Studio d A1, Cornelsen Verlag & Goyal Publishers & Distributors Pvt. Ltd.
6. 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, Huebner Verlag
3. Maximal Ernst klett Verlag & Goyal Publishers & Distributors Pvt. Ltd.

#### Online Resources and E-Learning Resources:

1. Youtube : <https://and.and.youtube.com/@LearnGermanwithAnja?si=BkJYDPi7TS0fT4lr>

<https://and.and.youtube.com/@deutschlernenmitheidi?si=TkIClAbzioaU0roZ>

2. Instagram

## COURSE CURRICULUM

Name of the Program:		MCA		Semester : II		Level: PG	
Course Name		Japanese language skill - L2		Course Code and Course Type		PFL201B/ AEC	
Course Pattern		2024		Version		1.0	
Teaching Scheme					Assessment Scheme		
Theor y	Practica l	Tutoria l	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
<b>UNIT I</b>		
<b>Katakana Script:</b> Katakana Script and Writing Kanji	<b>CLO 1</b>	<b>6</b>
<b>UNIT II</b>		
<b>System of demonstrative words :</b> Minna no Nihongo lesson no. 1,2 & 3	<b>CLO 2</b>	<b>6</b>
<b>UNIT III</b>		
Minna no Nihongo lesson no 4 (Write and Speak basic sentences in correct tenses)	<b>CLO 3</b>	<b>6</b>
<b>UNIT IV</b>		
Reading : Basic conversation using particles Listening : conversation related to particles Speaking : Sentences about give, lend, teach, receive	<b>CLO 4</b>	<b>6</b>
<b>UNIT V</b>		
<b>Tenses :</b> Writing : Affirmative present ,past & future Negative present ,past,& future sentences Writing : About Routine	<b>CLO 5</b>	<b>6</b>
<b>Total Hours</b>		<b>30</b>

## Learning resources

### Textbooks:

- Minna no Nihongo , “ Japanese for everyone” ,Elementary Main Textbook , Goyal Publishers & Distributors Pvt. Ltd.

### Reference books:

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

### Online Resources and E-Learning Resources:

#### 2. You Tube links

- [https://and.and.youtube.be/and1JephUxTHxg?si=ouCwTXZc\\_fYgY9Kh](https://and.and.youtube.be/and1JephUxTHxg?si=ouCwTXZc_fYgY9Kh)
- [https://and.and.youtube.be/and9EfbkBkF2ag?si=rLNzc55\\_REacMoGu](https://and.and.youtube.be/and9EfbkBkF2ag?si=rLNzc55_REacMoGu)
- <https://and.and.youtube.be/andDpEolYasgyg?si=dya9ue-YMSHO3VOG>
- [https://and.and.youtube.be/anditccOS1\\_LSk?si=hvPqILKlviuncMvA](https://and.and.youtube.be/anditccOS1_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		2024		Version		1.0	
Teaching Scheme					Assessment Scheme		
Theor y	Practica l	Tutoria l	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. To Discuss the requirement of information security , private and public key algorithms and to examine the mathematics of cryptography Understanding 2. To analyze authentication and integrity techniques available Analysing 3. To interpret the importance of firewalls and intrusion detection systems and signatures. Understanding 4. To relate to the security issues and technologies used in the web, internet, database and operating system 5. To examine and apply the fundamental techniques of computer security.			

### Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
<b>UNIT I</b>		
<b>Introduction :</b> Introduction to Information Security, principles, services and attacks, functional requirements of security, current trends in security, Need for security, Security approaches <b>Database and OS Security:</b> Introduction to database, Security requirements of database, sensitive data, Database access control, inference, Security in operating systems	<b>CLO 1</b>	<b>6</b>
<b>UNIT II</b>		
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	<b>CLO 2</b>	<b>6</b>
<b>UNIT III</b>		
<b>Digital certificates and integrity Digital Signature:</b> 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 <b>Integrity:</b> Message Integrity, Hash functions Properties Algorithm: MDC, MAC, HMAC, MD5, SHA -512	<b>CLO 3</b>	<b>6</b>
<b>UNIT IV</b>		
<b>Internet and web security:</b> 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.	<b>CLO 4</b>	<b>6</b>
<b>UNIT V</b>		
<b>Firewall and IDS Firewall:</b> Introduction, Characteristic, Types :Packet Filter, Stateful and Stateless Packet Filter, Attacks of Packet Filter, Circuit Level and Application Level Firewall, Bastion Host, Firewall Configurations. <b>Intrusion:</b> 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.	<b>CLO 5</b>	<b>6</b>
<b>Total Hours</b>		<b>30</b>

### **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](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](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](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>





## END SEMISTER II

## COURSE CURRICULUM

### Course Contents and Syllabus:

Name of the Program:		MCA		Semester: III		Level: PG	
Course Name		Cloud Computing		Course Code and Course Type		PMC201 /MAJM	
Course Pattern		2024		Version		1.0	
Teaching Scheme					Assessment Scheme		
Theor y	Practica l	Tutoria l	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical and Oral
3	-	-	3	3	40	60	-
Prerequisite: Some skills related to basic concepts of an Operating System (OS) , Database							
Course Objectives (CO):				The objectives of <b>Cloud Computing</b> 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. Analyse various cloud programming models and apply them to solve problems on the cloud. 5. To develop working experience in several services of cloud computing.			
Course Learning Outcomes (CLO):				Students will be able to: 1. To identify the basics of cloud computing, cloud models and its applications. 2. To understand cloud services and architecture. 3. To analyse how to use cloud services and to build applications. 4. To apply security needs for cloud service and analyse different slas 5. To design, develop & deploy real-world applications in the cloud computing platforms.			

<b>Descriptors and Topics</b>	<b>CLO</b>	<b>Hours</b>
<b>UNIT I</b>		
<b>Cloud Fundamentals:</b> Origins of Cloud computing – Cloud components - 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, Cloud Service Components - Deployment Models – Application of Cloud Computing	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		
<b>Application Architectures:</b> Architectural influences – High-performance computing, Utility and Enterprise grid computing, Cloud scenarios – Benefits: scalability ,simplicity ,vendors ,security, Limitations – Sensitive information - Application development- security level of third party - security benefits, Regularity issues: Government policies, Monolithic and	<b>CLO 2</b>	<b>9</b>

Distributed – Micro Service fundamentals – Design Approach – Cloud Native Application – Application Integration Process – API fundamental – API Management		
<b>UNIT III</b>		
<b>Cloud Architecture- Layers and Models:</b> 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.	<b>CLO3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>Cloud Simulators- CloudSim and GreenCloud:</b> Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to GreenCloud	<b>CLO4</b>	<b>9</b>
<b>UNIT V</b>		
<b>Introduction to VMWare Simulator:</b> 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	<b>CLO5</b>	<b>9</b>
<b>Total Hours</b>		<b>45</b>

### 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://andandwww.tutorialspoint.com/cloud\\_computing/cloud\\_computing\\_tutorial.pdf](https://andandwww.tutorialspoint.com/cloud_computing/cloud_computing_tutorial.pdf)
2. <https://andandwww.geeksforgeeks.org/cloud-computing/>
3. <https://andandwww.techtarget.com/searchcloudcomputing/definition/cloud-computing>

## COURSE CURRICULUM

### Course Contents and Syllabus:

Name of the Program:		MCA		Semester : III			Level: PG	
Course Name		Cloud Computing Lab		Course Code and Course Type			PMC202/ 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	
-	1	-	1	2	25	-	25	
Prerequisite: Some skills related to basic concepts of an Operating System (OS) , Database								
Course Objectives (CO):			The objectives of <b>Cloud Computing Lab</b> 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. Analyse various cloud programming models and apply them to solve problems on the cloud. 5. To develop working experience in several services of cloud computing.					
Course Learning Outcomes (CLO):			Students will be able to: 1. To Study the basics of cloud computing, cloud models and its applications. 2. To Understand cloud services and architecture. 3. To Realize security needs for cloud service and Analyse different slas 4. To analyse platform-specific security features and management of security controls. 5. To Design, Develop & Deploy real-world applications in the cloud computing platforms					

### 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, Google Cloud.	CLO1	2
2		Week2	Study and implementation of Infrastructure as a Service.	CLO2	2
3		Week3	Demonstrate cloud application using Windows Azure.	CLO2	2
4		Week4	Study and implementation of Infrastructure as a Service	CLO2	2
5		Week5	Implementation of Amazon cloud services.	CLO3	2
6		Week6	Patient Health Monitoring using AWS and Windows Azure.	CLO3	2
7.		Week7	Financial Trading Monitoring System using AWS and Windows Azure.	CLO4	2
8.	Case Study	Week 8 and 9	Cloud Use case resource monitoring using AWS and Windows Azure.	CLO1,CLO 3,CLO5	4
9	Case study	Week 10 and 11	Design and develop custom Application (Mini Project) using Salesforce Cloud.	CLO1,CLO 3,CLO5	4
10	Mini Project	Week 12,13, 14,15	<p>Setup your own cloud for Software as a Service (SaaS) over the existing LAN in your laboratory. In this assignment you have to write your own code for cloud controller using open-source technologies to implement with HDFS.</p> <p>Implement the basic operations may be like to divide the file in segments and blocks and upload and download file on and from cloud in encrypted form.</p> <p>Setup your own cloud for Software as a Service (SaaS) over the existing LAN in your laboratory. In this assignment you have to write your own code for cloud controller using open-source technologies to implement with HDFS.</p> <p>Implement the basic operations may be like to divide the file in segments and blocks and upload and download file on and from cloud in encrypted form.</p> <p>Setup your own cloud for Software as a Service (SaaS) over the existing LAN in your laboratory. In this assignment you have to write your own code for cloud controller using open-source technologies to implement</p>	CLO1,CLO 3,CLO5	8



			with HDFS. Implement the basic operations may be like to divide the file in segments and blocks and upload and download file on and from cloud in encrypted form.		
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.

#### **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.geeksforgeeks.org/cloud-computing/>
2. [https://www.tutorialspoint.com/cloud\\_computing/cloud\\_computing\\_tutorial.pdf](https://www.tutorialspoint.com/cloud_computing/cloud_computing_tutorial.pdf)
3. <https://www.techtarget.com/searchcloudcomputing/definition/cloud-computing>

## COURSE CURRICULUM

### Course Contents and Syllabus:

Name of the Program:		MCA		Semester: III		Level: PG	
Course Name		Machine Learning		Course Code and Course Type		PMC203 /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: Solid understanding of mathematics, statistics, programming, and data analysis.							
Course Objectives (CO):				The objectives of <b>Machine Learning</b> 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. To identify awareness about the concepts of various machine learning strategies 2. To learn computational data and learn applications of regression, classification of learning models. 3. To understand the model assessment and selection using different theory and algorithm 4. To develop different clusters models by using different algorithms 5. To learn how to define rl tasks and the core principles behind the rl, including policies, value functions, deriving bellman equations			

<b>Descriptors and Topics</b>	<b>CLO</b>	<b>Hours</b>
<b>UNIT I</b>		
<b>Introduction Of Machine Learning, Supervised and Unsupervised Learning:</b> Introduction to Machine Learning , Learning Paradigms , PAC learning , Version Spaces , Role of Machine Learning in Artificial Intelligence applications, Linear and Non,Linear examples , Multi,Class & Multi,Label classification , Linear Regression , Multiple Linear Regression , Naïve Bayes Classifier , Decision Trees , ID3 , CART , Error bounds, Clustering basics (Partitioned, Hierarchical and Density,based)	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		

<b>ML Models And Evaluation:</b> Regression: Multivariable regression; Model evaluation; Least squares regression; Regularization; LASSO; Applications of regression, Classification , KNN, Naïve Bayes, SVM, Decision Tree; Training and testing classifier models; Cross,validation; Model evaluation (precision, recall, F1,measure, accuracy, area under curve); Statistical decision theory including discriminant functions and decision surfaces.	<b>CLO 2</b>	<b>9</b>
<b>UNIT III</b>		
<b>Model Assessment And Inference And Association Rules:</b> Model assessment and Selection , Ensemble Learning , Boosting, Bagging, Model Inference and Averaging, Bayesian Theory, EM Algorithm, Mining Association Rules in Large Databases. Mining Frequent Patterns,, basic concepts , Efficient and scalable frequent item set mining ,methods, Apriori algorithm, FP,Growth algorithm	<b>CLO3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>Clustering:</b> The Graph ADT, Representation of adjacency list and matrix, Graph traversals , Depth First Search and Breadth First Search implementation. Shortest path , weighted graphs , Dijkstra's algorithm. Minimum spanning tee , Prim's and Kruskal's algorithm.	<b>CLO4</b>	<b>9</b>
<b>UNIT V</b>		
<b>Reinforcement Learning (RL):</b> Basics of RL , RL Framework , Markov Decision Process , Exploration Vs Exploitation , Policies, Value Functions and Bellman Equations , Solution Methods , Q,learning.	<b>CLO5</b>	<b>9</b>
<b>Total Hours</b>		<b>45</b>

### 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](https://andandwww.tutorialsduniya.com) and notes and machine, learning, notes and
2. [https://and and www.geeksforgeeks.org](https://andandwww.geeksforgeeks.org) and machine, learning and
3. [https://and and newtondesk.com](https://andandnewtondesk.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		2024		Version		1.0	
Teaching Scheme				Assessment Scheme			
Theor y	Practica l	Tuto rial	Total Credits	Hours	CIA (Continuou s 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 <b>Machine Learning Lab</b> 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. To identify awareness about the concepts of various machine learning strategies 2. To learn computational data and learn applications of regression, classification of learning models. 3. To understand the model assessment and selection using different theory and algorithm 4. To develop different clusters models by using different algorithms 5. To learn how to define tasks and the core principles behind the including policies, value functions, deriving bellman equations			

**Course Contents and Syllabus:**  
**Practical Plan**

Sr No	Practical Title	Week No. and Turn 1&2	Details	CLO	Hours
1	Practical 1: Demonstrate various data pre-processing techniques for a given dataset	Week 1	Write a python program to import and export data using Pandas library functions. Write a Python program to demonstrate various type conversion functions.	CLO1, CLO2	2
2		Week 2	Write a Python program to demonstrate various Data Visualization Techniques.	CLO1, CLO2	2
3	Find Solutions for Supervised Algorithms	Week 3	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Single and multiple Linear Regression algorithm to output a description of the set of all hypotheses consistent with the training examples.	CLO1, CLO2, CLO3	2
4		Week 4	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Logistic Regression Model algorithm to output a description of the set of all hypotheses consistent with the training examples.	CLO1, CLO2, CLO3	2
5	Find Solutions for Un-Supervised Algorithms	Week 5	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	CLO4, CLO5	2
6		Week 6 and 7	Implement Naïve Bayes Classification in Python	CLO4,	4
7		Week 8 and 9	Build KNN Classification model for a given dataset	CLO4,	4
8		Week 10 and 11	Build Artificial Neural Network model with back propagation on a given dataset	CLO4,	4
9		Week 12 and 13	a) Implement Random forest ensemble method on a given dataset. b) Implement Boosting ensemble method on a given dataset	CLO4,	4
10		Week 14 and 15	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Python ML library classes can be used for this problem	CLO4, CLO5	4

## **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://archive.ics.uci.edu/ml/datasets.html>) or constructed by the students.
2. <https://www.tutorialsduniya.com> and notes and machine,learning,notes and
3. <https://www.geeksforgeeks.org> and machine,learning and
4. <https://newtondesk.com> and machine,learning,tutorial,handwritten,study,notes,pdf and

## COURSE CURRICULUM

### Course Contents and Syllabus:

Name of the Program:		MCA		Semester: III		Level: PG	
Course Name		Software Testing		Course Code and Course Type		PMC205 A / MAJE	
Course Pattern		2024		Version		1.0	
Teaching Scheme				Assessment Scheme			
Theor y	Practica l	Tutoria l	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. To identify various software testing methods and strategies. 2. To understand a variety of software metrics, and identify defects and manage those defects for improvement in quality for given software. 3. To design test cases and test plans, review reports of testing for qualitative software. 4. To analyse different functional methods for software 5. To create the latest testing methods used in the software industries.			

Descriptors and Topics	CLO	Hours
<b>UNIT I</b>		
<b>Introduction to Software Testing:</b> 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.	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		
<b>Software Testing Strategies &amp; Techniques:</b> 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	<b>CLO 2</b>	<b>9</b>
<b>UNIT III</b>		
<b>Levels of Testing:</b> 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.	<b>CLO3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>Functional Testing:</b> 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	<b>CLO4</b>	<b>9</b>
<b>UNIT V</b>		
<b>Higher Order Testing:</b> Object Oriented Testing, Specification Based Testing, Performance Testing, Ad-hoc Testing, Usability and Accessibility Testing, Risk-based Testing, Exploratory Testing, Scenario-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	<b>CLO5</b>	<b>9</b>
<b>Total Hours</b>		<b>45</b>



### **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.guru99.com/software-testing.html>
2. <https://and.and.softwaretestingmaterial.com/testng-tutorial> and
3. <https://and.and.softwaretestinghelp.com/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		2024		Version		1.0	
Teaching Scheme					Assessment Scheme		
Theor y	Practica l	Tutoria l	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. To understand the knowledge of the fundamental elements and concepts related to Project Management activities and types of software projects.. 2. To Identify project risk, monitor and track project deadlines 3. To Schedule the activities of the project to get a critical path. 4. To apply different techniques in monitoring and control of project 5. To evaluate Work in teams to evaluate the different modes of communication among people.			

### **Course Contents and Syllabus:**

Descriptors and Topics	CLO	Hours
<b>UNIT I</b>		
<b>Introduction:</b> 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.	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		
<b>Project Evaluation And Activity Planning:</b> 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.	<b>CLO 2</b>	<b>9</b>
<b>UNIT III</b>		
<b>Risk Management And Monitoring:</b> 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	<b>CLO3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>Control And Organizing Teams:</b> 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.	<b>CLO4</b>	<b>9</b>
<b>UNIT V</b>		
<b>Project Management:</b> Team structure , Project tracking - Managing the contract , change control , Team management , Communication , Software Configuration Management.	<b>CLO5</b>	<b>9</b>
<b>Total Hours</b>		<b>45</b>



## **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.ocw.mit.edu/courses/esd-36-system-project-management-fall-2012/pages/lecture-notes/>
2. [https://and.ocw.mit.edu/courses/esd-36-system-project-management-fall-2012/resources/mitesd\\_36f12\\_lec04/](https://and.ocw.mit.edu/courses/esd-36-system-project-management-fall-2012/resources/mitesd_36f12_lec04/)
3. <https://and.www.manage.gov.in/studymaterial/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		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. To Identify the scope and necessity of Data Mining & Warehousing for the society 2. To describe the designing of Data Warehousing so that it can be able to solve the root problems. 3. To understand various tools of Data Mining and their techniques to solve the real time problems. . 4. To develop the ability to design various algorithms based on data mining tools. 5. To develop further interest in research and design of new Data Mining techniques.			

### **Course Contents and Syllabus:**

<b>Descriptors and Topics</b>	<b>CLO</b>	<b>Hours</b>
<b>UNIT I</b>		
<b>Data Warehousing and Business Analysis:</b> Data warehousing Components, Building a Data warehouse, Data Warehouse Architecture, DBMS Schemas for Decision Support, Data Extraction, Clean-up, and Transformation Tools, Metadata, reporting, Query tools and Applications, Online Analytical Processing (OLAP), OLAP and Multidimensional Data Analysis.	<b>CLO 1</b>	<b>6</b>
<b>UNIT II</b>		
<b>Data Mining:</b> 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. Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods , Mining Various Kinds of Association Rules , Association Mining to Correlation Analysis , Constraint-Based Association Mining.	<b>CLO 2</b>	<b>6</b>

<b>UNIT III</b>		
<b>Classification and Prediction:</b> Issues Regarding Classification and Prediction , Classification by Decision Tree Introduction , Bayesian Classification , Rule Based Classification , Classification by Back propagation , Support Vector Machines , Associative Classification , Lazy Learners , Other Classification Methods , Prediction , Accuracy and Error Measures , Evaluating the Accuracy of a Classifier or Predictor , Ensemble Methods , Model Section.	<b>CLO3</b>	<b>6</b>
<b>UNIT IV</b>		
<b>Cluster Analysis:</b> Types of Data in Cluster Analysis , A Categorization of Major Clustering Methods , Partitioning Methods , Hierarchical methods , Density-Based Methods , Grid-Based Methods , Model-Based Clustering Methods , Clustering High-Dimensional Data , Constraint-Based Cluster Analysis , Outlier Analysis.	<b>CLO4</b>	<b>6</b>
<b>UNIT V</b>		
<b>Mining Object, Spatial, Multimedia, Text and Web Data:</b> 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.	<b>CLO5</b>	<b>6</b>
<b>Total Hours</b>		<b>30</b>

### 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://www.dl.ebooksworld.ir> and [motoman](https://www.motoman.com) and [Cambridge.University.Press](https://www.cambridge.university.press).Data.Mining.and.Data.Warehousing.[www.EBooksWorld.ir](https://www.EBooksWorld.ir).pdf
2. <https://www.harshityadav95.medium.com> and [data-mining-and-data-warehousing-8068df0798](https://www.data-mining-and-data-warehousing-8068df0798)

### **COURSE CURRICULUM**

<b>Name of the Program:</b>		<b>MCA</b>		<b>Semester : III</b>		<b>Level: PG</b>	
<b>Course Name</b>		<b>Research Methodology IPR</b>		<b>Course Code and Course Type</b>		<b>PMC207 / VEC</b>	
<b>Course Pattern</b>		<b>2024</b>		<b>Version</b>		<b>1.0</b>	
<b>Teaching Scheme</b>					<b>Assessment Scheme</b>		
<b>Theor y</b>	<b>Practica l</b>	<b>Tutoria l</b>	<b>Total Credits</b>	<b>Hours</b>	<b>CIA (Continuous Internal Assessment)</b>	<b>ESA (End Semester Assessment )</b>	<b>Practical and Oral</b>
3	-	-	3	3	40	60	-
<b>Prerequisite:</b> student must research sense, Knowledge About hypothesis and research topic demand							
<b>Course Objectives (CO):</b>					The objectives of Research Methodology are:  <ol style="list-style-type: none"><li>1. To recall overview of the research methodology and explain the technique of defining a research problem</li><li>2. To recognize and explain the functions of the literature review in research.</li><li>3. To explain carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review.</li><li>4. To Design and create various research designs and their characteristics, several parametric tests of hypotheses and Chi-square test, the art of interpretation and the art of writing research reports.</li><li>5. To develop a good report by using different tools.</li></ol>		
<b>Course Learning Outcomes (CLO):</b>					Students will be able to: <ol style="list-style-type: none"><li>1. To identify the basics of research and its types.</li><li>2. To learn the concept of literature review, technical reading, attributions and citations.</li><li>3. To apply ethics in engineering research.</li><li>4. To discuss the concepts of intellectual property rights in engineering</li><li>5. To explain how ipr would take such an important place in the growth of individuals &amp; nation, to summarize the need for information about intellectual property right to be promoted among student community in general &amp; engineering in particular.</li></ol>		

### Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
<b>UNIT I</b>		
<b>Research Methodology:</b> Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		
<b>Reviewing The Literature:</b> Place of the literature review in research, Bringing clarity and focus to research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, 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. Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.	<b>CLO 2</b>	<b>9</b>
<b>UNIT III</b>		
<b>Design of sample surveys:</b> Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.	<b>CLO 3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>Testing Of Hypotheses:</b> Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, 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, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests.	<b>CLO 4</b>	<b>9</b>
<b>UNIT V</b>		
<b>Interpretation and report writing:</b> 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	<b>CLO 5</b>	<b>9</b>
<b>Total Hours</b>		<b>45</b>



### **Learning resources**

#### **Textbooks:**

1. Research Methodology: Methods and Techniques C.R. Kothari, Gaurav Garg New Age international 4th Edition, 2018
2. ResearchMethodologyastep-bystepguideforbeginners. (For the topic Reviewing the literature under module 2) Ranjit Kumar SAGE PublicationsLtd 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. Conducting Research Literature Reviews: From the Internet to Paper Fink A Sage Publications 2009

#### **Online Resources and E-Learning Resources**

1. <https://andonlinecourses.swayam2.ac.in> and ntr24\_ed08 and preview
2. <https://andnptel.ac.in> and courses and 106 and 105 and 106105077 and

## 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		2024		Version		1.0	
Teaching Scheme					Assessment Scheme		
Theor y	Practica l	Tutoria l	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. To identify Block chain ecosystem and its services in real world sceneries 2. To apply and Analyse the primitives of the distributed computing and cryptography related to block chain 3. To design and Demonstrate end-to-end decentralized applications 4. To explore the concepts of Bitcoin and their usage. 5. To explain Privacy, Security issues of block Chain			

Descriptors and Topics	CLO	Hours
<b>UNIT I</b>		
<b>Cryptography and Technical Foundations:</b> 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.	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		
<b>Cryptocurrency Regulation:</b> : 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	<b>CLO 2</b>	<b>9</b>
<b>UNIT III</b>		
<b>Bitcoin and Alternative Coins A:</b> Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash	<b>CLO3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>Bit Coin and Crypto currency:</b> What is Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree	<b>CLO4</b>	<b>9</b>
<b>UNIT V</b>		
<b>Privacy, Security issues in Blockchain:</b> 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	<b>CLO5</b>	<b>9</b>
<b>Total Hours</b>		<b>45</b>

### 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://anddocuments1.worldbank.org/and/curated/and/en/293821525702130886/and/pdf/and/Cryptocurrencies-and-blockchain.pdf>
2. <https://andfreecomputerbooks.com/and/Blockchain-and-Crypto-Currency.html>
3. <https://andwww.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		2024		Version		1.0	
Teaching Scheme					Assessment Scheme		
Theor y	Practica l	Tutoria l	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment )	Practical and Oral
3	-	-	3	3	40	60	-
<b>Prerequisite:</b> Basic Understanding of Software Development, Operating Systems and Networking, Security and Compliance, Programming Languages.							
Course Objectives (CO):				The objectives of DevOps are: 1. To understand the need of DevOps as a software engineering practice. 2. To understand the background of DevOps Evolution. 3. To know and understand the concept of Continuous Integration Continuous Delivery (CICD). 4. To learn the concept of continuous deployment and test strategies. 5. To learn the monitoring system and reliability engineering. 6. To explore the emerging tools used in the DevOps lifecycle.			
Course Learning Outcomes (CLO):				Students will be able to: 1. To understand the fundamental concepts of devops 2. To link the background of devops with other technologies 3. To comprehend the concept of continuous integration and continuous delivery 4. To compare various stages of continuous deployment and test strategies 5. To justify the importance of monitoring system and reliability engineering			

### Course Contents and Syllabus:

Descriptors and Topics	CLO	Hours
<b>UNIT I</b>		
<b>Introduction to DevOps and the Culture:</b> What is DevOps? Role of DevOps Engineer, Developer responsibility, Introduction to Continuous Integration and Continuous Delivery Policies, DevOps Culture: Dilution of barriers in IT departments, Process automation, Agile Practices, Reason for adopting DevOps, What and Who Are Involved in DevOps? Changing the Coordination, Introduction to DevOps pipeline phases, Defining the Development Pipeline, Centralizing the Building Server, Monitoring Best Practices, Best Practices for Operations.	<b>CLO 1</b>	<b>9</b>
<b>UNIT II</b>		
<b>Microservices Architecture and Cloud Native Development:</b> Monolithic applications, Introduction to microservice architecture, Implementing a microservices Architecture, Pros and Cons of a microservice Architecture, Characteristics of microservice architecture, Monolithic applications and microservices compared, microservices best practices, Deployment strategies, Introduction to cloud computing, cloud computing deployment models, service models, why to use cloud, Principle of container based application design, Introduction to Docker, Serverless computing, orchestration, Difference between orchestration and automation	<b>CLO 2</b>	<b>9</b>
<b>UNIT III</b>		
<b>Continuous Integration and Test-Driven Development:</b> Introduction to continuous integration, time to market and quality, Build in a Continuous Integration Scenario, Code Repository Server, Continuous Integration Server, Introduction to Continuous Delivery and chain, Differentiate Continuous Integration and Continuous Delivery, Strategies for Continuous Delivery, Benefits of Continuous Integration and Continuous Delivery, Designing a CI and CD System, Building Continuous Integration and Continuous Delivery Pipelines, Continuous Database Integration, Preparing the Build for Release, Identifying the Code in the Repository, Creating Build Reports, Putting the Build in a Shared Location, Releasing the Build	<b>CLO3</b>	<b>9</b>
<b>UNIT IV</b>		
<b>Continuous Deployment and Orchestration:</b> Implementing a testing Strategy: Types of Tests, Integration testing, managing defect backlogs, what is Continuous Deployment? Changes moving through the deployment pipeline, Trade-offs in the deployment pipeline, Basic Deployment pipeline, Deployment pipeline practices & Commit stage, Automated Acceptance Test Gate, Subsequent test stages, preparing to release, Implementing a deployment pipeline	<b>CLO4</b>	<b>9</b>
<b>UNIT V</b>		
<b>Continuous Monitoring and Site Reliability:</b> What is a monitoring system? Factors involved in monitoring systems, why monitoring is important, white-box and black-box monitoring, building a monitoring system, monitoring infrastructure and applications, collecting data, logging, creating dashboard, behaviour driven monitoring, what is site reliability engineering? SRE and DevOps, roles, and responsibilities of SRE, common tools used by SREs	<b>CLO5</b>	<b>9</b>
<b>Total Hours</b>		<b>45</b>



## **Learning resources**

### **Textbooks:**

1. PierluigiRiti, "Pro DevOps with Google Cloud Platform", Apress, ISBN: 978-1-4842-3896-7.
2. Katrina Clokic, "A Practical Guide to Testing in DevOps", Lean Publishing published on 2017-08-01
3. Jez Humble and David Farley, "Continuous Delivery", Pearson Education, Inc, ISBN: 978-0-321-60191-9

### **Reference Books:**

1. Viktor Farcic, "The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipeline with Containerized Microservices"
2. Jennifer Davis and Katherine Daniels, "Effective DevOps: Building a Culture of Collaboration, Anity, and Tooling at Scale", O'Reilly Media, Inc., ISBN: 978-1-491-92630-7
3. Sanjeev Sharma and Bernie Coyne, "DevOps for Dummies", John Wiley & Sons, Inc., 2nd IBM Limited Edition, ISBN: 978-1-119-04705-6

### **Online Resources and E-Learning Resources .**

1. <https://and.and/www.redhat.com/en/resources/cloud-native-container-design-whitepaper>
2. <https://and.and/www.redhat.com/en/topics/cloud-native-apps/what-is-serverless>
3. <https://and.and/www.redhat.com/en/topics/automation/what-is-orchestration>
4. <https://and.and/www.atlassian.com/continuous-delivery/continuous-integration>
5. <https://and.and/www.flagship.io/glossary/site-reliability-engineer>
6. <https://and.and/docs.microsoft.com/en-us/learn/paths/intro-to-vc-git>
7. <https://and.and/www.javatpoint.com/kubernetes>
8. <https://and.and/www.javatpoint.com/docker-tutorial>
9. <https://and.and/www.javatpoint.com/jenkins>
10. <https://and.and/www.javatpoint.com/jenkins>
11. <https://and.and/www.javatpoint.com/ansible>
12. <https://and.and/www.javatpoint.com/selenium-tutorial>
13. <https://and.and/prometheus.io/docs/introduction/overview>
14. <https://and.and/www.javatpoint.com/jira-tutorial>
15. <https://and.and/www.geeksforgeeks.org/what-is-elastic-stack-and-elasticsearch>