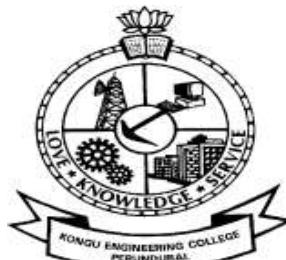


KONGU ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

PERUNDURAI ERODE – 638 060

TAMILNADU INDIA



REGULATIONS, CURRICULUM & SYLLABI – 2022

**(CHOICE BASED CREDIT SYSTEM AND
OUTCOME BASED EDUCATION)**

(For the students admitted during 2022 - 2023 and onwards)

MASTER OF COMPUTER APPLICATIONS DEGREE IN COMPUTER APPLICATIONS

DEPARTMENT OF COMPUTER APPLICATIONS





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**KONGU ENGINEERING COLLEGE
PERUNDURAI ERODE – 638 060
(Autonomous)**

INSTITUTE VISION

To be a centre of excellence for development and dissemination of knowledge in Applied Sciences, Technology, Engineering and Management for the Nation and beyond.

INSTITUTE MISSION

We are committed to value based Education, Research and Consultancy in Engineering and Management and to bring out technically competent, ethically strong and quality professionals to keep our Nation ahead in the competitive knowledge intensive world.

QUALITY POLICY

We are committed to

- Provide value based quality education for the development of students as competent and responsible citizens.
- Contribute to the nation and beyond through research and development
- Continuously improve our services

DEPARTMENT OF COMPUTER APPLICATIONS

VISION

To be a center of excellence for development and dissemination of knowledge in Computer Applications for the nation and beyond

MISSION

Department of Computer Applications is committed to:

- MS1: empower individuals with a strong foundation in Computational knowledge to enable them to become IT professionals to meet societal needs.
- MS2: provide recent technology and develop communication, leadership, and entrepreneurial skills among students to support continual improvement in the teaching-learning process and research activities.
- MS3: impart professional ethics to students and make them socially responsible graduates.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Post Graduate of Computer Applications programme will:

- PEO1: apply computing and mathematical knowledge to identify, formulate, design, implement and develop software solutions for problems across a broad range of application domains
- PEO2: communicate effectively as an individual and also as a leader in diverse groups and in multi-disciplinary setting
- PEO3: develop the professional ethics in work and realize the role of self in the development of society with a strive for independent and life-long learning in the broadest context ever-flourishing technological changes

**MAPPING OF MISSION STATEMENTS (MS) WITH PEOs**

MS\PEO	PEO1	PEO2	PEO3
MS1	3	2	2
MS2	2	3	3
MS3	2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial

PROGRAM OUTCOMES (POs)

Post Graduates of Computer Applications will:

- PO1 Computational Knowledge:** Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
- PO2 Problem Analysis:** Identify, formulate, research literature, and solve *complex* computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
- PO3 Design/Development of Solutions:** Design and evaluate solutions for *complex* computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
- PO4 Conduct Investigations of Complex Computing 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, adapt and apply appropriate techniques, resources, and modern computing tools to *complex* computing activities, with an understanding of the limitations
- PO6 Professional Ethics:** Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices
- PO7 Life-long Learning:** Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional
- PO8 Project Management and Finance:** Demonstrate knowledge and understanding of the computing 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.
- PO9 Communication Efficacy:** Communicate effectively with the computing community, and with society at large, about *complex* computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.
- PO10 Societal and Environmental Concern:** Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices
- PO11 Individual and Team Work:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.
- PO12 Innovation and Entrepreneurship:** Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large



PROGRAM SPECIFIC OUTCOMES (PSOs)

Post Graduates of Computer Applications will:

PSO1 use computing technologies to solve problems and meet industrial needs.

PSO2 become a socially responsible person with strong leadership quality and effective interpersonal skills.

MAPPING OF PEOs WITH POs AND PSOs

PEO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO1	3	3	3	3	3	3	3	2		2	2	3	3	2
PEO2	2	2	2	2	2	3	3	3	3	2	2	2	3	2
PEO3	2	2				2	2	3		2		3	2	2

1 – Slight, 2 – Moderate, 3 – Substantial



CURRICULUM BREAKDOWN STRUCTURE						
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Summary of Credit Distribution

Category	Semester				Total number of credits	Curriculum Content (% of total number of credits of the program)
	1	2	3	4		
FC	04				04	4.71
PC	18	20	14		52	61.18
PE		03	10		13	15.29
EC	02	02		12	16	18.82
BC					--	---
Semester wise Total	24	25	24	12	85	100.00

Category	Abbreviation
Lecture hours per week	L
Tutorial hours per week	T
Practical, Project work, Internship, Professional Skill Training, Industrial Training hours per week	P
Credits	C

CATEGORISATION OF COURSES						
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FOUNDATION COURSES (FC)

S. No.	Course Code	Course Name	L	T	P	C	Sem.
1.	22MCT11	Mathematical Foundation of Computer Applications	3	1	0	4	I
Total Credits to be earned						04	

BRIDGE COURSES (BC)						
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S. No.	Course Code	Course Name	L	T	P	C	Sem.
1.	22MCB01	Problem Solving Techniques using C	3	0	0	0	1
2.	22MCB02	Computer Organization and Design	3	0	0	0	1
3.	22MCB03	C++ Programming	2	0	2	0	2
4.	22MCB04	Operating Systems	3	0	0	0	2

**PROFESSIONAL CORE (PC)**

S. No.	Course Code	Course Name	L	T	P	C	Sem	Domain/ Stream
1.	22MCC11	Python Programming	3	0	2	4	I	SD
2.	22MCT12	Advanced Data Structures and Algorithms	3	0	0	3	I	SD
3.	22MCT13	Advanced Database Technologies	3	0	0	3	I	SD
4.	22MCT14	Software Engineering Methodologies	3	1	0	4	I	SDE
5.	22MCL11	Advanced Data Structures and Algorithms Laboratory	0	0	4	2	I	SD
6.	22MCL12	Advanced Database Technologies Laboratory	0	0	4	2	I	SD
7.	22MCT21	Advanced Java Programming	3	0	0	3	II	SD
8.	22MCT22	Machine Learning	3	0	0	3	II	DS
9.	22MCT23	Data Communication Networks	3	1	0	4	II	NS
10.	22MCC21	Internet of Things	3	0	2	4	II	NS
11.	22MCL21	Advanced Java Programming Laboratory	0	0	4	2	II	SD
12.	22MCL22	Machine Learning Laboratory	0	0	4	2	II	DS
13.	22GEL21	Professional Skills Training	0	0	4	2	II	GEN
14.	22MCT31	Cloud Computing Technologies	3	0	0	3	III	NS
15.	22MCT32	C# and ASP.Net	3	0	0	3	III	SD
16.	22MCT33	Data Science	3	1	0	4	III	DS
17.	22MCL31	Cloud Computing Technologies Laboratory	0	0	4	2	III	NS
18.	22MCL32	C# and ASP.Net Laboratory	0	0	4	2	III	DS
Total Credits to be earned						52		



PROFESSIONAL ELECTIVES (PES)							
S. No.	Course Code	Course Name	L	T	P	C	Domain/Stream
Semester – II							
Professional Elective – I							
1.	22MCE01	Artificial Intelligence	3	0	0	3	DS
2.	22MCE02	Advanced Design and Analysis of Algorithms	3	0	0	3	SD
3.	22MCE03	Web Technologies	3	0	0	3	SD
4.	22GET11	Research Methodologies	3	0	0	3	GEN
5.	22MCE04	Big Data Technologies	3	0	0	3	DS
6.	22MCE05	Optimization Techniques	3	0	0	3	GEN
Semester – III							
Professional Elective – II							
7.	22MCE06	Mobile Computing	3	0	0	3	NS
8.	22MCE07	Blockchain Technologies	3	0	0	3	NS
9.	22MCE08	Distributed Systems	3	0	0	3	NS
10.	22MCE09	Software Project Management	3	0	0	3	SDE
11.	22MCE10	Deep Learning	3	0	0	3	DS
12.	22MCE11	Service Oriented Architecture	3	0	0	3	NS
Professional Elective – III							
13.	22MCF01	Software Testing	3	0	2	4	SDE
14.	22MCF02	PHP and MYSQL	3	0	2	4	SD
15.	22MCF03	Cross-Platform Mobile Application Development	3	0	2	4	SD
16.	22MCF04	Full Stack Framework	3	0	2	4	SD
17.	22MCF04	Data Visualization Techniques	3	0	2	4	DS
18.	22MCF06	Accounting and Financial Management	3	0	2	4	GEN
Professional Elective – IV							
19.	22MCE12	Bioinformatics	3	0	0	3	DS
20.	22MCE13	Business Intelligence	3	0	0	3	DS
21.	22MCE14	Cryptography and Network Security	3	0	0	3	NS
22.	22MCE15	Economics and Management for Information Technology	3	0	0	3	GEN
23.	22MCE16	Social Network Analysis	3	0	0	3	DS
24.	22GET13	Innovation, Entrepreneurship and Venture Development	3	0	0	3	GEN
Total Credits to be earned						13	

* Domain/Stream Abbreviations: SD – Software Development, NS - Network and Security, DS – Data Science, SDE- Software Development Engineering, GEN - General



EMPLOYABILITY ENHANCEMENT COURSES (EC)						
S. No.	Course Code	Course Name	L	T	P	C
1.	22MCP11	Mini Project – I	0	0	4	2
2.	22MCP21	Mini Project – II	0	0	4	2
3.	22MCP41	Project Work	0	0	24	12
Total Credits to be earned					16	

**KEC R2022: SCHEDULING OF COURSES – MCA (Computer Applications) Total Credits: 85**

Sem	Course1	Course2	Course3	Course4	Course5	Course6	Course7	Course8	Course9	Course10	Course11	CH
I	22MCT11 - Mathematical Foundation of Computer Applications (3-1-0-4)	22MCC11 - Python Programming (3-0-2-4)	22MCT12 - Advanced Data Structures and Algorithms (3-0-0-3)	22MCT13 - Advanced Database Technologies (3-0-0-3)	22MCT14 - Software Engineering Methodologies (3-1-0-4)	22MCB01 - Problem Solving Techniques using C (3-0-0-0)	22MCB02 - Computer Organization and Design (3-0-0-0)	22MCL11 - Advanced Data Structures and Algorithms Laboratory (0-0-4-2)	22MCL12 - Advanced Database Technologies Laboratory (0-0-4-2)	22MCP11 - Mini Project I (0-0-4-2)	--	24
II	22MCT21 - Advanced Java Programming (3-0-0-3)	22MCT22 - Machine Learning (3-0-0-3)	22MCT23 - Data Communication Networks (3-1-0-4)	22MCC21 - Internet of Things (3-0-2-4)	Professional Elective I (3-0-0-3)	22MCB03 - C++ Programming (2-0-2-0)	22MCB04 - Operating Systems (3-0-0-0)	22MCL21 - Advanced Java Programming Laboratory (0-0-4-2)	22MCL22 - Machine Learning Laboratory (0-0-4-2)	22GEL21 - Professional Skills Training (0-0-4-2)	22MCP21 - Mini Project II (0-0-4-2)	25
III	22MCT31 - Cloud Computing Technologies (3-0-0-3)	22MCT32 - C# and ASP.Net (3-0-0-3)	22MCT33 - Data Science (3-1-0-4)	Professional Elective II (3-0-0-3)	Professional Elective III (3-0-2-4)	Professional Elective IV (3-0-0-3)	22MCL31 - Cloud Computing Technologies Laboratory (0-0-4-2)	22MCL32 - Software Testing Laboratory (0-0-4-2)				24
IV	22MCP41 - Project work (0-0-24-12)											12

**MAPPING OF COURSES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	22MCT11	Mathematical Foundation of Computer Applications	✓	✓	✓	✓	✓						✓	✓	✓	
1	22MCC11	Python Programming	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓
1	22MCT12	Advanced Data Structures and Algorithms	✓	✓	✓	✓	✓		✓				✓		✓	
1	22MCT13	Advanced Database Technologies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1	22MCT14	Software Engineering Methodologies	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
1	22MCL11	Advanced Data Structures and Algorithms Laboratory	✓	✓	✓	✓			✓				✓		✓	✓
1	22MCL12	Advanced Database Technologies Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	22MCT21	Advanced Java Programming	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	22MCT22	Machine Learning	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
2	22MCT23	Data Communication Networks	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓
2	22MCC21	Internet of Things	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
2	22MCL21	Advanced Java Programming Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	22MCL22	Machine Learning Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	22GEL21	Professional Skills Training	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓
3	22MCT31	Cloud Computing Technologies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	22MCT32	C# and ASP.Net	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	22MCT33	Data Science	✓	✓	✓	✓	✓							✓	✓	
3	22MCL31	Cloud Computing Technologies Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓



Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
3	22MCL32	C# and ASP.Net Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1	22MCP11	Mini Project – I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	22MCP21	Mini Project – II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	22MCP41	Project Work	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Professional Elective Courses

2	22MCE01	Artificial Intelligence	✓	✓	✓	✓	✓			✓				✓	✓	
2	22MCE02	Advanced Design and Analysis of Algorithms	✓	✓	✓	✓	✓		✓				✓		✓	
2	22MCE03	Web Technologies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	22GET11	Introduction to Research	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	22MCE04	Big Data Technologies	✓	✓	✓	✓	✓		✓			✓		✓	✓	✓
2	22MCE05	Optimization Techniques	✓	✓	✓	✓	✓					✓	✓	✓	✓	
3	22MCE06	Mobile Computing	✓	✓	✓	✓									✓	
3	22MCE07	Blockchain Technologies	✓	✓	✓	✓	✓	✓	✓						✓	✓
3	22MCE08	Distributed Systems	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	22MCE09	Software Project Management	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓
3	22MCE10	Deep Learning	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
3	22MCE11	Service Oriented Architecture	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	22MCF01	Software Testing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	22MCF02	PHP and MYSQL	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	22MCF03	Cross-Platform Mobile Application Development	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓



Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
3	22MCF04	Full Stack Framework	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
3	22MCF05	Data Visualization Techniques	✓	✓	✓		✓	✓		✓			✓	✓	✓	
3	22MCF06	Accounting and Financial Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	22MCE12	Bioinformatics	✓	✓	✓		✓	✓				✓				✓
3	22MCE13	Business Intelligence	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
3	22MCE14	Cryptography and Network Security	✓	✓	✓	✓		✓								✓
3	22MCE15	Economics and Management for Information Technology	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
3	22MCE16	Social Network Analysis	✓	✓	✓	✓	✓					✓	✓		✓	
3	22GET13	Innovation, Entrepreneurship and Venture Development	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Bridge Courses

1	22MCB01	Problem Solving Techniques using C	✓	✓	✓	✓									✓	✓
1	22MCB02	Computer Organization and Design	✓	✓	✓	✓	✓	✓							✓	✓
2	22MCB03	C++ Programming	✓	✓	✓	✓	✓		✓						✓	
2	22MCB04	Operating Systems	✓	✓	✓	✓						✓		✓		



MASTER OF COMPUTER APPLICATIONS CURRICULUM – R2022
(For the students admitted from the academic year 2022-23 onwards)

SEMESTER – 1									
Course Code	Course Title	Hours/Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
22MCT11	Mathematical Foundation of Computer Applications	3	1	0	4	40	60	100	FC
22MCC11	Python Programming	3	0	2	4	50	50	100	PC
22MCT12	Advanced Data Structures and Algorithms	3	0	0	3	40	60	100	PC
22MCT13	Advanced Database Technologies	3	0	0	3	40	60	100	PC
22MCT14	Software Engineering Methodologies	3	1	0	4	40	60	100	PC
22MCB01	Problem Solving Techniques using C	3	0	0	0	100	0	100	BC
22MCB02	Computer Organization and Design	3	0	0	0	100	0	100	BC
Practical/Employability Enhancement									
22MCL11	Advanced Data Structures and Algorithms Laboratory	0	0	4	2	60	40	100	PC
22MCL12	Advanced Database Technologies Laboratory	0	0	4	2	60	40	100	PC
22MCP11	Mini Project – I	0	0	4	2	50	50	100	EC
Total Credits to be earned						24			

SEMESTER – 2									
Course Code	Course Title	Hours/Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
22MCT21	Advanced Java Programming	3	0	0	3	40	60	100	PC
22MCT22	Machine Learning	3	0	0	3	40	60	100	PC
22MCT23	Data Communication Networks	3	1	0	4	40	60	100	PC
22MCC21	Internet of Things	3	0	2	4	50	50	100	PC
	Professional Elective – I	3	0	0	3	40	60	100	PE
22MCB03	C++ Programming	2	0	2	0	100	0	100	BC
22MCB04	Operating Systems	3	0	0	0	100	0	100	BC
Practical/Employability Enhancement									
22MCL21	Advanced Java Programming Laboratory	0	0	4	2	60	40	100	PC
22MCL22	Machine Learning Laboratory	0	0	4	2	60	40	100	PC
22GEL21	Professional Skills Training*	-	-	-	2	100	0	100	PC
22MCP21	Mini Project – II	0	0	4	2	50	50	100	EC
Total Credits to be earned						25			

*80 hours of Training



MASTER OF COMPUTER APPLICATIONS CURRICULUM – R2022
(For the students admitted from the academic year 2022-23 onwards)

SEMESTER – III									
Course Code	Course Title	Hours/Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
22MCT31	Cloud Computing Technologies	3	0	0	3	40	60	100	PC
22MCT32	C# and ASP.Net	3	0	0	3	40	60	100	PC
22MCT33	Data Science	3	1	0	4	40	60	100	PC
	Professional Elective – II	3	0	0	3	40	60	100	PE
	Professional Elective – III	3	0	2	4	50	50	100	PE
	Professional Elective – IV	3	0	0	3	40	60	100	PE
Practical/Employability Enhancement									
22MCL31	Cloud Computing Technologies Laboratory	0	0	4	2	60	40	100	PC
22MCL32	C# and ASP.Net Laboratory	0	0	4	2	60	40	100	PC
Total Credits to be earned						24			

SEMESTER – IV									
Course Code	Course Title	Hours/Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Practical/Employability Enhancement									
22MCP41	Project Work	0	0	24	12	50	50	100	EC
Total Credits to be earned						12			

Total Credits :85



LIST OF PROFESSIONAL ELECTIVES (PEs)							
S. No.	Course Code	Course Name	L	T	P	C	Domain/ Stream
Semester – II							
Elective – I							
1.	22MCE01	Artificial Intelligence	3	0	0	3	DS
2.	22MCE02	Advanced Design and Analysis of Algorithms	3	0	0	3	SD
3.	22MCE03	Web Technologies	3	0	0	3	SD
4.	22GET11	Introduction to Research	2	1	0	3	GEN
5.	22MCE04	Big Data Technologies	3	0	0	3	DS
6.	22MCE05	Optimization Techniques	3	0	0	3	GEN
Semester – III							
Elective – II							
7.	22MCE06	Mobile Computing	3	0	0	3	NS
8.	22MCE07	Blockchain Technologies	3	0	0	3	NS
9.	22MCE08	Distributed Systems	3	0	0	3	NS
10.	22MCE09	Software Project Management	3	0	0	3	SDE
11.	22MCE10	Deep Learning	3	0	0	3	DS
12.	22MCE11	Service Oriented Architecture	3	0	0	3	NS
Elective – III							
13.	22MCF01	Software Testing	3	0	2	4	SDE
14.	22MCF02	PHP and MYSQL	3	0	2	4	SD
15.	22MCF03	Cross-Platform Mobile Application Development	3	0	2	4	SD
16.	22MCF04	Full Stack Framework	3	0	2	4	SD
17.	22MCF05	Data Visualization Techniques	3	0	2	4	DS
18.	22MCF06	Accounting and Financial Management	3	0	2	4	GEN
Elective – IV							
19.	22MCE12	Bioinformatics	3	0	0	3	DS
20.	22MCE13	Business Intelligence	3	0	0	3	DS
21.	22MCE14	Cryptography and Network Security	3	0	0	3	NS
22.	22MCE15	Economics and Management for Information Technology	3	0	0	3	GEN
23.	22MCE16	Social Network Analysis	3	0	0	3	DS
24.	22GET13	Innovation, Entrepreneurship and Venture Development	3	0	0	3	GEN



22MCT11 - MATHEMATICAL FOUNDATION OF COMPUTER APPLICATIONS														
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	1	FC	3	1	0	4							
Preamble	To demonstrate the basic knowledge of Mathematics, probability and statistics to solve computational problems													
Unit – I	Mathematical Logic: Propositions - Logical operators - Truth tables - Laws of logic - Proofs in propositional calculus – Predicates - Quantifiers - free & bound variables - Universe of discourse - Inference in Predicate calculus - Mathematical induction.													
Unit – II	Set Theory: Basic definitions - Venn diagrams and set operations - Laws of set theory – principle of inclusion and exclusion. Relations - Properties of relations - Matrices of relations - Closure operations on relations. Functions - Injective, surjective and bijective functions.													
Unit – III	Probability and Random Variables: Probability - Axioms of Probability – Mutually exclusive events – Independent events - Conditional Probability - Addition and multiplication laws of Probability - Baye's theorem. One dimensional Random Variables - Discrete and continuous random variables - Probability mass function and Probability density functions - Cumulative distribution function –Expectation and variance of random variables - Binomial, Poisson, Uniform, Normal distributions..													
Unit – IV	Statistical hypothesis testing: Sampling distributions - Tests based on small and large samples - Normal, Student's t, Chi-square and F distributions for testing of mean and variance, testing of difference of means and variances - Tests for independence of attributes and goodness of fit.													
Unit – V	Design of experiments: Analysis of variance - Completely randomized design - Random block design (One-way and Two-way classifications) - Latin square design.													
Lecture:45, Tutorial:15, Total: 60														
REFERENCES:														
1.	Kenneth H. Rosen, "Discrete Mathematics and its Applications", 8 th Edition, McGraw-Hill Education, India, 2019. (Unit I – II)													
2.	Devore, J.L, "Probability and Statistics for Engineering and Sciences", Cengage Learning, 8 th Edition, New Delhi, 2014. (Unit III – V)													
3.	Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8 th Edition, 2015.													



COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply logical operations and predicate calculus to solve problems	Applying (K3)
CO2	demonstrate the concept of sets, relation and functions for designing and solving problems	Understanding (K2)
CO3	make use of probability and the distribution of discrete and continuous ideas in solving real world problems	Applying (K3)
CO4	analyze real-world problems using statistical hypothesis testing	Analyzing(K4)
CO5	analyze various experimental design principles to draw valid conclusions from data collected	Analyzing (K4)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2							1	2	2	
CO2	3	3										1		
CO3	3	3	2	2								2	2	
CO4	3	3	2	3	2						1	2	2	
CO5	3	3	2	3	2						1	2	2	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	40	45	-	-	-	100
CAT2	15	40	45	-	-	-	100
CAT3	15	20	15	50	-	-	100
ESE	10	20	35	35	-	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks

**22MCC11- PYTHON PROGRAMMING**

Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	1	PC	3	0	2	4							
Preamble	To make the students to be able to create and run scripts using python for real time applications.													
Unit – I	Python Basics:													
Introduction to Python – Writing our First Python Program – Data types in python- operators in python - Input and Output-Control Statements: if..else - if..elif - while – for - infinite loops - nested loops - else suite – break – continue –pass – assert – return-command line arguments.							9							
Unit – II	Sequential and Non Sequential Collection Operations:													
Arrays in Python: creating Arrays-Mathematical operations on Arrays- Comparing-Aliasing- Slicing and Indexing-Strings and Characters - Functions: defining – calling - returning results - Formal and Actual arguments- Types of actual arguments-Local and Global variables - Recursive function - Anonymous function - List and Tuples - Dictionaries.							9							
Unit – III	Object Oriented Programming in Python:													
Introduction to OOPS: Features of OOPs - Classes and Objects: creating a class – self variable – constructor – types of variables and methods – passing members – inner classes - Inheritance and Polymorphism - Abstract classes and Interfaces - Exceptions.							9							
Unit – IV	Python Advances:													
Files: Types - open, close and working file - Binary files- with statement – seek() and tell() methods- Access binary files - zipping and unzipping files – Working with directories - Regular Expressions in Python-Date and Time: combining -formatting - comparing – sorting - Working with Calendar module.							9							
Unit – V	Graphical User Interface:													
GUI in Python- Root Window - Fonts and Colors- Working with Containers- Canvas- Frame- Types of Widget: button-label – message – text – scrollbar - checkbutton – radiobutton – entry – spinbox - listbox - menu- Creating Tables- Pythons Database Connectivity - CRUD operations.							9							
LIST OF EXPERIMENTS / EXERCISES:														
1.	Develop python code to demonstrate different types of operators.													
2.	Develop python code to demonstrate the use of control structures.													
3.	Implement python code to demonstrate built in functions of array and string.													
4.	Write python code to demonstrate the user defined function with different types of arguments, call by object reference and multiple returning statements.													
5.	Demonstrate the different types of techniques like filter (), map () and reduce () using user defined functions and anonymous function.													
6.	Implement python code to demonstrate built in functions of list, tuple, dictionary and set.													
7.	Develop python code to implement bank operations using OOPS concepts.													
8.	Develop python code to implement payroll calculation of an employee using OOPS concepts.													
9.	Develop python code to implement electricity bill calculation based on commercial and non-commercial constraintsusing OOPS concepts.													
10.	Implement the python code to perform various text file operations using different types modes													
11.	Implement the python code to perform various binary file operations using different types modes													
12.	Write python code to extract necessary information from the .txt file using different string patterns of regular expression.													
13.	Write python code to manipulate date and time using datetime module and calendar module.													
14.	Develop an CUI application to perform CRUD operations on database (MySQL/Oracle)													
15.	Develop a GUI based application to perform CRUD operations on database (MySQL/Oracle)													
Lecture:45, Practical:30, Total:75														
REFERENCES/ MANUAL / SOFTWARE:														
1.	Nageswara Rao R., “Core Python Programming”, 2 nd Edition, Dreamtech Press, New Delhi, 2018.													
2.	Kenneth A. Lambert, “Fundamentals of Python – First Programs”, 2 nd Edition, Cengage Publication, New Delhi, 2019.													
3.	Paul Barry, “Head First Python”, 2 nd Edition, O'Reilly Media, Beijing, 2016.													



COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the fundamental concepts of python programming on real time applications.	
CO2	implement python code to perform various operations using sequential and non-sequential collections.	
CO3	develop python applications using object oriented programming concepts.	
CO4	apply operations on files, search the patterns using regular expression and working with date and time modules.	
CO5	develop real-time applications to know about the interaction between front-back end.	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	2					2			1	2
CO2	3	2	3	2	3		1			2			1	3
CO3	3	2	2	2	3		1			1			1	2
CO4	3	2	2	3	3		1	2		1			1	3
CO5	3	2	2	2	3		1	2	1	1			1	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	50	-	-	-	100
CAT2	10	40	50	-	-	-	100
CAT3	10	40	50	-	-	-	100
ESE	5	35	60	-	-	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks



22MCT12 - ADVANCED DATA STRUCTURES AND ALGORITHMS														
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	1	PC	3	0	0	3							
Preamble	To focus on a variety of ideas, methods, and algorithmic implementations relevant to linear-Nonlinear data structures.													
Unit – I	Linked Lists, Stacks and Queues:													
Introduction - Representation and Operations: Linear Linked List - Doubly Linked List– Circular Linked List – Header Linked Lists - Applications of Linked list -Stacks: Operations on stacks-Representation of a stack in memory – Applications of stack – Queues: Operations – Representation of Queues in memory – Applications of Queues.														
Unit – II	Trees:													
Introduction – Tree terminology – Binary trees – Tournament trees – Binary search trees: Representation of a binary and Binary search tree –Operations on binary and Binary search tree – Creation – Traversal – AVL Trees – Threaded binary trees – B Tree – B+ Trees - Heaps.														
Unit – III	Graphs:													
Introduction – Graph terminology – Representation of Graphs –Operations on Graphs – Applications of Graph - Topological Sort – Minimum Spanning Tree – Finding Shortest paths - Articulation Points, Bridges, and Biconnected Components, Strongly connected components – Eulerian Tour – Hamiltonian Tour.														
Unit – IV	Hash Tables and Hashing:													
Introduction – Direct Address table - Hash Table – Hash Function – Resolving collisions: Synonyms Chaining– Open Addressing - Rehashing.														
Unit – V	Sorting, Searching and Merging:													
Introduction – Bubble sort – Selection sort –Insertion Sort – Bucket / Radix Sort - Merge Sort – Quick Sort – Heap Sort – Tree sort – Shell Sort – Searching: Linear – Binary search – Merging.														
Total:45														
REFERENCES:														
1.	R.S.Salaria, "Data structures & Algorithms Using C", 5 th Edition, Khanna Book Publishing Co.Pvt.Ltd.,SRS Enterprises, New Delhi, 2022.													
2.	ReemaThareja., "Data Structures using C", 2 nd Edition, Oxford University Press, New Delhi, 2018.													
3.	Jean Paul Tremblay and Paul G. Sorensen, "An Introduction to Data Structures with Applications", 2 nd Edition, Tata McGraw Hill, New Delhi, 2017.													



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)		
CO1	solve the problems using linear data structures.												Applying (K3)	
CO2	construct a tree and perform various operations on a tree along with implementation												Applying (K3)	
CO3	examine the solution for solving various computing problems using graph data structure												Analyzing (K4)	
CO4	make use of hashing techniques to generate hash address and to resolve the collision on it												Applying (K3)	
CO5	apply the concept of sorting , searching and merging techniques												Applying (K3)	
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2		1				1		3	
CO2	3	3	3	2	2		1				1		3	
CO3	3	3	3	2	2		1				1		3	
CO4	3	3	3	2	2		1				1		3	
CO5	3	3	3	2	2		1				1		3	
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														
ASSESSMENT PATTERN – THEORY														
Test / Bloom's Category*	Remembering (K1) %		Understanding (K2) %		Applying (K3) %		Analyzing (K4) %		Evaluating (K5) %		Creating (K6) %		Total %	
CAT1	10		40		50		-		-		-		100	
CAT2	10		30		45		15		-		-		100	
CAT3	10		40		50		-		-		-		100	
ESE	10		30		45		15		-		-		100	

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks

**22MCT13 - ADVANCED DATABASE TECHNOLOGIES**

Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	1	PC	3	0	0	3							
Preamble	To understand the designing, modeling, manipulating, storing and retrieving of information													
Unit – I	Data Models: Introduction – Database System Applications – Purpose of database systems – View of data – Database Languages – Relational Databases – Database Design – Data Storage and Querying – Transaction Management – Database Architecture – Database Users and administrators – Relational Model – Structure of Relational Databases – Database Schema – Keys – Schema Diagrams – Relational Query Languages – Relational Operations- Database Design and E-R model : E-R model- Constraints – ER diagrams – Reduction to Relational Schema – ER design issues													
Unit – II	Query Evaluation and Relational Query Language: Overview – SQL data definition – Basic structure – Operations – Aggregate Functions –Nested Sub queries – Modification of the database – Intermediate SQL : Joins – views- Integrity Constraints– SQL data types and schemas – Authorization – Formal Relational Query Languages - Relational Algebra													
Unit – III	Normalization Concepts , Indexing and Query Processing: Relational Database Design: Features of good relational designs- atomic domains and first normal form-functional dependency theory – Decomposition using functional dependencies: 2NF, 3NF, BCNF – Decomposition using Multivalued Dependencies- 4NF, 5NF- Indexing – Types of Indices - Query Processing: Overview – Measures of Query Cost -Query optimization – Overview – Transformation of Relational Expressions – Choice of Evaluation Plan													
Unit – IV	Transaction Processing and Management: Transaction Concept – Properties - Transaction States – Serializability – Lock-Based Protocols- Multiple Granularity - Timestamp-Based Protocols – Validation-Based Protocols – Recovery System – Failure Classification – Storage – Recovery and Atomicity													
Unit – V	Distributed and Advanced Database Models: Distributed Database - Types of Distributed Database Systems- Distributed Database Architectures - Enhanced Data Models for Advanced Applications - Active Database Concepts and Triggers - Temporal Database -Spatial Databases - Multimedia Database													
Total:45														
REFERENCES:														
1.	Abraham Silberschatz, Henry F. Korth and Sudharshan S., "Database System Concepts", 7 th Edition, Tata McGraw Hill, New York, 2019 . (Unit I, II, IV)													
2.	RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 7 th Edition, Pearson, 2017. (Unit III, V)													
3.	Lee Chao, "Database Development and Management", Auerbach Publications, 2010.													



COURSE OUTCOMES:												BT Mapped (Highest Level)	
On completion of the course, the students will be able to													
CO1	illustrate the importance of databases and different data models.												Understanding (K2)
CO2	apply the techniques for working with combined tables using the relational model and relational algebra.												Applying (K3)
CO3	analyze the various normalization techniques and assess how they influence the organization and sequencing of data storage.												Analyzing (K4)
CO4	identify the concepts of transaction processing and concurrency control, and apply techniques to manage data integrity in multi-user environments.												Applying (K3)
CO5	summarize the concepts of distributed databases, multimedia databases, and its features.												Understanding K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2				2	1		1	2	2	2
CO2	3	3	2	2							2	2	2	3
CO3	3	2	2	3	3	2						2	3	3
CO4	2	2	2	2	2		3	2		1			2	2
CO5	2	3	3	2	3				1	2	3	2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40	-	-	-	100
CAT2	10	40	40	10	-	-	100
CAT3	15	35	50	--	-	-	100
ESE	15	35	40	10	-	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks



22MCT14 - SOFTWARE ENGINEERING METHODOLOGIES																
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit									
Prerequisites	Nil	1	PC	3	1	0	4									
Preamble	To facilitate and understand the formal method to develop software project, analyze the requirement ,design, management advanced technologies of software development															
Unit – I	Formal and Agile Methodologies: The Nature of software- Software Engineering – Software Process Models – Prescriptive process model–Specialized process model-The Unified Process – Agile Development: Agile Process – Extreme Programming-Other Agile process															
Unit – II	Requirements Analysis and Modeling: Understanding Requirements - Requirements Modeling: Scenario Based Methods-Class Based Methods – Behavior, Patterns, Web/ Mobile Apps.															
Unit – III	Software Design: Design Concepts - Architectural Design - Component Level Design - User Interface Design - Pattern Based Design – Web App Design – Mobile App Design.															
Unit – IV	Review Techniques and Project Scheduling : Review metrics and their use-informal reviews-formal technical reviews-Project scheduling - Risk management - Maintenance-Reengineering: Business Process Reengineering – Software Reengineering - Reverse Engineering –restructuring-Forward Engineering															
Unit – V	Advances in software Engineering: SPI-SPI process-CMMI-people CMM-SPI Frameworks- Technology Evolution-Observing software Engineering trends- identifying soft trends-Technology directions-Tools related trends- Software engineer's responsibility.															
Lecture:45, Tutorial:15, Total: 60																
REFERENCES:																
1.	RogerS.Pressman,BruceR.Maxim, "Software Engineering -A Practitioner's Approach", 8 th Edition, Tata McGraw Hill, New York, 2020.															
2.	PankajJalote, "An Integrated Approach to Software Engineering", 3 rd Edition, Narosa publications, 2011.															
3.	Somerville Ian, "Software Engineering", 9 th Edition, Pearson Education Asia, Singapore, 2011.															



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1 apply the various formal and agile life cycle models of software engineering												Applying (K3)	
CO2 develop requirement models for web and mobile applications using various modeling techniques.												Applying (K3)	
CO3 apply architectural and functional design concepts to structure and organize software systems.												Applying (K3)	
CO4 evaluate the effectiveness of software review processes and their role in improving software quality.												Evaluating(K5)	
CO5 assess the responsibilities of a software engineer in aligning with ethical practices, industry standards and emerging technological shifts												Evaluating (K5)	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2				1		2		1	
CO2	2	3	3	2	2		1	2	1	2		1		2
CO3	2	3			3									
CO4	2	2	2	2	1			2						1
CO5	2	3		2	2		3	3	2				2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	30	45	-	-	-	100
CAT2	25	25	50	-	-	-	100
CAT3	20	20	35	15	10	-	100
ESE	10	25	35	15	15	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks



22MCL11 - ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY																										
Programme & Branch		MCA & Computer Applications				Sem.	Category	L	T	P	Credit															
Prerequisites		Nil				1	PC	0	0	4	2															
Preamble	To provide the set of problems covering the basic algorithms as well as numerous computing problems demonstrating the applicability of various data structures and related algorithms Implementation.																									
LIST OF EXPERIMENTS / EXERCISES:																										
1.	Compute the Polynomial Addition $d=a + b$ using singly linked list where a and b be the pointers to two polynomials.																									
2.	Design a data structure to represent a stack in an array named elements of size n. Also write a functions for demonstrating push (), pop () and peep () operations on stack i, where the stack is initially empty.																									
3.	Design an application to demonstrate the use of stack data structure in checking whether the arithmetic expression is properly parenthesised.																									
4.	Design a Queue data structure and to perform various operations using linked list along with its size n, where n=10.																									
5.	Program to illustrate the implementation of Insert, Delete and Searching operations on a binary search tree.																									
6.	Write a function to implement pre-order, in-order and post-order traversals of a binary tree.																									
7.	Consider an undirected graph $G= (V, E)$. Assume that the vertices V are numbered 1, 2, 3 ... and perform traversal of graph using iterative DFS Technique. The DFS starts from first node.																									
8.	Implement a program using Hashing Techniques																									
9.	Write a Program to sort an array of integers in ascending order using selection sort.																									
10.	Develop a program to sort an array of integers in ascending order using divide and conquer techniques.																									
11.	Write a program to find an element among the list of elements in an array using Linear search Techniques.																									
12.	Implement a program to find an element among the list of elements in an array using Divide and Conquer Technique.																									
13.	Design an application for online shopping system using appropriate data structure.																									
14.	Implementing forward and backward buttons of a Browser using stack or linked list.																									
15.	Design chess game applications using graph data structures.																									
Total:60																										
REFERENCES/ MANUAL /SOFTWARE:																										
1.	Front End : Windows/Linux OS																									
2.	Software : Turbo/Borland/GCC compilers																									
3.	Laboratory Manual																									
COURSE OUTCOMES:																										
On completion of the course, the students will be able to																										
CO1	implement a program using Linear and Non Linear Data Structures.										BT Mapped (Highest Level)															
CO2	make use of hashing technique to implement a program and to resolve collisions										Applying (K3) Manipulation (S2)															
CO3	apply the concept of sorting , searching and merging techniques to solve a problem										Applying (K3) Manipulation (S2)															
Mapping of Cos with POs and PSOs																										
COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2												
CO1	3	3	3	2			1				1		3	2												
CO2	3	3	3	2			1				1		3	2												
CO3	3	3	3	2			1				1		3	2												

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



22MCL12 - ADVANCED DATABASE TECHNOLOGIES LABORATORY														
Programme & Branch		MCA & Computer Applications				Sem.	Category	L	T	P	Credit			
Prerequisites		Nil				1	PC	0	0	4	2			
Preamble		To deliver students the elementary concepts of a database management system and equips them to design and implement a database application built over those concepts.												
LIST OF EXPERIMENTS / EXERCISES:														
1. Consider a University Database and use necessary schema (Student, Department, Faculty, Courses...etc), Make use of DDL operations to perform creation of table, alter, modify, drop and truncate. Additionally apply DML transactions over the schema and use appropriate Integrity constraints like Primary Key, Unique key, Foreign Key, Check, Default, Null and Not Null.														
2. Construct the University database and schema to perform the controlling privileges operations with TCL –Commit, Save point and Rollback the transactions. To deal with the rights, permissions, and other controls of the database system use DCL that includes commands such as GRANT and REVOKE.														
3. Build the essential DB objects using view, sequences ,indexes and synonyms for University Database														
4. Make use of Employee Database and perform SQL Statements on <ul style="list-style-type: none"> i. Single row General functions, Case Conversion functions, Character functions, Date functions, Number functions. ii. Aggregate functions AVG, COUNT, MAX, MIN, SUM. iii. Set operations Union, UnionAll, Intersect, Minus. 														
5. Experiment with Employee Database and Perform various Joins & Sub queries for displaying data from multiple tables using SQL operators, GROUPBY, HAVING and ORDERBY clause														
6. Construct a basic block to combine database language and procedural programming language using PL/SQL programs														
7. Generate a payroll process for employee tables by stored functions and stored procedures using PL/SQL programs														
8. Iterate n number of employees using Cursors in PL/SQL programs and perform Implicit, Explicit Cursor Operations for the table.														
9. Create Triggers for DML Statement, DDL Statement, System and User event. Make Use of PL/SQL block to call multiple functions, procedures, cursors using package.														
10. Write PL/SQL programs to Handle Exceptions with inbuilt libraries and customized way to raise an exceptions.														
Total:60														
REFERENCES/ MANUAL /SOFTWARE:														
1.	Front End: Microsoft Visual Studio 6.0, Microsoft .NET Framework SDK v2.0, Java Eclipse.													
2.	Back End : ORACLE /MongoDB/ SQL Server / MYSQL													
3.	Laboratory Manual													
COURSE OUTCOMES: On completion of the course, the students will be able to										BT Mapped (Highest Level)				
CO1	develop SQL and PL/SQL commands to create and manipulate databases.									Applying (K3) Manipulation (S2)				
CO2	make use of the complex queries using SQL.									Applying(K3) Manipulation(S2)				
CO3	solve real world problems using SQL and PL/SQL.									Applying (K3) Manipulation (S2)				
Mapping of Cos with POs and PSOs														
COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	2	1		1		1	1	2	2
CO2	3	3	3	2	2	1	2		2	2	2	1	2	2
CO3	3	2	2	3	3	2	2	2		2	3	2	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														



22MCP11 - MINI PROJECT – I																	
Programme & Branch		MCA & Computer Applications					Sem.	Category	L	T	P	Credit					
Prerequisites		Nil					1	EC	0	0	4	2					
Total:60																	
COURSE OUTCOMES: On completion of the course, the students will be able to											BT Mapped (Highest Level)						
CO1	identify the problem by applying acquired knowledge											Applying (K3) Precision (S3)					
CO2	analyze and categorize executable project modules after considering risks											Analyzing (K4) Precision (S3)					
CO3	analyze efficient tools for designing project modules											Analyzing (K4) Precision (S3)					
CO4	integrate all the modules through effective teamwork after efficient testing and validation											Evaluating (K5) Precision (S3)					
CO5	compile the results in the form of technical report with oral presentation											Creating (K6) Precision (S3)					
Mapping of COs with POs and PSOs																	
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2			
CO1	3	3	3	3	3	3	3	2	3	3	3	3	3	3			
CO2	3	3	3	3	3	3	3	2	3	3	3	3	3	3			
CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3			
CO4	3	3	3	3	3	3	3	2	3	3	3	3	3	3			
CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3			
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy																	



22MCT21 - ADVANCED JAVA PROGRAMMING																
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit									
Prerequisites	Nil	2	PC	3	0	0	3									
Preamble	To develop general purpose applications using object-oriented design principles with database connectivity in java language.															
Unit – I	Basics of Java, Classes and Objects:															
The Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Introducing Classes – Methods and Classes: Overloading Methods – Passing and returning Objects – Recursion – Access control – static – final – Nested and Inner classes.																
Unit – II	Inheritance, Packages and Interfaces:															
Inheritance : Basics – Using super – Method Overriding – Dynamic Method dispatch – Abstract classes – final with Inheritance. Packages and Interfaces : Packages – Packages and Member Access – importing Packages – Interfaces – Default Interface Methods – static Methods in Interface - Private Interface methods.																
Unit – III	Exception Handling, Multithreading and Collection Frameworks:															
Fundamentals – Types – Uncaught Exceptions – try and catch – Multiple catch – Nested try – throw – throws – finally – Built-in Exceptions – Multithreaded: Java Thread Model – Main Thread – Creating a Thread and Multiple threads – is Alive() and join() - Collection Frameworks: Collection Interfaces - Collection Classes: ArrayList - LinkedList - HashSet - TreeSet - PriorityQueue - Iterator - Map: Map Interfaces - Map Classes: HashMap – TreeMap - Comparators.																
Unit – IV	Servlets and Java server Pages:															
Working with Servlets: Features – Servlet API – Servlet Life Cycle – Creating a Sample Servlet - Java Server Pages: Architecture of JSP pages – Life Cycle of JSP – Working with JSP Basic Tags and implicit objects – Exploring Action Tags.																
Unit – V	JDBC, Hibernate and Spring:															
Working with JDBC: Introduction - JDBC Drivers – Features of JDBC – JDBC API – Major Classes and Interfaces – Process with java.sql package – Working with Hibernate: Architecture – Downloading hibernate - Exploring HQL – Hibernate O/R mapping – Working with Hibernate. Introduction to Spring: Overview – Dependency Injection – Spring Libraries – Spring Tool Suite – Developing a simple Spring Application – RESTful Applications.																
Total:45																
REFERENCES:																
1.	Herbert Schild, "Java: The Complete Reference", 12 th Edition, McGraw Hill, 2021(Unit I – III)															
2.	CDAC, "Core and Advanced Java - Black Book", 1 st Edition, Dreamtech Press, 2018 (Unit IV- V)															
3.	Cay Horstmann, "Core Java -Volume 1: Fundamentals", 12 th Edition , Oracle Press, 2021															



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1 apply object-oriented programming concepts to solve simple logic problems.												Applying (K3)	
CO2 build reusable classes using inheritance, packages, and interfaces.												Applying (K3)	
CO3 experiment the concepts of multithreading, exception handling, and collection frameworks to develop efficient and error-free code.												Applying (K3)	
CO4 develop Serverside java applications using Servlet and JSP concepts.												Applying (K3)	
CO5 develop simple applications to effectively interact with relational database systems using JDBC and Hibernate.												Applying (K3)	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	1	1	1	1	1	2	2	3	2
CO2	3	3	2	2	2	1	1	1	1	1	2	2	3	2
CO3	3	3	3	3	3	2	1	1	2	1	2	2	3	2
CO4	3	3	3	3	3	2	2	2	2	2	3	3	3	3
CO5	3	3	3	3	3	2	2	2	2	2	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	50	-	-	-	100
CAT2	5	30	65	-	-	-	100
CAT3	5	30	65	-	-	-	100
ESE	5	30	65	-	-	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks

**22MCT22 - MACHINE LEARNING**

Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	2	PC	3	0	0	3							
Preamble	To provide core concepts of machine learning to endorse research ideas among the students.													
Unit – I	Machine Learning Fundamentals: Machine Learning Landscape: Introduction- Types of Machine Learning Systems- Main Challenges of Machine Learning- Testing and Validating-End to End Machine Learning Project: Working with Real Data- Discover and visualize the data to gain insights- Prepare the data for Machine Learning algorithms-Select and Train a model-Fine-Tune the model.													
Unit – II	Feature Engineering: Motivation towards Feature Engineering - Basic Feature engineering processes- Feature Selection-Dimensionality Reduction: The Curse of Dimensionality - Main Approaches for Dimensionality Reduction-PCA-Kernel PCA-LLE- Other Dimensionality Reduction Techniques.													
Unit – III	Concepts of Classification and Regression: Classification: Training a Binary Classifier – Performance Measures - Multiclass Classification- Error Analysis- Multi label Classification and Multi output Classification-Training Models: Linear Regression- Gradient Descent- Polynomial Regression- Learning Curves.													
Unit – IV	Supervised Learning: Classification: Introduction-Example-Classification Model-Learning Steps- Common classification algorithms- K-Nearest Neighbor- Decision Tree-Random Forest Model - Support Vector Machines. Regression: Introduction-Example-Multiple linear regression- Assumptions and problems in Regression Analysis- Improving the accuracy.													
Unit – V	Unsupervised Learning and Artificial Neural Network: Introduction - Unsupervised Learning Vs Supervised Learning – Applications – Clustering - Introduction-Biological neuron - Artificial Neuron- Types of activation function-Architectures of NN – Learning process in ANN – Backpropagation.													
Total:45														
REFERENCES:														
1.	AurelienGeron, "Hands – On Machine Learning with SciKit-Learn, Keras&TensorFlow – Concepts, Tools and Techniques to Build Intelligent Systems", 2 nd Edition, O'Reilly Media , CA, 2019. (Unit I - III)													
2.	SaikatDutt, Subramanian Chandramouli and Amit Kumar Das, Machine Learning, 1 st Edition, Pearson Education, India, 2019. (Unit IV - V)													
3.	Henrik Brink, Joseph W Richards, Mark Fetherolf, Real World Machine Learning, 1 st Edition Reprint, Dreamtech Press, New Delhi, 2018.													



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1 infer the foundations of machine learning and end to end machine learning project development steps												Understanding(K2)	
CO2 make use of feature engineering process and dimensionality reduction approaches												Applying(K3)	
CO3 analyze the performance of the machine learning models using various performance measures.												Analyzing(K4)	
CO4 apply various classification and regression algorithms for solving a given problem.												Applying(K3)	
CO5 make use of clustering and neural networks techniques to solve real world problems.												Applying(K3)	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2						2	1	2	2	1	3	2
CO2	3	2	2	2			1		1		2	1	2	2
CO3	3	3	3	2			1		1		2	1	3	2
CO4	3	2	3	2			1		1		2	1	2	2
CO5	3	2	2	2			1		1		2	1	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40	-	-	-	100
CAT2	10	20	50	20	-	-	100
CAT3	10	40	50	-	-	-	100
ESE	10	40	40	10	-	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks



22MCT23 - DATA COMMUNICATION NETWORKS														
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	2	PC	3	1	0	4							
Preamble	To provide the basic concepts of computer networking model with different data communication techniques and protocols.													
Unit – I	Introduction:													
Uses of computer networks - Network hardware - Network software - Reference models - Example networks: RFID and Sensor Networks - Physical Layer: Theoretical basis for data communication - Guided transmission media: Twisted pairs - Coaxial cable - Fiber Optics - Unguided transmission: The Electromagnetic spectrum - Radio wave transmission- Micro wave transmission - Infrared transmission.														
Unit – II	Data Link Layer:													
Design issues : Services provided to the network layer - Framing - Flow Control - Error Control - Error detection and correction - Elementary data link protocols: A Simplex Stop-and-Wait protocol - Sliding window protocols: A One-Bit Sliding window Protocol - MAC Layer: Channel allocation problem - Multiple access protocols: ALOHA - CSMA.														
Unit – III	Network Layer:													
Design issues: Services provided to the Transport Layer - Routing algorithms: Shortest Path events - Distance Vector Routing - Link State Routing - Congestion control algorithms: Traffic aware routing - Admission Control - Internetworking: Tunneling - Internetwork Routing - Packet Fragmentation.														
Unit – IV	Transport Layer:													
Transport service: Services provided to upper layer - Transport Service primitives - Elements of transport protocols: Addressing - Connection Establishment and Release - Error Control and Flow Control - Multiplexing – The internet transport protocols: UDP – RPC - TCP: Service Model - Connection Establishment and Release.														
Unit – V	Application Layer:													
Domain Name System: The DNS Name Space - Resource Records - Name Servers - Electronic mail: Architecture and Services - The User Agents - Message Formats - Message Transfer and Delivery - World Wide Web: Architectural overview - Static and Dynamic Web Pages - HTTP - Mobile Web - Web Search.														
Lecture:45, Tutorial:15, Total:60														
REFERENCES:														
1.	Andrew S. Tanenbaum,David J Wetherall, Nick Feamster, "Computer Networks", 6 th Edition, Pearson Education., New Delhi, 2022.													
2.	Forouzan Behrouz A., "Data Communication and Networking", 5 th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2018.													
3.	William Stallings, "Data and Computer Communication", Pearson Education, 10 th Edition, 2018.													



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1 interpret the components required to build different types of networks .												Understanding (K2))	
CO2 identify the various error and flow control mechanisms and protocols of data link layer.												Applying (K3)	
CO3 apply various routing protocols to describe the network functionalities for a given application.												Applying (K3)	
CO4 identify the protocols involved at the various layers.												Applying (K3)	
CO5 analyze the working principles of application layer.												Analyzing (K4)	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	2	3	2	2				1				1	2	2
CO2	3	3	3	2	3				1				1	3	2
CO3	3	3	2	2	3		1		1			1	1	2	2
CO4	3	3	2	3	3		1		1			1	1	3	2
CO5	2	2	2	2	3		1		1			2	1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40	-	-	-	100
CAT2	20	40	40	-	-	-	100
CAT3	20	40	30	10	-	-	100
ESE	10	30	40	20	-	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks

**22MCC21 - INTERNET OF THINGS**

Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	2	PC	3	0	2	4							
Preamble	To study and implement the Internet concept of things by the integration of various technologies.													
Unit – I	Technologies in Internet of Things:													
Various Technologies Used in IoT - IoT Revolution - Benefits of IoT - IoT Frameworks: Value Chain - Frameworks and Platforms - AWS IoT-Waston IoT Platform-IoT Ecosystem - Elements for IoT Implementation - Case Studies: E-Health System - Environmental Monitoring.							9							
Unit – II	Components In Internet of Things: Design Pattern, IoT Architecture and Core Modules:													
Various Design Patterns - Challenges and Solutions for Designing Architecture for IoT - Four Layer Architecture - Seven Layer Architecture - Core Modules: Protocols – Sensors – Endpoints - Data Communication - IoT Data Managements - Analytics.														
Unit – III	IoT Implementation:													
IoT Implementation Strategies: Challenges and Solutions - Things to Know Before an IoT Implementation - Types of Testing in IoT - Testing Challenges and Tools - Testing Smart Wearables. Case Studies: Monitoring Traffic Volume in Petrol Stations to Improve Sales Strategies, Smartphone Detection System in the Crowd.														
Unit – IV	Technologies Behind IoT:													
Artificial Intelligence for IoT: Exploring the world of AI, IoT and AI in the context of Industry 4.0 – Data Analytics and Machine Learning for IoT – Security Challenges for IoT.														
Unit – V	Internet of Things in Industry:													
Industries: Manufacturing – Oil and Gas – Transportation – Public Safety.														
LIST OF EXPERIMENTS / EXERCISES:														
1.	Familiarization with concept of IoT, Arduino/Raspberry-Pi and perform necessary software installation.													
2.	Study of different operating systems for Raspberry-Pi. Understanding the process of OS installation on Raspberry-Pi.													
3.	Study of connectivity and configuration of Raspberry-Pi with basic peripherals, LED ON / OFF using Push Button, understanding GPIO and its use in program.													
4.	Understanding and connectivity of Raspberry-Pi with Distance measuring using Ultrasonic Sensor. Write an application to measure the distance of the obstacle using Ultrasonic Sensor.													
5.	Understanding and connectivity of Raspberry-Pi with Temperature and Humidity Sensor. Write an application to read an environment temperature and Humidity value. If a temperature crosses a threshold value, the application indicated user using LEDs.													
6.	Understanding and connectivity of Raspberry-Pi with IR Sensor. Write an application to detect obstacle and notify user using LEDs.													
7.	Understanding and connectivity of Raspberry-Pi with camera. Write an application to detect the color of the object or obstruction detection.													
8.	Write an application using Raspberry-Pi based health monitoring using heartbeat and Pulse Sensor.													
9.	Write an application using Raspberry-Pi based Eye blinking/closeness detection sensor.													
10.	Write an application using Raspberry-Pi based Rain fall detection using Rain Sensor.													
Lecture:45, Practical:30, Total:75														
REFERENCES/ MANUAL / SOFTWARE:														
1.	MayurRamgir, "Internet of Things- Architecture, Implementation, and Security", 1 st Edition, Pearson Publication, 2020. (Unit I - IV)													
2.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 9 th Impression, Pearson Publication, 2022. (Unit V)													
3.	Dr. Ovidiu Vermesan and Dr. Peter Friess, "Internet of Things: From research and innovation to market deployment", River Publishers, 2014.													



COURSE OUTCOMES:												BT Mapped (Highest Level)	
On completion of the course, the students will be able to													
CO1 infer IoT technologies, frameworks, platforms and their real-world applications.												Understanding (K2)	
CO2 extend IoT design patterns, architectures, core modules, protocols, data communication and analytics.												Understanding (K2)	
CO3 implement IoT strategies, testing methods, and analytics to address real-world challenges and case studies.												Applying (K3) Manipulation(S2)	
CO4 interpret and integrate AI with IoT for Industry 4.0, data analytics, machine learning and security challenges.												Understanding (K2)	
CO5 identify the impact of IoT solutions in various industries, such as manufacturing, oil and gas and transportation.												Applying (K3) Precision(S3)	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2									3	
CO2	3	3		2									3	
CO3	3	3	3	2					1	1	1		3	
CO4	3	3	3	2	2	1		1	1	1	1	2	3	2
CO5	3	3	3	2	2					1			3	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60	-	-	-	-	100
CAT2	20	30	50	-	-	-	100
CAT3	20	40	40	-	-	-	100
ESE	10	55	35	-	-	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks

**22MCL21 - ADVANCED JAVA PROGRAMMING LABORATORY**

Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	2	PC	0	0	4	2							
Preamble	To develop General purpose and web based applications													
LIST OF EXPERIMENTS / EXERCISES:														
1. Design a Class which consists of instance variables and methods. Create an object for the class to access all the members of the class and create more than one objects and store the reference of all objects in a single variable.														
2. Construct a class with more than one methods having same name but with different signature. Also test the static methods with same name, with different input parameters.														
3. Design a java classes which acquire the properties of the parent class and also design a subclass which provides the specific implementation of the method that has been declared by one of its parent class and create an object which should bound its functionality at runtime. Design another class that implements two or more interfaces and all the implemented interfaces contain default methods with the same name and signature.														
4. Develop an application with a custom-container that should bundle related types like classes and interfaces into a single group with proper access protection and namespace management.														
5. Design error events in java that occurs during the execution of a program and disrupts the normal execution of the program's code.														
6. Write a java program with Light-weight sub-processes that should be executed concurrently to maximize the utilization of CPU.														
7. Design a dynamic array using collection class ArrayList and implement the Linked list data structure using LinkedList collection class.														
8. Implement a Java Servlet Program to implement a dynamic HTML using Servlet and JSP.														
9. Design a java application that should establish the connection from Java Client to any relational database systems using JDBC API and Hibernate.														
10. Create a simple application using Spring Framework.														
11. Develop a Library management system with basic modules and users like Database module: This has two functions – Insertion of data and extraction of data. Report module: For the borrowed books list to display. Availability module: To view the availability of books. Search Module: search facility for books and members. Users in the system: Librarian Student User functions: Librarian: Add, view, delete the book details and user details, issue and return books. Student: view and requesting books, returning books.														
12. Design an employee payroll management system with basic modules and its processes as Admin: <ul style="list-style-type: none">• Admin can Add/Edit/delete the employees.• Admin can Add/Edit/delete the schedule the work of the employees.• Admin can Add and calculate/Edit/Delete the Salary of the employee. Employee: <ul style="list-style-type: none">• Employees can view his/her schedule set by Admin.• Employees can check his/her attendance.• Employees can update his/her details.• Employees can View their salary details.														
13. Design a Hospital Management with basic modules and its processes as Three main actors of the system who are going to manage or run the complete application are Admin, Doctor and Receptionist. Admin Module: <ul style="list-style-type: none">• Admin can ADD/DELETE/UPDATE a doctor.• Admin can VIEW the list of doctors.• Admin can ADD/DELETE/UPDATE a receptionist.• Admin can VIEW the list of receptionists.• Admin can ADD/DELETE/UPDATE a patient.														



	<ul style="list-style-type: none"> Admin can ADD/DELETE/UPDATE an appointment. <p>Doctor Module:</p> <ul style="list-style-type: none"> The doctor can VIEW the appointments. The doctor can VIEW the patient list. <p>Receptionist Module:</p> <ul style="list-style-type: none"> The receptionists can ADD/EDIT/VIEW appointments. The receptionists can ADD/EDIT/VIEW the patient.
14.	<p>Design an Electricity bill management system with basic modules and its processes as follows</p> <p>Login registration:</p> <ul style="list-style-type: none"> Admin(Electricity board user), and User(Customer) can log in and register in the application. Admin can add a new user in the application as well as a new customer also can log in by itself by using its consumer number. <p>Billing:</p> <ul style="list-style-type: none"> Admin can add details about the consumer details according to the consumed electricity units consumed by the consumer. Users can view the bill
15.	<p>Design an online Quiz system with basic modules and its processes as follows</p> <p>Users of the System</p> <ul style="list-style-type: none"> Teacher Student <p>Functional Requirements</p> <p>Teacher:</p> <ul style="list-style-type: none"> Can create quiz after getting logged in. Can enter subjects and enter question with its options and answer at the time of creating quiz. 10 Question for each quiz required to be completed. <p>Student:</p> <ul style="list-style-type: none"> Can search quiz according to their interest. select the id of quiz and ready to start it. After completing all questions, result will be displayed automatically. Can view the description about each and every question in the respective quiz.

Total:60**REFERENCES/ MANUAL /SOFTWARE:**

1.	JDK / IDEs: Eclipse / Netbeans
2.	Database system: MYSQL
3.	Laboratory Manual

COURSE OUTCOMES:**On completion of the course, the students will be able to****BT Mapped
(Highest Level)**

CO1	solve basic logics using arrays, class and objects and to implement reusable concepts using inheritance, packages and interfaces.	Applying (K3) Manipulation(S2)
CO2	make use of the exception handling to develop error free codes, multithreading to implement multiprocessing and collection classes in java program.	Applying (K3) Manipulation(S2)
CO3	develop simple real time applications using Servlets, JSP, JDBC, hibernate and Spring framework.	Applying (K3) Manipulation(S2)

Mapping of Cos with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	2	1	1	1	2	2	2	3	3
CO2	3	3	3	2	3	2	1	1	2	2	2	2	2	3
CO3	3	3	3	3	3	3	1	2	1	3	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



22MCL22 - MACHINE LEARNING LABORATORY																								
Programme & Branch		MCA & Computer Applications				Sem.	Category	L	T	P	Credit													
Prerequisites		Nil				2	PC	0	0	4	2													
Preamble		To promote the development knowledge among the students in the field of machine learning.																						
LIST OF EXPERIMENTS / EXERCISES:																								
1.	Exploration of a Data Set in the IDE, to perform various pandas operations																							
2.	Exploration of a Data Set in the IDE , to perform various numpy operations																							
3.	Write a python program to calculate mean, median, variance, standard deviation and exploring relationship between variables of the given numerical data																							
4.	Implement various data preprocessing techniques on real time dataset using python																							
5.	Develop a python code to perform dimensionality reduction using PCA																							
6.	Write a python code to perform different visualization for the given data set																							
7.	Construct a python program to find the attribute with maximum information gain and gain ratio and construct the decision tree for the given data																							
8.	Develop a python program to implement K-NN algorithm for the given data																							
9.	Develop a python program to implement Random Forest Algorithm for the given data																							
10.	Construct a python program to implement Support Vector Machines learning algorithm for the given data																							
11.	Write a python program to implement Naïve Bayes Classifier Algorithm for the given data																							
12.	Construct a python code to implement Simple Linear regression for the given data																							
13.	Develop a python code to implement Multi Linear regression algorithms for the given data set																							
14.	Write a python program to implement k-means clustering algorithm																							
15.	Implement Multi-Layer Artificial Neural Network analysis for the given dataset using python code																							
Total:60																								
REFERENCES/ MANUAL /SOFTWARE:																								
1.	Operating System : Windows/Linux																							
2.	Software : Python packages, IDE etc.,																							
3.	Laboratory Manual																							
COURSE OUTCOMES: On completion of the course, the students will be able to										BT Mapped (Highest Level)														
CO1	apply basic operations, preprocessing and visualization using data set									Applying (K3) Manipulation(S2)														
CO2	analyze the performance of various classification algorithms									Analyzing (K4) Manipulation(S2)														
CO3	apply regression, unsupervised learning and neural network algorithms to solve real world problems									Applying (K3) Manipulation(S2)														
Mapping of Cos with POs and PSOs																								
COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2										
CO1	3	2	3	2	3			2		1		2	2	2										
CO2	3	3	3	2	3		2	3	1	1	2	2	2	2										
CO3	3	3	3	2	3	3	1	3	1	1		2	3	2										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



22GEL21 – PROFESSIONAL SKILLS TRAINING

Programme & Branch	Master of Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	2	PC	0	0	80	2							
Preamble	This subject is to enhance the employability skills and to develop career competency.													
Unit – I	Soft Skills:													
Soft skills and its importance: Pleasure and pains of transition from an academic environment to work – environment-Need for change- Fears, stress and competition in the professional world-Importance of positive attitude- Self motivation and continuous knowledge up gradation-Self-confidence. Professional grooming and practices: Basics of corporate culture-Key pillars of business etiquette- Basics of etiquette-Introductions and greetings-Rules of the handshake, earning respect, business manners-Telephone etiquette- Body Language. Group discussions: Advantages of group discussions-Structured GD- Team work: Value of team work in organizations- Definition of a team, why team-Elements of leadership, disadvantages of a team, stages of team formation- Group development activities. Facing an interview: Foundation in core subject- industry orientation / knowledge about the company- professional personality-Communication skills-Activities before Interview, upon entering interview room, during the interview and at the end Mock interviews.														
Unit – II	Quantitative Aptitude and Logical Reasoning:													
Problem Solving: Number Systems - LCM/HCF - divisibility - Simple Equations - Ratio Proportion Variations - Percentages; Profit and Loss - Partnerships -Simple Interest Compound Interest -Averages - Mixtures and Allegations - Time and Work -Time and Distance -Data Interpretations-Tables -Bar Graph -Line Graph -Pie Chart - Caselets - Geometry - Mensuration -Permutation and Combinations - Probability -Quadratic Equations - Special Equations and Inequalities - Sequence and Series - Statistics - Logarithms -Data Sufficiency - Trigonometry - Coordinate Geometry. Logical Reasoning: Letter Series - Number Series -Blood Relations - Direction Sense - Coding-Decoding - Symbols and Notations -Clocks and Calendars - Puzzles - Seating Arrangement (Linear and Circular) - Selections and Distributions -Cubes - Venn Diagrams -Deductions/Syllogism -Cryptogarithms - Flaw Detection –Binary Logic														
Unit – III	Grammar, Vocabulary, Listening, Speaking, Reading and Writing:													
Grammar: Tenses - Articles and Prepositions - Direct & Indirect Speeches - Active & Passive voice - Vocabulary: Analogies - Syllogism - Spelling test - Cloze test - Concord - Spotting Errors - Unscrambling words - Assertion and Reason - Verbal puzzle - Pair words - Logical sequence of words - Listening: Listening to TED talks, ESL & ESOL Videos - Podcasts - Speaking: Mock Interviews - Personality traits - Better pronunciation - Extempore talk - Telephonic conversations - Technical project presentations - Role Play - Negotiation skills - Mock Interview - Life skills - Team Management - Leadership skills - Group Discussion - Reading: Reading with stress, pauses, slurs and fillers - Soft skills - Stress & Intonation - Effective reading strategies - Notices & book reviews - GATE type reading comprehension - Writing: Job application letter & resume - Video resume - Jumbled sentences - Professional e-mail writing - Business letters - One page essay - Report writing - Editing & proofreading - Writing skills for IELTS - Summary Writing - Review of real time interviews/Competitive examinations.														
Total:80														
REFERENCES:														
1.	R.S. Aggarwal, "Quantitative Aptitude", 7 th Edition, S. Chand Publication, 2022.													
2.	R.S. Aggarwal, "A Modern Approach to Logical Reasoning", S. Chand Publication, 2022 edition.													
3.	Edgar Thorpe and Showick Thorpe, "Objective English for Competitive Examination", 6th Edition, Pearson India Education Services Pvt Ltd, 2017.													
4.	Stephen Bailey, "Academic Writing: A practical guide for students", Routledge, New York, 2011.													
5.	Meenakshi Raman and Sangeeta Sharma. "Technical Communication- Principles and Practice". 4th Edition, Oxford University Press, New Delhi, 2022.													
6.	ArunaKoneru, "Professional Speaking Skills," Oxford University Press India, 2015.													
7.	Edgar Thorpe and Showick Thorpe, "Winning at Interviews," 5th Edition, Pearson Education, India, 2013.													



COURSE OUTCOMES:													BT Mapped (Highest Level)	
On completion of the course, the students will be able to														
CO1	develop the soft skills of learners to support them work efficiently in an organization as an individual and as a team													Applying (K3), Precision (S3)
CO2	solve real time problems using numerical ability and logical reasoning													Applying (K3), Precision (S3)
CO3	apply english language skills for various academic and professional purposes													Applying (K3), Precision (S3)
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				3	3	2	3	3	3	2	2	3
CO2	3	2				3	3	2	3	3	3	2	2	3
CO3	2	2				2	3	3	2	3	3	3	2	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														
ASSESSMENT PATTERN – THEORY														
Test / Bloom's Category*	Remembering (K1) %		Understanding (K2) %		Applying (K3) %		Analyzing (K4) %		Evaluating (K5) %		Creating (K6) %		Total %	
CAT1	20		40		40		-		-		-		100	
CAT2	-		50		50		-		-		-		100	
Assessment Test	-		50		50		-		-		-		100	
* ±3% may be varied (CAT 1 & 2 – 60 marks & Assessment Test – 100 marks)														



22MCP21 - MINI PROJECT – II																				
Programme & Branch		MCA & Computer Applications							Sem.	Category	L	T	P	Credit						
Prerequisites		Nil							2	EC	0	0	4	2						
													Total:60							
COURSE OUTCOMES: On completion of the course, the students will be able to													BT Mapped (Highest Level)							
CO1	identify the problem by applying acquired knowledge											Applying (K3) Precision (S3)								
CO2	analyze and categorize executable project modules after considering risks											Analyzing (K4) Precision (S3)								
CO3	analyze efficient tools for designing project modules											Analyzing (K4) Precision (S3)								
CO4	integrate all the modules through effective teamwork after efficient testing and validation											Evaluating (K5) Precision (S3)								
CO5	compile the results in the form of technical report with oral presentation											Creating (K6) Precision (S3)								
Mapping of COs with POs and PSOs																				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2						
CO1	3	3	3	3	3	3	3	2	3	3	3	3	3	3						
CO2	3	3	3	3	3	3	3	2	3	3	3	3	3	3						
CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3						
CO4	3	3	3	3	3	3	3	2	3	3	3	3	3	3						
CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3						
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy																				

**22MCT31 - CLOUD COMPUTING TECHNOLOGIES**

Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil.	3	PC	3	0	0	3							
Preamble	To become familiar with the various cloud architecture and service model principles													
Unit – I	Cloud Computing Fundamentals, Architecture: Define Cloud Computing – Cloud Types –Examining the Characteristics – Benefits, Disadvantages – Cloud Computing Architecture-Exploring the Cloud Computing Stack - Connecting to the Cloud.													
Unit – II	Understanding Services and Virtualization: Infrastructure as a Services-Platform as a Service-Software as a Service-Identity as a Service – Compliance as a Service –Virtualization Technologies –Load Balancing and Virtualization-Understanding Hypervisors													
Unit – III	Cloud Platform: Google Web Services- Amazon Web Services - Components – Working with the Elastic Compute Cloud –Amazon Storage Systems - Amazon Database Services - Microsoft Cloud Services.													
Unit – IV	Cloud Security and Web Mail Services:: Securing the Cloud-Securing Data-Establishing Identity and Presence - Working with Productivity Software - Web Mail Services: Exploring the Cloud Mail Services - Exploring Instant Messages..													
Unit – V	Best Practices and the future of cloud Computing & Migrating to the cloud: Cloud services individuals-sky tap solution-cloud services at the mid-market-Enterprise class cloud offerings-Migration-Analyze your services-Establishing a baseline and metrics-Tools-Best Practices-Finding the Right vendor-Finding the Right Vendor-How Cloud Computing Might Evolve-Researcher Predictions.													
Total:45														
REFERENCES:														
1.	Barrie Sosinsky, "Cloud Computing", 1 st Edition, Wiley Publishing inc, Canada, 2018. (Unit I - IV)													
2.	Anthony T.Velte,Toby.J.Velte, Robert Elsenpeter, "Cloud Computing A practical Approach", MCGraw Hill,2012.(Unit - V)													
3.	Rajkumar Buyya, Christian Vecchiola.,Thamarai Selvi.S, "Mastering Cloud Computing", 1 st Edition, McGraw hill , 2015													



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1	understand cloud computing fundamentals												Understanding (K2)
CO2	inspect the various cloud programming models to solve problems on the cloud												Analyzing (K4)
CO3	apply cloud tools to real world scenarios												Applying (K3)
CO4	analyze the data security techniques in cloud environments												Analyzing (K4)
CO5	utilize the cloud native and third party tools for tracking, auditing and minimizing cloud environments												Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2	2		1			1	1			2
CO2	3	2	2	2	2	2	2	2	1	2	2	2	2	
CO3	3	2		2	2	2	2		2	2	1	2	2	3
CO4	3	2	2	2	2	2	2	2	2	2	2		2	2
CO5	2	2	2	2	2	2	2		2	2	2	2		2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	40	50	10	-	-	100
CAT2	--	40	40	20	-	-	100
CAT3	--	50	35	15	-	-	100
ESE	--	40	45	15	-	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks



22MCT32 - C# AND ASP.NET															
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit								
Prerequisites	Nil	3	PC	3	0	0	3								
Preamble	To make the student to understand the object oriented feature of C# under the .NET framework and to develop Web based applications on ASP.NET.														
Unit – I	Object Oriented Concepts and Advanced C# Features:							9							
Inheritance and Polymorphism- Interfaces - Exception Handling- Collections and Generics – Boxing and UnBoxing, ListT: QueueT, StackT, Sorted SetT, Delegates, Multicast Delegates, Events, and Lambda Expressions, Anonymous Method, - Advanced C# Language Features: Indexer Method, Operator Overloading.															
Unit – II	Windows Workflow Foundation and WPF:							9							
Introducing Windows Workflow Foundation: Defining a Business Process, building a Simple Workflow, Examining Workflow Activities, building a Flowchart Workflow, Introducing Windows Presentation Foundation and XAML: Building a WPF Application Without XAML and using only XAML, Programming with WPF Controls: Controlling Content Layout using Panels, building a Window's Frame using Nested Panels, Introducing the WPF Data-Binding Model															
Unit – III	Language-Integrated Query:							9							
LINQ to Objects: LINQ, Types of LINQ, LINQ Queries to Primitive Arrays: Deferred Execution, Immediate Execution, – Understanding Object Lifetime: Garbage Collection, Generations of Garbage Collection, Finalizable and Disposal Objects, – Building and Configuring Class Libraries: Role of .NET Assemblies – Understanding Late Binding – Introducing LINQ to XML: XElement and XDocument.															
Unit – IV	ADO.NET:							9							
ADO.NET: Introduction, ADO.NET architecture, The Connected Layer: DataProviders, DataReader, DataAdapter, ExecuteNonQuery method, ExecuteReader method, Connected Oriented Architecture, The Disconnected Layer: DataSet, Features of DataSet, Architecture of Disconnected Layer, Difference between DataReader and DataSet.															
Unit – V	ASP.NET WEB FORMS:							9							
Introducing ASP.NET web forms: The Role of HTTP, The Role of HTML, The Role of Client Side Scripting, Posting Back to the Web Server, interacting with the Incoming HTTP Request, Interacting with the Outgoing HTTP Response, The Life Cycle of an ASP.NET Web Page, ASP.NET Web Controls, Master Pages, and Themes: Understanding the Nature of Web Controls, Building the ASP.NET Cars Web Site, The Role of the Validation Controls, Working with Themes.															
Total:45															
REFERENCES:															
1.	Andrew Troelsen, Philip Japikse, "C# 6.0 and the .NET 4.6 Framework", 7 th Edition, Apress, 2015.														
2.	Herbert Schildt, "The Complete Reference: C# 4.0", 1 st Edition, Tata McGraw Hill, 2012.														
3.	Ben Albahari, Peter Drayton and Brad Merrill, "C# Essentials", 2 nd Edition, O'Reilly, 2002														



COURSE OUTCOMES: On completion of the course, the students will be able to													BT Mapped (Highest Level)	
CO1	develop an application using advanced concepts of C#.													Applying (K3)
CO2	analyze a Windows Presentation Foundation (WPF) application implemented with and without the use of XAML.													Analyzing (K4)
CO3	apply Language-Integrated Query to solve the problem.													Applying (K3)
CO4	create windows applications with database access using ADO.NET.													Applying (K3)
CO5	construct web forms using ASP.NET.													Applying (K3)

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	1	2	1	1	2	1	2	3	2
CO2	3	3	3	3	3	2	2	2	1	2	2	3	3	2
CO3	3	2	3	2	3	1	2	1	1	2	2	3	3	2
CO4	3	3	2	3	3	3	2	2	1	3	2	3	3	2
CO5	3	3	3	3	3	2	3	2	2	2	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	30	50	20	-	-	100
CAT2	--	45	40	15	-	-	100
CAT3	--	50	50	-	-	-	100
ESE	--	40	45	15	-	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks



22MCT33 - DATA SCIENCE														
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Python Programming	3	PC	3	1	0	4							
Preamble	To apply the knowledge for describing and visualizing data using Python													
Unit – I	Basics of Data Science: Need for data science—benefits and uses—facets of data—data science process—setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis—build the models—presenting and building applications													
Unit – II	Statistics: Frequency distributions – Outliers – relative frequency distributions – cumulative frequency distributions – frequency distributions for nominal data – interpreting distributions – graphs – averages – mode – median – mean – averages for qualitative and ranked data – describing variability—range—variance—standard deviation—degrees of freedom—interquartile range—variability for qualitative and ranked data													
Unit – III	Data manipulation using Python: Basics of Numpy arrays—aggregations—computations on arrays—comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection — operating on data — missing data — hierarchical indexing — combining datasets — aggregation and grouping—pivot tables													
Unit – IV	Normal Distribution, Correlation & Regression analysis: Normal distributions – z scores – normal curve problems – finding proportions – finding scores – correlation – scatter plots – correlation coefficient for quantitative data – computational formula for correlation coefficient – regression – regression line – least squares regression line – standard error of estimate – interpretation of r ² – multiple regression equations – regression toward the mean													
Unit – V	Data Visualization using Python: Visualization with mat plot lib – line plots – scatter plots – visualizing errors – density and contour plots – histograms, binnings, and density – three dimensional plotting – geographic data – data analysis using statmodels and seaborn – graph plotting using Plotly – interactive data visualization using Bokeh													
Lecture:45, Tutorial:15, Total: 60														
REFERENCES:														
1.	David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. (Unit – I)													
2.	Robert S. Witte and John S. Witte, “Statistics”, 11 th Edition, Wiley Publications, 2017. (Unit – II,IV)													
3.	Jake VanderPlas, “Python Data Science Handbook”, O'Reilly, 2019 Reprint (Unit – III,V)													



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1	explain the process of retrieving data, cleansing, integrating, and transforming data and build the models												Understanding (K2)
CO2	make use of between data dependencies using statistics												Applying (K3)
CO3	use python tools to handle data												Applying (K3)
CO4	apply correlation and regression techniques to learn the relationship between variables												Applying (K3)
CO5	use visualization techniques to any specific dataset												Applying (K3)

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3							2	2	
CO2	3	3	3	2	3							2	2	
CO3	3	3	3	2	3							2	2	
CO4	3	3	3	2	3							2	2	
CO5	3	3	3	2	3							2	2	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	50	50	-	-	-	100
CAT2	--	30	70	-	-	-	100
CAT3	--	30	70	-	-	-	100
ESE	--	30	70	-	-	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks



22MCL31 - CLOUD COMPUTING TECHNOLOGIES LABORATORY																							
Programme & Branch		MCA & Computer Applications					Sem.	Category	L	T	P	Credit											
Prerequisites		Nil					3	PC	0	0	4	2											
Preamble		To equip students with the knowledge and abilities needed for practical applications of cloud computing and the internet of things.																					
LIST OF EXPERIMENTS / EXERCISES:																							
1. Demonstrate the procedure for creating AWS instance and install compiler and run program																							
2. Create S3 bucket and upload a file using AWS S3 bucket.																							
3. Demonstrate the procedure for creating AWS RDS instance and execute sample SQL statement																							
4. Host a web application in AWS instance																							
5. Develop and deploy an application using Microsoft Azure																							
6. Create a Customer Relationship Management System (CRM) using salesforce.com portal.																							
7. Design scheduler and personal information management using zohoworkerly																							
8. Create and use a repository using github																							
9. Create visually appealing data visualizations and insightful dashboards using Zoho																							
10. Create a blog to show the profile of our MCA department																							
11. Demonstrate the steps for web application deployment using azure devops																							
12. Create a web application and deployment in 000webhost cloud platform																							
Total:60																							
REFERENCES/ MANUAL /SOFTWARE:																							
1. Operating System : Windows/Linux																							
2. Software : open source																							
3. Laboratory Manual																							
COURSE OUTCOMES:																							
On completion of the course, the students will be able to																							
CO1	apply various cloud programming models to solve problems on the cloud.										BT Mapped (Highest Level)												
CO2	experiment industry-recognized security standards to cloud-based systems.										Applying (K3) Precision (S3)												
CO3	develop cloud applications in various fields using suitable cloud platforms.										Applying (K3) Precision (S3)												
Mapping of Cos with POs and PSOs																							
COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2									
CO1	3	3	2	2	3	1	2	1	1	2	1	2	2										
CO2	2	3	3	2	3	2	2	2	2	2	2	2	2										
CO3	2	2	3	3	3	2	2	2	1	2	2	2											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



22MCL32 - C# AND ASP.NET LABORATORY																								
Programme & Branch		MCA & Computer Applications				Sem.	Category	L	T	P	Credit													
Prerequisites		Nil				3	PC	0	0	4	2													
Preamble		To make the student to develop the object oriented feature of C# under the .NET framework for windows and web based applications with ADO.NET																						
LIST OF EXPERIMENTS / EXERCISES:																								
1.	C# program using Late Binding																							
2.	Attribute based Programs using C#																							
3.	Language Integrated Query (LINQ) based programs using C#																							
4.	C# program that used Lambda Expressions																							
5.	Program for creating web services using C#																							
6.	C# program for Windows Presentation Foundation (WPF)																							
7.	C# programs for Windows Workflow foundations (WF)																							
8.	Program to perform ADO.NET																							
9.	Design a web application in ASP using ADO.																							
10.	Creating a Custom Data-Bound ASP.NET Web Control for ASP.NET2.0																							
Total:60																								
REFERENCES/ MANUAL /SOFTWARE:																								
1.	Front End: Microsoft Visual Studio 10.0, Microsoft .NET Framework SDK v2.0.																							
2.	Back End : ORACLE /MongoDB/ SQL Server / MYSQL																							
3.	Laboratory Manual																							
COURSE OUTCOMES: On completion of the course, the students will be able to										BT Mapped (Highest Level)														
CO1	apply C# and LINQ-based queries to write programs									Applying (K3) Precision (S3)														
CO2	develop the web applications using WPF and to create web services using .NET									Applying (K3) Precision (S3)														
CO3	develop ASP.NET web Forms and Connectivity through ADO.NET									Applying (K3) Precision (S3)														
Mapping of Cos with POs and PSOs																								
COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2										
CO1	3	2	2	2	2	1	1		1		1	1	2	2										
CO2	3	3	3	2	3	1	1		1	1	2	1	2	3										
CO3	3	3	3	3	3	2	2	1	2	2	2	1	3	3										
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy																								



22MCP41- PROJECT WORK																	
Programme & Branch		MCA & Computer Applications					Sem.	Category	L	T	P	Credit					
Prerequisites		Nil					4	EC	0	0	24	12					
Total:360																	
COURSE OUTCOMES: On completion of the course, the students will be able to											BT Mapped (Highest Level)						
CO1	identify the problem by applying acquired knowledge										Applying (K3) Precision (S3)						
CO2	analyze and categorize executable project modules after considering risks										Analyzing (K4) Precision (S3)						
CO3	analyze efficient tools for designing project modules										Analyzing (K4) Precision (S3)						
CO4	integrate all the modules through effective teamwork after efficient testing and validation										Evaluating (K5) Precision (S3)						
CO5	compile the results in the form of technical report with oral presentation										Creating (K6) Precision (S3)						
Mapping of COs with POs and PSOs																	
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2			
CO1	3	3	3	3	3	3	3	2	3	3	3	3	3	3			
CO2	3	3	3	3	3	3	3	2	3	3	3	3	3	3			
CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3			
CO4	3	3	3	3	3	3	3	2	3	3	3	3	3	3			
CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3			
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy																	



22MCE01 - ARTIFICIAL INTELLIGENCE																
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit									
Prerequisites	Nil	2	PE	3	0	0	3									
Preamble	To provide an introduction to the basic principles and applications of Artificial Intelligence.															
Unit – I	Introduction: The Foundations of Artificial Intelligence - History of AI - State of the Art - Intelligent Agents: Agents and Environments – Good Behaviour – Nature of Environments - Structure of Agents.															
Unit – II	Problem Solving Methods: Problem - Solving Agents - Example Problems - Searching for Solutions - Uninformed Search Strategies – Heuristic Functions.															
Unit – III	Knowledge and Reasoning: Logic Agents: Knowledge based agents - WumpusWorld - Logic - Propositional logic - Syntax and Semantic of FOL - Using FOL - Propositional vs First order inference - Unification and Lifting - Forward chaining - Backward chaining – Resolution.															
Unit – IV	Planning: Classical Planning: Definitions - Algorithms for Planning as state space search - Planning graphs - Planning and acting in the real world: Time, Schedule and Resources - Hierarchical planning - Planning and acting in Non-deterministic domain - Multiagent planning.															
Unit – V	Learning: Forms of Learning - Supervised Learning – Learning Decision Trees – Evaluating and Choosing the Best Hypothesis – Theory of Learning – Regression and Classification with Linear Models.															
Total:45																
REFERENCES:																
1.	S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", 3 rd Edition, Prentice Hall, 2021.															
2.	Daugherty, Paul R., and H. James Wilson, "Human + Machine: Reimagining Work in the Age of AI", Harvard Business Review Press, 2018.															
3.	Joshi Prateek, "Artificial Intelligence with Python", 1 st Edition, Packt Publishing Ltd, 2017.															



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1 summarize the fundamental concepts of Artificial Intelligence												Understanding (K2)	
CO2 make use of uninformed strategies to find solution for a problem												Applying (K3)	
CO3 apply process of inference to derive new facts												Applying (K3)	
CO4 apply various planning techniques to construct plans of actions												Applying (K3)	
CO5 make use of machine learning models that learns from samples of data												Applying (K3)	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	2			1				2	2	
CO2	3	3	3	2	2			1				2	2	
CO3	3	3	3	2	2			1				2	2	
CO4	3	3	3	2	2			1				2	2	
CO5	3	3	3	2	2			1				2	2	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	50	35		-	-	100
CAT2	10	30	60		-	-	100
CAT3	10	30	60		-	-	100
ESE	10	30	60		-	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks



22MCE02 –ADVANCED DESIGN AND ANALYSIS OF ALGORITHMS																
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit									
Prerequisites	Data Structures and Algorithms	2	PE	3	0	0	3									
Preamble	To obtain a knowledge in algorithm design techniques and solve the problem in most effective and efficient way.															
Unit – I	Introduction:															
Algorithm Definition – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency: Analysis Frame Work –Asymptotic Notations – Mathematical Analysis of Non-recursive and Recursive Algorithms.																
Unit – II	Brute Force and Exhaustive search:															
Sequential search and Brute Force String Matching – Closest Pair and Convex- Hull Problems by Brute Force – Exhaustive Search: Traveling Salesman Problem – Knapsack Problem – Assignment Problem – Decrease and Conquer: Decrease by a Constant Factor Algorithms – Variable Size Decrease Algorithms.																
Unit – III	Dynamic Programming and Greedy Technique:															
Three Basic Examples – The Knapsack Problem and Memory Functions – Optimal Binary Search Trees –Warshall's and Floyd's Algorithms – Greedy Technique.																
Unit – IV	Iterative Improvement and Limitations of Algorithm Power:															
Iterative Improvement: The Maximum Flow Problem – Maximum Matching in Bipartite Graphs – The Stable Marriage Problem – Limitations of Algorithm Power: Decision Trees – P, NP and NP Complete Problems..																
Total:45																
REFERENCES:																
1.	Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3 rd Edition, Pearson Education, New Delhi, 2018.															
2.	Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2 nd Edition, Galgotia Publications, Hyderabad, 2012.															
3.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3 rd Edition, Prentice Hall of India, New Delhi, 2012.															



COURSE OUTCOMES:												BT Mapped (Highest Level)	
On completion of the course, the students will be able to													
CO1	describe the algorithm efficiency using different frameworks												Understanding (K2)
CO2	utilize brute force and exhaustive search techniques to solve a problem												Applying (K3)
CO3	apply dynamic programming and greedy techniques to solve problems.												Applying (K3)
CO4	inspect the iterative improvement and limitations power algorithm to solve complex problems.												Analyzing (K4)
CO5	examine the solution using backtracking and branch and bound techniques.												Analyzing (K4)

Mapping of Cos with POs and PSOs

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2		1				1		3	
CO2	3	3	2	2	2		1				1		3	
CO3	3	3	2	2	2		1				1		3	
CO4	3	3	2	2	2		1				1		3	
CO5	3	3	2	2	2		1				1		3	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	50	40		-	-	100
CAT2	10	50	40		-	-	100
CAT3	10	30	45	15			100
ESE	10	30	45	15	-	-	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



22MCE03 –WEB TECHNOLOGIES																
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit									
Prerequisites	Nil.	2	PE	3	0	0	3									
Preamble	To be developed to provide an interactive real time online applications															
Unit – I	Web Essentials: Clients, Servers and Communication: The Internet - Basic Internet Protocols - The World Wide Web - HTTP Request Message - Response Message -Web Clients - Web Servers - Markup Languages: HTML – History and Versions - Basic XHTML Syntax and Semantics-HTML Elements-Relative URLs–Lists–Tables–Frames–Forms- XML –Creating HTML Documents.															
Unit – II	Style Sheets: CSS – Features - Core Syntax - Style Sheets and HTML - Style Rule Cascading and Inheritance - Text Properties - Box Model – Normal Flow Box Layout - Client-Side Programming: The JavaScript Language- JavaScript in Perspective – Syntax - Variables and Data Types-Statements-Operators– Literals– Functions– Objects– Arrays -Built-in Objects-JavaScript Debuggers.															
Unit – III	DOM: DOM - DOM History and Levels - Intrinsic Event Handling - Modifying Element Style -The Document Tree - DOM Event Handling - Accommodating Noncompliant Browsers - Properties of Window.															
Unit – IV	XML and JSP: XML - Documents and Vocabularies - Versions and Declaration - Namespaces - JavaScript and XML: Ajax - DOM based XML Processing- JSP Technology - JSP and Servlets - Running JSP Applications -Basic JSP-Tag Libraries and Files- Model-View-Controller Paradigm															
Unit – V	Angular JS: Introduction to Angular JS-Directives, Expressions, Controllers, Filters, Module, Events, Forms, Validations, Examples.															
Total:45																
REFERENCES:																
1.	Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", 1 st Edition, Pearson Education, 2015.(Unit I -IV)															
2.	Krishna Rungta,"Learn AngularJS in 1 Day" Independent Publication, 2018. (Unit V)															
3.	Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", 5 th Edition, Pearson Education, 2012.															



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1	apply the necessary HTML elements to the Document's design.												Applying (K3)
CO2	inspect the programs using scripting language and CSS presentation												Analyzing (K4)
CO3	utilize server side scripting technologies to develop dynamic web sites.												Applying (K3)
CO4	analyze a web application using JSP Technology												Analyzing (K4)
CO5	apply a variety of web service languages to implement the web service.												Applying (K3)

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3		2			1	1		2	2
CO2	3	3	2	2	2	1	2	1	1	2	1		2	
CO3	2	3	2	2	2		2	1	1	2	2	1	2	2
CO4	2	2	3	2	2	1	3	1	2	2	2	1	2	2
CO5	3	2	2	2	2	1	2	1	2	2	2	2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	40	30	-	-	100
CAT2	10	25	35	30	-	-	100
CAT3	10	25	40	25	-	-	100
ESE	10	30	40	20	-	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks

**22GET11- INTRODUCTION TO RESEARCH**

Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	PE	2	1	0	3
Preamble	Preamble: This course will familiarize the fundamental concepts/techniques adopted in research, problem formulation and patenting. Also will disseminate the process involved in collection, consolidation of published literature and rewriting them in a presentable form using latest tools.						
Unit – I	Concept of Research:						
Meaning and Significance of Research: Skills, Habits and Attitudes for Research - Time Management - Status of Research in India. Why, How and What a Research is? - Types and Process of Research - Outcome of Research - Sources of Research Problem - Characteristics of a Good Research Problem - Errors in Selecting a Research Problem - Importance of Keywords - Literature Collection – Analysis - Citation Study - Gap Analysis - Problem Formulation Techniques.							9
Unit – II	Research Methods and Journals:						
Interdisciplinary Research - Need for Experimental Investigations - Data Collection Methods - Appropriate Choice of Algorithms / Methodologies / Methods - Measurement and Result Analysis - Investigation of Solutions for Research Problem - Interpretation - Research Limitations. Journals in Science/Engineering - Indexing and Impact factor of Journals - Citations - h Index - i10 Index - Journal Policies - How to Read a Published Paper - Ethical issues Related to Publishing - Plagiarism and Self-Plagiarism.							9
Unit – III	Paper Writing and Research Tools:						
Types of Research Papers - Original Article/Review Paper/Short Communication/Case Study - When and Where to Publish? - Journal Selection Methods. Layout of a Research Paper - Guidelines for Submitting the Research Paper - Review Process - Addressing Reviewer Comments. Use of tools / Techniques for Research - Hands on Training related to Reference Management Software - EndNote, Software for Paper Formatting like LaTeX/MS Office. Introduction to Origin, SPSS, ANOVA etc., Software for detection of Plagiarism.							9
Unit – IV	Effective Technical Thesis Writing/Presentation:						
How to Write a Report - Language and Style - Format of Project Report - Use of Quotations - Method of Transcription Special Elements: Title Page - Abstract - Table of Contents - Headings and Sub-Headings - Footnotes - Tables and Figures - Appendix - Bibliography etc. - Different Reference Formats. Presentation using PPTs.							9
Unit – V	Nature of Intellectual Property:						
Patents - Designs - Trade and Copyright. Process of Patenting and Development: Technological research - innovation - patenting - development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents.							9
Total:45							
REFERENCES:							
1.	DePoy, Elizabeth, and Laura N. Gitlin, "Introduction to Research-E-Book: Understanding and Applying Multiple Strategies", Elsevier Health Sciences, 2015.						
2.	Walliman, Nicholas, "Research Methods: The basics", Routledge, 2017.						
3.	Bettig Ronald V., "Copyrighting culture: The political economy of intellectual property", Routledge, 2018.						



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1	examine the various stages in research and categorize the quality of journals.												Analyzing (K4)
CO2	formulate a research problem from published literature/journal papers.												Analyzing (K4)
CO3	compose and present a journal paper/ project report in proper format.												Creating (K6)
CO4	select suitable journal and submit a research paper.												Applying (K3)
CO5	compile a research report and the presentation.												Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2		2	3	3	3	2	3	3	2
CO2	3	3	2	2	2		2	3	3	3	2	3	3	2
CO3	3	3	3	3	3	2	3	3	3	3	2	3	2	3
CO4	3	3	2			2	3	3	3	3		3	2	3
CO5	3	2	2	2	3	3	2	3	3	3	2	3	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	30	40	30	-	-	100
CAT2	-	20	30	30	10	10	100
CAT3	-	40	60	-	-	-	100
ESE	-	40	60	-	-	-	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



22MCE04 - BIG DATA TECHNOLOGIES																
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit									
Prerequisites	Nil	2	PE	3	0	0	3									
Preamble	Provides basic knowledge about Big data, its framework and its storage technologies															
Unit – I	Big Data and Big Data Analytics: Types of Digital Data – Introduction to Big Data: Characteristics – Evolution – Challenges – Big Data – Big Data Analytics : Data science – Terminologies – Analytical Tools.															
Unit – II	Hadoop: Introduction – Distributed Computing Challenges – Hadoop Overview – Hadoop Distribution – HDFS – Processing Data with Hadoop – Managing Resources and Applications with Hadoop YARN – Hadoop Ecosystem.															
Unit – III	Big Data Technology Landscape and MongoDB: NoSQL: Types of NoSQL – SQL versus NoSQL – MongoDB - Terms used in RDBMS and MongoDB – Datatypes – MongoDB Query Language - Introduction to MapReduce Programming															
Unit – IV	Hive & Pig: Hive – Hive Architecture – Data Types - File Format – Hive Query Language – Pig: Anatomy – Pig Latin Overview - Data Types – Running Pig – Execution Modes of Pig – HDFS commands - Relational Operators - Eval function – Complex Datatypes – Piggy Bank – User-Defined Functions – Parameter substitution.															
Unit – V	Cassandra: Introduction – Features – Data Types – CQLSH – CRUD – Collections – Using a Counter – Time to Live - Alter Commands – Import and Export – Querying System Tables.															
Total:45																
REFERENCES:																
1.	Seema Acharya,Subhashini Chellappan,“Big Data and Analytics”, 2 nd Edition, Wiley, 2019.															
2.	DT Editorial Services, “Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization”, Dreamtech Press, 1 st Edition, 2018.															
3.	Dr.AnilMaheshwari,“Big Data”, 1 st Edition, McGraw Hill Education, 2017															



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1 interpret the concepts and characteristics of big data and relate the tools used in big data analytics.												Understanding (K2)	
CO2 develop and execute MapReduce programs using the Hadoop framework.												Applying (K3)	
CO3 utilize NoSQL with MongoDB to implement database operations and data handling.												Applying (K3)	
CO4 apply Hive and Pig to develop the solutions for big data problems.												Applying (K3)	
CO5 build an application using Cassandra database.												Applying (K3)	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2		3		2			2			2	3
CO2	3	3	3	3	3		3					1	3	1
CO3	3	3	3	2	3		3					2	3	1
CO4	3	2	3	3	3		3					1	3	1
CO5	3	2	3	3	3		3			2		1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20	-	-	-	100
CAT2	10	50	40	-	-	-	100
CAT3	10	50	40	-	-	-	100
ESE	5	55	40	-	-	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks



22MCE05 - OPTIMIZATION TECHNIQUES														
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	2	PE	3	0	0	3							
Preamble	To understand the importance of optimization techniques in finding optimum or nearly optimum solution for difficult decision-making problems													
Unit – I	Linear Programming Models: Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables: big-M method, degeneracy and unbound solutions													
Unit – II	Transportation and Assignment Models: Formulation - Methods for finding basic Feasible Solution - Optimality Test - MODI method -Degeneracy in Transportation Problem - Unbalanced Transportation Problem. Assignment Method: Mathematical formulation of assignment models – Hungarian Algorithm – Variants of the Assignment problem													
Unit – III	Scheduling By PERT And CPM: Introduction - Rules to frame a Network - Fulkerson's Rule to numbering of events - Activity, Times - Critical Path Computation - Slack and Float - PERT- Steps and computing variance, Merits and demerits of PERT, CPM- Time estimating & Limitations, Comparison between PERT & CPM													
Unit – IV	Inventory Models: Introduction to inventory – Cost involved in inventory problems - Economic Order Quantity (EOQ) – Deterministic Single Item inventory Models– EOQ problem without shortages with uniform demand – EOQ problem with no several production runs of unequal lengths - production problem with no shortage – purchasing problem with shortages - EOQ problems with price breaks.													
Unit – V	Game Theory: Basic Terminology - Two person zero sum game – Games with saddle point-Games without saddle point - Dominance principle- Graphical solution for $2 \times n$ or $m \times 2$ games.													
Total: 45														
REFERENCES:														
1.	Taha H.A., "Operations Research: An Introduction", 10 th Edition, Prentice Hall of India, New Delhi, 2017													
2.	KantiSwarup, P.K. Gupta, Man Mohan, "Operations Research", 15 th Revised Edition, S. Chand& Sons Education Publications, New Delhi, 2017													
3.	Natarajan A.M, Balasubramanie R, and Tamilarasi A, "Operations Research" Pearson Education Publishers, 4 th Edition, 2009													



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1 solve linear programming problems using appropriate techniques												Applying (K3)	
CO2 apply transportation and assignment models to find optimal solution												Applying (K3)	
CO3 construct network modeling for planning and scheduling the project activities												Applying(K3)	
CO4 understand about inventory models												Understanding(K2)	
CO5 analyze the best strategy and value of the given game model												Analyzing (K4)	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2						1	2	2	
CO2	3	3	3	2	2							2	2	
CO3	3	3	3	2	2						2	2	2	
CO4	3	3	3	2	2						2	2	2	
CO5	3	3	3	2	2							2	2	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	25	60	-	-	-	100
CAT2	15	25	60	-	-	-	100
CAT3	15	35	15	35	-	-	100
ESE	10	20	50	20	-	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks

**22MCE06 - MOBILE COMPUTING**

Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Data Communication Networks	3	PE	3	0	0	3							
Preamble	To realize the vision of "Optimally Connected Anywhere, Anytime" supported by all system levels from access methods and networks to services for Mobile Devices.													
Unit – I	Introduction to Wireless Transmission:													
Introduction: Applications, Reference Model - Signals - Antennas - Signal Propagation: path loss of radio signals, signal propagation – Multiplexing: SDM, FDM, TDM, CDM - Modulation: ASK, FSK, PSK, AFSK, APSK, multi carrier modulation - Spread Spectrum.														
Unit – II	Wireless Communication Techniques:													
Medium Access Control: Hidden and Exposed Terminals, Near and Far Terminals –S/F/T/CDMA - GSM – Architecture, Services, Protocols, Localization and Calling, Handover, Security - DECT system: System and Protocol architecture - UMTS: architecture, UTRAN.														
Unit – III	Mobile Computing Architecture and through Telephony:													
Internet – The Ubiquitous Network – Architecture – Design Considerations for Mobile Computing –Mobile Computing through Internet – Making Existing Applications Mobile–Enabled Evolution of Telephony – Multiple Access Procedures – Satellite Communication Systems – Mobile Computing through Telephone – Developing an IVR Application – Telephony Application Programming Interface.														
Unit – IV	Data Networks:													
Bluetooth – RFID - WiMAX - SMS – GPRS network architecture – GPRS services and features - EDGE – CDMA vs GSM – 3G Networks – Applications on 3G.														
Unit – V	Overview of Intelligent Networks and Next Generation Networks:													
Introduction – Fundamentals of Call Processing – Intelligence in the Networks – Signaling – IN Conceptual Model – Softswitch – Technologies and Interface for IN – SS7 Security – MAPSec – Virtual Private Network – All in One: The Converged Scenario – Narrowband to Broadband – All IP and B3G Network – OFDM- FAMA/DAMA – MPLS - .														
Total:45														
REFERENCES:														
1.	Schiller Jochen, "Mobile Communications", 2 nd Edition, Pearson Education, New Delhi, 2014. (Unit I - II)													
2.	Asoke K Talukder, Hasan Ahmed, RoopaYavagal, "Mobile Computing: Technology, Applications and Service Creation", 2 nd Edition, McGraw Hill Education, 2018. (Unit III - V)													
3.	M.Bala Krishna, Jaime LloretMauri, "Advances in Mobile Computing and Communications: Perspectives and Emerging Trends in 5G Networks", 1 st Edition, CRC, 2016.													



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1	understanding the concepts of wireless transmission models												Understanding (K2)
CO2	conduct a survey on effective communication mechanisms, including medium access control and telecommunication systems												Understanding (K2)
CO3	explore mobile computing architecture and its implementation through mobile telephony system												Applying (K3)
CO4	describe the basic concepts of data networks for various applications												\Understanding (K2)
CO5	relate the concept of intelligent networks and next-generation networks.												Understanding (K2)

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2											2	
CO2	2	2											2	
CO3	3	2	2	2									2	
CO4	2	2											2	
CO5	2	2											3	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	100	-	-	-	-	100
CAT2	--	40	60	-	-	-	100
CAT3	--	100	-	-	-	-	100
ESE	--	70	30	-	-	-	100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks



22MCE07 - BLOCKCHAIN TECHNOLOGIES																
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit									
Prerequisites	Nil	3	PE	3	0	0	3									
Preamble	To know about the basics in Blockchain Technology and its Applications with different Framework and Platforms.															
Unit – I	Blockchain Essentials: History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization.															
Unit – II	Cryptocurrency: Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative Coins – Bitcoin limitations – Name coin – Prime coin – Zcash – Smart Contracts – Ricardian Contracts.															
Unit – III	Ethereum: Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.															
Unit – IV	Web3 and Hyperledger: Introduction to Web3 – Contract Deployment – POST Requests – Development Frameworks – Hyperledger as a Protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda.															
Unit – V	Alternative Blockchain and Emerging Trends: Kadena – Ripple – Rootstock – Quorum – MaidSafe – BigchainDB - Tendermint – Scalability – Privacy – Blockchain Research – Notable Projects – Miscellaneous Tools.															
Total:45																
REFERENCES:																
1.	Imran Bashir, "Mastering Blockchain", 2 nd Edition, Packt Publication, Mumbai, 2018.															
2.	Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands On Approach", VPT Publisher, 2017.															
3.	Andreas M. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", 1 st Edition, O'Reilly Media Inc, USA, 2015.															



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1	infer the basics of block chain technology concepts and its applications												Understanding (K2)
CO2	experiment the implementation of crypto currency												Applying (K3)
CO3	utilize knowledge of the Ethereum model, its consensus mechanism and code execution in various applications												Applying (K3)
CO4	construct the architectural components of a hyperledger and its development framework												Applying (K3)
CO5	discover the alternative blockchain and emerging trends in blockchain												Analyzing (K4)

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2											3	1
CO2	3	3	3		2	2	2						3	2
CO3	2	3	3	2	2	2	2						3	2
CO4	3	3	3	2	2		2						3	2
CO5	3	3	3	2	2								3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	60	40	-	-	-	100
CAT2	--	60	40	-	-	-	100
CAT3	--	50	40	10	-	-	100
ESE	--	50	40	10	-	-	100

* ±3% may be varied (CAT 1, 2,3 – 50 marks & ESE – 100 marks)



22MCE08 - DISTRIBUTED SYSTEMS																
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit									
Prerequisites	Data Communication Networks	3	PE	3	0	0	3									
Preamble	To understand the architecture of distributed systems and the guiding concepts behind the creation of the internet, distributed applications, and file systems															
Unit – I	Introduction and System Models:															
Characterization – Trends in Distributed systems –resource sharing – challenges – case study-System Models :Introduction – Physical models – Architectural Models – Fundamental models																
Unit – II	Networking and Internetworking & Inter process communication:															
Types of Network – Network principles – internet protocols – case studies: Ethernet, WiFi and Bluetooth- –Inter process communication-The API for the internet protocols – External data representation and marshaling – Multicast communication-Network Virtualization: Overlay networks																
Unit – III	Remote Invocation and indirect communication:															
Request reply protocols-Remote procedure call-Remote method invocation-Group communication-Publish Subscribe systems- Message ques- Shared memory approaches																
Unit – IV	Operating systems support and peer to peer systems:															
The operating system layer – Protection – Processes and threads – communication and threads –communication and invocation – Operating system architecture – Virtualization at the operating system level – Napster and its legacy – peer to peer middleware - Routing overlays– cast studies																
Unit – V	Distributed file systems and Name services:															
File service Architecture – Name services and the domain Name system– Directory services-Time and Global states: clocks, events, process states – Synchronizing physical clocks-Logical time and logical clocks – Global states- Distributed Debugging																
Total:45																
REFERENCES:																
1.	Coulouris George, Dollimore Jean, Kindberg Tim and Blair Gordon, "Distributed Systems - Concepts and Design", 5 th Edition, Pearson Education, New Delhi, 2017.															
2.	Liu M.L., "Distributed Computing Principles and Applications", Pearson Education, 2014.															
3.	Tanenbaum Andrew S and Maarten Van Steen, "Distributed Systems – Principles and Paradigms", 2 nd Edition, Pearson Education, 2017.															



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1	understand the principles of resource sharing in distributed environments.												Understanding (K2)
CO2	analyze interprocess communication using internet protocol APIs.												Analyzing (K4)
CO3	examine the structure and use-cases of Remote Procedure Call (RPC) and Remote Method Invocation (RMI) in distributed applications.												Analyzing (K4)
CO4	apply the concepts of thread communication, synchronization and invocation mechanisms in distributed operating environments.												Applying (K3)
CO5	implement synchronization of physical clocks using algorithms												Analyzing (K4)

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2								2	
CO2	2	2	3	2	2		1		1	1			1	2
CO3	2	2	2	3	2	1	1	1	2	2		2		
CO4	2	2	2	2	2	1	2	1	2		2		2	
CO5	2	3	3	2	2	2	2			2	2		2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	50	40	10	-	-	100
CAT2	--	50	30	20	-	-	100
CAT3	--	35	50	15	-	-	100
ESE	--	40	40	20	-	-	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



22MCE09 - SOFTWARE PROJECT MANAGEMENT														
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Software Engineering Methodologies	3	PE	3	0	0	3							
Preamble	To perform various activities for successful completion of a project in spite of all the risks.													
Unit – I	Software Project Management and Evaluation:													
Software Project Definition - Software Projects Versus Other Types of Projects – Contract Management and Technical Project Management - Plans, Methods and Methodologies – Categorizing Software Projects - Stakeholders - Setting Objectives - Business Case - Project Success and Failure - Management Control – Project Portfolio Management – Evaluation of Individual Projects – Cost-benefit Evaluation Techniques – Risk Evaluation – Programme Management.														
Unit – II	Project Planning and Software Effort Estimation:													
Step Wise Project Planning - Where are the Estimates Done - Problem with Over and Under Estimates - The Basis for Software Estimating - Software Effort Estimation Techniques - Bottom up Estimating - The Top Down Approach and Parametric Models - Expert Judgment - Estimating by Analogy - Function Points – COCOMO – Cost Estimation – Staffing Pattern.														
Unit – III	Activity Planning and Risk Management:													
Objectives - Project Schedules - Sequencing and Scheduling Activities - Network Planning Models - Formulation of a Network Model - Forward Pass - Backward Pass - Critical Path - Activity Float - Risk Management Approaches - Risk Identification, Assessment, Planning and Management – Evaluating the Risks – PERT Technique.														
Unit – IV	Resource Allocation, Monitoring and Managing Contracts:													
Nature of Resources, Identifying Resource Requirements, Scheduling, Critical Paths – Creating the Framework, Collecting the data, Visualizing Progress, Cost Monitoring, Change Control - Managing Contracts - Types of Contracts - Stages in Contract Placement - Contract Management.														
Unit – V	Software Quality and Project Closure:													
The Place of Software Quality in Project Planning - Importance – Definition - Product versus Process Quality Management - Quality Management Systems - Process Capability Models - Techniques to Help Enhance Software Quality – Reasons for Project Closure, Project Closure Process, Performing a Financial Closure.														
Total:45														
REFERENCES:														
1.	Bob Hughes, Mike Cotterell & Rajib Mall, "Software Project Management", 6 th Edition, McGraw Hill, New Delhi, 2018.													
2.	S. A. Kelkar, "Software Project Management", 3 rd Edition, PHI, New Delhi, 2013.													
3.	Adolfo Villafiorita , "Introduction to Software Project Management", 1 st Edition, CRC Press, 2014.													



COURSE OUTCOMES:												BT Mapped (Highest Level)	
On completion of the course, the students will be able to													
CO1 outline the modern project management practices for different applications.												Understanding (K2)	
CO2 interpret the cost and effort estimation of the software development												Understanding (K2)	
CO3 apply PERT and CPM to find the solution for networks scheduling problems.												Applying (K3)	
CO4 infer the activities and the risks involved in various activities like resource allocation, monitoring, and managing contracts.												Understanding (K2)	
CO5 summarize the quality of software and project closures.												Understanding(K2)	

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	3			2		1	1	1	3	2
CO2	2	2	3	2	3			2		1	1	1	2	2
CO3	3	3	3	2	3			1		1	1	1	2	2
CO4	2	2	3	3	3			2	1	1	2	2	3	3
CO5	2	2	3	2	3			1	1	1	2	2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	100	-	-	-	-	100
CAT2	--	40	60	-	-	-	100
CAT3	--	100	-	-	-	-	100
ESE	--	80	20	-	-	-	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



22MCE10 - DEEP LEARNING																
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit									
Prerequisites	Machine Learning	3	PE	3	0	0	3									
Preamble	Explores the knowledge in fundamental concepts of deep learning and popular architectures of deep neural network to build the effective models.															
Unit – I	Deep Networks: Overview of neural networks- Loss functions- Hyper parameters-Defining Deep Learning - Common Architectural Principles of Deep Networks: Core Components - Building Blocks of Deep Networks: RBMs – Auto encoders – Variational Auto encoders.															
Unit – II	Mathematical Building Blocks of Neural Networks: Data Representation for neural networks – The gears of neural networks: Tensors operations-The engine of Neural networks: gradient based optimization-Introduction to Keras - Setting up a deep learning work station – Classifying Movie reviews: Binary Classification example.															
Unit – III	Architectures of Deep Networks: Unsupervised Predefined Networks: Deep Belief Networks – Generative Adversarial Networks- Convolutional Neural Networks- Recurrent Neural Networks- Recursive Neural Networks.															
Unit – IV	Building Deep Networks: Matching Deep Networks to the right problems-DL4J suite of tools- Basic concepts of the DL4J API-Modeling CSV data with Multilayer Perceptron Networks- Modeling handwritten images using CNN-Modeling Sequence data by using RNN.															
Unit – V	Deep Learning for Computer Vision: Introduction to Convnets – Training a convent from scratch on a small dataset – Using a predefined convent: Feature Extraction – Fine Tuning – Wrapping up – Visualizing convent: intermediate activations – convent filters – heat maps of class activation.															
Total:45																
REFERENCES:																
1.	Josh Patterson & Adam Gibson, "Deep Learning - A Practitioner's Approach", 4 th Indian Reprint, O'Reilly Media, CA, 2021. (Unit I, III, IV)															
2.	Francois Chollet, "Deep Learning with Python", 1 st Edition, Manning Publications, New York, 2018. (Unit II, V)															
3.	Nikhil Buduma, "Fundamentals of Deep Learning – Designing Next Generation Machine Intelligence Algorithms", 1 st Edition, O'Reilly Media, CA, 2017.															



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1	describe the fundamentals, architectural principles and building blocks of neural networks												Understanding(K2)
CO2	construct neural network data representation, tensor operations, and deep learning techniques using Keras for classification.												Applying (K3)
CO3	comprehend deep learning architectures, including CNNs, RNNs, GANs, and Deep Belief Networks and its applications.												Understanding(K2)
CO4	discover deep learning models using DL4J tools to process CSV data, images, and sequence data effectively.												Analyzing (K4)
CO5	examine predefined Convnet and Convnet from scratch.												Analyzing (K4)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2											
CO2	3	3	3	2										
CO3	3	2	2	2								1	2	
CO4	3	3	3			1		2	1	1			2	2
CO5	3	3	3		2	1		2		1			2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	65	35	-	-	-	100
CAT2	--	55	45	-	-	-	100
CAT3	--	25	55	20	-	-	100
ESE	--	45	35	20	-	-	100

* ±3% may be varied (CAT1,2,3 – 50 marks & ESE – 100 marks)



22MCE11 - SERVICE ORIENTED ARCHITECTURE															
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit								
Prerequisites	Nil	3	PE	3	0	0	3								
Preamble	To provide the basic set of services that each application can access the common functionalities.														
Unit – I	Service Oriented Architecture:														
		Fundamental SOA- Common characteristics of contemporary SOA-Common misperceptions about SOA-Common tangible benefits of SOA-Common pitfalls of adopting SOA - Evolution of SOA - An SOA timeline - The continuing evolution of SOA - The roots of SOA.													
Unit – II	Web Services and Primitive SOA:														
		The Web services framework - Service descriptions with WSDL - Messaging with SOAP - Web Services and Contemporary SOA - Message exchange patterns - Service activity - Coordination - Atomic transactions - Business activities - Orchestration - Choreography													
Unit – III	SOA and Service-Orientation:														
		Web Services and Contemporary SOA - Addressing - Reliable messaging - Correlation - Policies - Metadata exchange - Security - Notification and eventing - Principles of Service-Orientation - Service-orientation and the enterprise- Anatomy of a service-oriented architecture-Common principles of service-orientation-How service-orientation principles inter-relate													
Unit – IV	Service Layers & Building SOA -Planning and Analysis:														
		Service-orientation and contemporary SOA - Service layer abstraction - Application service layer - Business service layer - Orchestration service layer - Service layer configuration scenarios - SOA Delivery Strategies - SOA delivery lifecycle phases- The top-down strategy - The bottom-up strategy - The agile strategy													
Unit – V	Building SOA - Technology and Design & WS Specifications:														
		Introduction to service-oriented design - WSDL-related XML Schema language basics - WSDL language basics - SOAP language basics - Service interface design tools - Steps to composing SOA - Considerations for positioning core SOA standards - Considerations for choosing SOA extensions -WS-BPEL language basics - WS-Addressing language basics.													
Total:45															
REFERENCES:															
1.	Thomas Erl, "Service-Oriented Architecture : Concepts, Technology, and Design", Pearson Education, 2019														
2.	Munindar P. Singh and Michael N. Huhns , "Service-Oriented Computing: Semantics, Processes, Agents", John Wiley & Sons, Ltd., 2005														
3.	Michael Papazoglou , "Web Services and SOA: Principles and Technology ", Pearson Canada; 2 nd Edition ,2012														



COURSE OUTCOMES:												BT Mapped (Highest Level)	
On completion of the course, the students will be able to													
CO1	identify the basic principles of service orientation												Understanding (K2)
CO2	make use of web services in SOA for any e-commerce development.												Applying (K3)
CO3	describe the concept of web services and service orientation.												Understanding (K2)
CO4	illustrate the functions of service layers and SOA delivery techniques.												Understanding (K2)
CO5	build SOA solutions using service design and key web services standards.												Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	2	1	1	2	1	2	1	3	2
CO2	3	3	3	2	3	2	1	1	2	1	2	2	3	2
CO3	3	3	3	2	3	2	1	1	2	1	2	1	3	2
CO4	3	3	3	3	3	2	1	1	2	1	2	1	3	2
CO5	3	3	3	3	3	2	1	1	2	1	2	1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	65	35	-	-	-	100
CAT2	--	65	35	-	-	-	100
CAT3	--	65	35	-	-	-	100
ESE	--	65	35	-	-	-	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



22MCF01 -SOFTWARE TESTING								
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit	
Prerequisites	Software Engineering Methodologies	3	PE	3	0	2	4	
Preamble	To learn the ways to improve software testing and quality assurance through planning, establishing a productive work environment to deliver the customer expected product.							
Unit – I	Fundamentals of Software Testing:							
Principles of Testing – Phases of Software Project – Quality Assurance and Control – Verification and Validation - White Box Testing: Static Testing – Structural Testing – Challenges.								9
Unit – II	Black Box Testing and Levels of Testing:							
Black Box Testing: Requirements based Testing – Positive and Negative Testing – Boundary Value Analysis – Decision Tables – Equivalence Class Partitioning – State Based Testing – Compatibility Testing – User Documentation Testing – Domain Testing. Levels of Testing: System and Acceptance Testing.								
Unit – III	Performance, Regression and Ad-hoc Testing:							
Factors – Methodology – Tools – Challenges. Regression Testing: Types – Methods. Internationalization Testing – Ad-hoc Testing: Buddy and Pair Testing – Exploratory Testing – Iterative Testing – Agile and Extreme Testing. Usability and Accessibility Testing.								9
Unit – IV	Life Cycle Based Testing:							
Life Cycle Based Traditional Waterfall Testing, Testing in Iterative Life Cycles, Agile Testing, Agile Model–Driven Development - Model-Based testing: Testing Based on Models - Integration Testing: Decomposition-Based Integration, Call Graph–Based Integration, Path-Based Integration.								9
Unit – V	Test-Driven Development:							
Object-Oriented Testing: Issues in Testing Object-Oriented Software, Object-Oriented Unit Testing, Object-Oriented Integration Testing, Object-Oriented System Testing - Software Complexity: Unit-Level Complexity, Integration-Level Complexity, System-Level Complexity - Model-Based Testing for Systems of Systems: Characteristics, Sample Systems of Systems Software Engineering for Systems of Systems.								
LIST OF EXPERIMENTS / EXERCISES:								
1.	To Prepare Test Plan for the implemented system under test. The Test Plan shall be based on System Requirement Specification. The Test plan consists of the following issues. a. Purpose of the test. /Location and schedule of the test. b. Test descriptions. /Pass and Fail Criteria.							
2.	To perform Unit testing, especially indicating the traced Independent data paths, Control paths, and Error handling paths. Prepare control flow graphs for the unit under test and compute the Cyclomatic Complexity of the unit.							
3.	Test a program to login a specific web page.							
4.	Test a program to update 10 student records inside the Excel file based on user conditions.							
5.	Test a program to select the number of students who have scored more than 60 in all the subjects.							
6.	Test a program to provide the total number of objects present/available on the page.							
7.	Design, develop, code, and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of dataflow testing, derive at least 10 different test cases, execute these test cases and discuss the test results.							
8.	Design, develop, code, and run the program in any suitable language to solve the NextDate problem. Analyze it from the perspective of decision table-based testing, derive at least 10 different test cases, execute these test cases and discuss the test results.							
9.	Design, develop, code, and run the program in any suitable object-oriented language to solve the calendar problem. Analyze it from the perspective of OO testing, derive test cases to test the method that increments the date and the method that increments the month, execute these test cases and discuss the test results.							
10.	Design, develop, code and run the program in any suitable object-oriented language to solve the currency converter problem. Analyze it from the perspective of use case-based system testing, derive appropriate system test cases, execute these test cases and discuss the test results.							
Lecture:45, Practical:30, Total:75								



REFERENCES/ MANUAL / SOFTWARE:	
1.	Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing Principles and Practices", 1 st Edition, Pearson Education, New Delhi, 2016. (Unit I - III)
2.	Paul C. Jorgensen, "Software Testing: A Craftsman's Approach", 4 th Edition, CRC Press (Auerbach) Publications, New York, 2017. (Unit IV - V)
3.	William E. Perry, "Effective Methods for Software Testing", 3 rd Edition, Wiley India, New Delhi, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	outline the importance of software testing ensure software quality and reliability.	Understanding (K2)
CO2	build testing operations, manage software defects, and generate testing reports using appropriate testing techniques.	Applying (K3) Precision (S3)
CO3	make use of performance and other related testing to find the functionality of a software.	Applying (K3) Manipulation (S2)
CO4	interpret the concepts of life cycle-based testing and model-based testing approaches for a given situation.	Understanding (K2)
CO5	summarize the use of test-driven development approaches with its complexity.	Understanding(K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				1		2		2	1	1	3	2
CO2	3	2	2	2	3		2	2		2	2	2	2	2
CO3	3	3	2	2	3		2		2	3	1	3	3	3
CO4	2	2				2		2	1	1	2	1	2	2
CO5	2	2						2	2	1	2	1	2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	50	50	-	-	-	100
CAT2	--	35	65	-	-	-	100
CAT3	--	100	-	-	-	-	100
ESE	--	60	40	-	-	-	100

* ±3% may be varied (CAT 1,2,3– 50 marks & ESE – 100 marks)



22MCF02 - PHP AND MYSQL																
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit									
Prerequisites	Nil	3	PE	3	0	2	4									
Preamble	To provide the strong foundation in PHP Programming and MYSQL platform for web application development.															
Unit – I	PHP:															
Incorporating PHP Within HTML-The Structure of PHP-Expressions and Control Flow in PHP: Expressions-Operators-Conditionals-Looping.																
Unit – II	PHP Functions, Objects and Arrays:															
PHP Functions-Including and Requiring Files-PHP Version Compatibility-PHP Objects-PHP Arrays: Basic Access- for each loop-Multidimensional Arrays-Array Functions.																
Unit – III	MySQL:															
MySQL Basics-Accessing MySQL via the Command Line-Indexes-MySQL Functions-Database Design-Normalization-Relationships-Transactions-Backing Up and Restoring.																
Unit – IV	Form Handling:															
Building Forms-Retrieving Submitted Data-HTML5 Enhancements-Cookies, Sessions, Authentication-Using Cookies in PHP-HTTP Authentication-Using Sessions.																
Unit – V	jQuery:															
jQuery Syntax-Selectors-Handling Events-Event Functions and Properties-Special Effects-Manipulating the DOM-Modifying Dimensions-DOM Traversal-Using jQuery Without Selectors-Using Asynchronous Communication.																
LIST OF EXPERIMENTS / EXERCISES:																
1.	Write a PHP to evaluate expressions using different kind of operators															
2.	Write a PHP program to demonstrate the use of decision making control structures using a. If statement b. If-else statement c. Switch statement															
3.	Write a PHP program to demonstrate the use of looping structures using- a. While statement b. Do-while statement c. For statement d. Foreach statement															
4.	Develop a PHP code to perform various task using user defined functions															
5.	Write a PHP code to perform string handling operations with and without using built in functions.															
6.	Write a PHP program for creating and manipulating- a. Indexed array b. Associative array c. Multidimensional array															
7.	Write a PHP program to a. Inherit members of super class in subclass. b. Create constructor to initialize object of class by using object oriented concepts.															
8.	Create a MySQL database with proper normalization and perform DDL and DML operations															
9.	Using MySQL, perform various file format like excel, csv data loading, backup and restoring the database information.															
10.	Design a PHP Form and use regular expression to validate the fields.															
11.	Write a PHP program to – a. set cookies and read it. b. demonstrate session management.															
12.	Write a PHP program for sending and receiving plain text message (e -mail).															
13.	Implement a PHP application to process student on-duty requisition															
14.	Implement a PHP application to store and retrieve student co and extracurricular information															
15.	Develop a PHP code to create and download PDF file while accessing database information(Report Generation)															
Lecture:45, Practical:30, Total:75																



REFERENCES/ MANUAL / SOFTWARE:	
1.	Robin Nixon, "Learning PHP, MySQL & JavaScript - with jQuery CSS and HTML5", 5 th Edition, O'Reilly Media, Incorporated, 2018.
2.	Larry E. Ullman, "PHP and MySQL for Dynamic Websites: Visual QuickPro Guide", 4 th Edition, Peachpit Press, CA, 2014.
3.	Marty Matthews, "PHP And Mysql Web Development: A Beginner's Guide", Indian Edition, McGraw Hill, India, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	implement the fundamental concepts of PHP.	Applying (K3) Imitation(S1)
CO2	develop PHP programs to perform various tasks using arrays and functions.	Applying (K3) Manipulation(S2)
CO3	make use of MySQL to create a backend platform.	Applying (K3) Precision(S3)
CO4	design a frontend application and implement various event-handling mechanisms using jQuery.	Applying (K3) Manipulation(S2)
CO5	build a dynamic web application using PHP for the frontend and MySQL for data management.	Applying (K3) Precision(S3)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3		2								2	
CO2	3	2	3		3								2	
CO3	3	2	3		3	1		1					2	
CO4	3	2	3		3	1		1	1			1		2
CO5	3	2	3		3	1	2	1	1	1	1	2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY								
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %	
CAT1	--	40	60	-	-	-	-	100
CAT2	--	45	55	-	-	-	-	100
CAT3	--	45	55	-	-	-	-	100
ESE	--	45	55	-	-	-	-	100

* ±3% may be varied (CAT 1, 2, 3 – 50 marks & ESE – 100 marks)



22MCF03 –CROSS-PLATFORM MOBILE APPLICATION DEVELOPMENT																
Programme & Branch	MCA & Computer Applications		Sem.	Category	L	T	P	Credit								
Prerequisites	Nil		3	PE	3	0	2	4								
Preamble	To build beautiful cross platform mobile apps for iOS and Android devices using Flutter Framework															
Unit – I	Getting Started with Flutter: Introducing Flutter – Widget Lifecycle Events- Widget Tree and Element Tree- Installing the Flutter SDK – Creating a Hello World APP: Setting Up the Project – Hot Reload – Themes to style – Stateless and stateful widgets – External Packages.															
Unit – II	Learning Dart: Variables – Operators – Flow Statements – Functions – Packages – Classes – Asynchronous Programming – Creating a Starter Project Template – Understanding the Widget Tree: Building the full widget tree – building a shallow Widget Tree.															
Unit – III	Intermediate Flutter: Common Widgets: Using Basic Widgets:SafeArea – Container – Text – RichText – Column – Row – Buttons – Images and Icons – Decorators – Form Widgets – Checking Orientation. Adding Animation to an APP: AnimatedContainer – AnimatedCrossFade – AnimatedOpacity- AnimationController															
Unit – IV	Navigation, Effects and Layouts: Navigator – Hero Animation – BottomNavigationBar – BottomAppBar – TabBar and TabBarView – Drawer and ListView – Card – ListView and ListTile – Gridview – Stack – CustomScrollView with Slivers – High-Level View of the Layout – Creating the LayoutSetting Up GestureDetector – Draggable and Dragtarget widgets – Moving and Scaling.															
Unit – V	Database and Cloud Deployment: Saving Data with Local Persistence: JSON Format – Database Classes – Formatting Dates – Sorting – Retrieving Data – Adding the Firebase and Firestore Backend: Firebase and Cloud Firestore – Configuring the Firebase Project – Adding a Cloud Firestore Database and Implementing Security.															
LIST OF EXPERIMENTS / EXERCISES:																
1.	Write a dart program to implement string and array concept															
2.	Write a dart program using OOPS concept															
3.	Develop a dart program using list and set objects															
4.	Write a dart programs using Iterating Collections															
5.	Develop an application in android studio to understand the basics of the Flutter application															
6.	Develop a Flutter App by applying the Widgets, layouts and user management															
7.	Write a Flutter code to perform navigation through screens															
8.	Develop an application using importing external libraries															
9.	Design a code to work with JSON data in Flutter															
10.	Implement session management using packages for login page															
11.	Use cloud Firestore in a flutter application and perform operations like reading, writing and retrieving data.															
12.	Use firebase cloud real-time database with Flutter APP															
Lecture:45, Practical:30, Total:75																
REFERENCES/ MANUAL / SOFTWARE:																
1.	Marco L. Napoli “Beginning Flutter A Hands On Guide To App Development”, 1 st Edition, John Wiley & Sons, 2020															
2.	Alessandro Biessek, “Flutter for Beginners: An introductory guide to building cross-platform mobile applications with Flutter and Dart 2”, Packt Publishing, 1 st Edition, 2019															
3.	Frank Zammetti, “Practical Flutter”, 1 st Edition, Apress, 2019															



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1 sketch the internal and external packages of flutter framework												Understanding (K2) Imitation(S1)	
CO2 use various features of the Dart programming language.												Applying (K3) Manipulation(S2)	
CO3 develop an application using various components of the Flutter framework												Applying (K3) Manipulation(S2)	
CO4 make use of navigation, effects and layouts during app development												Applying (K3) Manipulation(S2)	
CO5 construct a web-based mobile application that accesses a database and the cloud.												Applying (K3) Manipulation(S2)	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3		2								2	
CO2	3	2	3		3			1					2	
CO3	3	2	3		3	1		1	1	1	1	1	2	
CO4	3	2	3		3	1		1					2	
CO5	3	2	3		3	1		1	1	1	1	1	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	40	60	-	-	-	100
CAT2	-	40	60	-	-	-	100
CAT3	-	40	60	-	-	-	100
ESE	-	40	60	-	-	-	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



22MCF04 - FULL STACK FRAMEWORK																
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit									
Prerequisites	Nil	3	PE	3	0	2	4									
Preamble	To understand the development procedure for full stack application development															
Unit – I	Full-Stack Development Overview															
Introducing Full-Stack Development : The Web Server/platform – Express Framework –MongoDB Database – Angular Front-end Framework : jQuery Vs Angular – Two-Way Data Binding – Load New Pages – Developing in TypeScript - Supporting Cast: Twitter Bootstrap – Git for Source Control – Hosting – Mean Stack Components Work Together																
Unit – II	MEAN Stack Architecture and Building a Node Web Application															
MEAN Stack Architecture – Beyond SPAs – Flexible MEAN Architecture –Planning a Real Application – Development into stages – Hardware Architecture – Creating and Setting up a MEAN Project : Look at Express, Node and npm – Creating an Express Project – Modifying Express for MVC – Importing Bootstrap – Making it Live.																
Unit – III	Node, Express, MongoDB and Mongoose															
Building a Static Site: Defining the routes in Express – Building Basic controllers – Views – Adding the rest of the Views – Taking the Data Out of the Views – Building a Datamodel with MongoDB and Mongoose: Connecting the Express Application to MongoDB– Model the Data - Mongoose Schemas – MongoDB Shell – Database Live																
Unit – IV	REST API															
Writing a REST API: The Rules of a REST API – Setting up the API in Express - Reading Data from MongoDB – Adding Data to MongoDB – Updating Data in MongoDB – Delete Method – Consuming a REST API: Call an API from Express – Lists of Data from an API – Single Documents from an API – Adding Data to the Database via the API																
Unit – V	Dynamic Front End with Angular															
Angular Application with TypeScript: Getting up and Running with Angular – Angular Components – Getting Data from an API – Angular Application into Production – Building a Single-page Application with Angular: Foundations – Adding Navigation – Multiple Nested Components – Adding Geolocation– Binding HTML Content -Building a Single-Page Application with Angular: The Next Level – Authenticating Users, Managing Sessions and Securing APIs – Authentication API in Angular Applications																
LIST OF EXPERIMENTS / EXERCISES:																
1.	Create a NodeJS server that serves static HTML and CSS files to the user without usingExpress.															
2.	Create a NodeJS server using Express that stores data from a form as a JSON file anddisplays it in another page. The redirect page should be prepared using Handlebars															
3.	Create a NodeJS server using Express that creates, reads, updates and deletessstudents' details and stores them in MongoDB database. The information about the usersshould be obtained from a HTML form															
4.	Create a counter using AngularJS															
5.	Create a Todo application using AngularJSStore the data to a JSON file using a simpleNodeJS server and retrieve the information from the same during page reloads.															
6.	Create a simple Sign up and Login mechanism and authenticate the user using cookies.The user information can be stored in either MongoDB or MySQL and the server shouldbe built using NodeJS and Express Framework.															
7.	Create and deploy a virtual machine using a virtual box that can be accessed from thehost computer using SSH.															
8.	Create a docker container that will deploy a NodeJS ping server using the NodeJSimage.															
9.	Build an online MCQ quiz app. The questions and options should be fetched based on the chosen topic from a NodeJS server. The questions can be stored in a JSON file in the backend. Once the user has answered the questions, the frontend must send the chosen options to the backend and the backend must identify the right answers and send the score back to the front end. The frontend must display the score in a separate neatly designed page															
10.	Build a blog website where you can add blog posts through a simple admin panel and the users can view the blog posts. The contents of the blog posts can be stored in either MongoDB or MySQL database. The home page should contain the titles of the blog post and the full post can be viewed by clicking the title. Frontend can be built either using AngularJS or through template engines served by the NodeJS server															
11.	Build a simple calculator app with AngularJS. The user should be able to add numbers and operations to the app by clicking on buttons, just like you would do in a mobile phone. The moment the operation and the two operations are defined, the answer should be displayed															
Lecture:45, Practical:30, Total:75																



REFERENCES/ MANUAL / SOFTWARE:														
1.	SmonHolmoes, Clive Harber, "Getting MEAN with Mongo, Express, Angular and Node", Manning Publications, 2 nd Edition, 2019													
2.	Colin Ihrig, Adam Bretz, "Full Stack Javascript Development with Mean: MongoDB, Express, AngularJS, and Node.JS", 1 st Edition, SitePoint, 2015													
3.	Ravi Kant Soni, "Full Stack AngularJS for Java Developers", Apress, 1 st Edition, 2018													
COURSE OUTCOMES:														
On completion of the course, the students will be able to													BT Mapped (Highest Level)	
CO1	demonstrate full-stack development essential concepts.											Understanding (K2) Imitation (S1)		
CO2	develop web applications using MEAN stack architecture.											Applying (K3) Precision (S3)		
CO3	build static web applications using Node, Express, MongoDB and Mongoose with dynamic data modeling.											Applying (K3) Precision (S3)		
CO4	examine the design and functionality of REST APIs.											Analyzing (K4) Manipulation (S2)		
CO5	develop single-page applications using Angular and TypeScript.											Applying (K3) Precision (S3)		
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2				1						2	
CO2	3	3	3	2	2		2						2	
CO3	3	3	3	3	2		2		1			2	2	
CO4	3	3	3	3	2	1	2	2	1		1	2	2	
CO5	3	3	3	3	2	1	1	2	1		1	2	2	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														
ASSESSMENT PATTERN – THEORY														
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %							
CAT1	--	30	70	-	-	-	100							
CAT2	--	40	60	-	-	-	100							
CAT3	--	30	50	20	-	-	100							
ESE	--	30	50	20	-	-	100							

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



22MCF05- DATA VISUALIZATION TECHNIQUES														
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	3	PE	3	0	2	4							
Preamble	To understand the various types of data, apply and evaluate the principles of data visualization.													
Unit – I	Data Visualization Fundamentals:													
Visualization Basics– Visualization Process – Role of Cognition – Pseudocode Conventions – Scatter plot - Data foundation : Types of data - Structure within and between Records - Data Preprocessing – Human Perceptions and Information Processing – Visualization Foundations.														
Unit – II	Tree, Graph, Networks, Text and Document:													
Displaying Hierarchical Structure – Displaying Arbitrary Graphs/Networks – Other Issues - Levels of Text Representation – Vector Space Model – Single Document Visualization – Document Collection Visualization- Extended Text Visualizations.														
Unit – III	Spatial and Geospatial Data:													
Visualization Techniques for Spatial Data: One, Two, and Three Dimensional Data – Dynamic Data- Combining Techniques - Visualization Techniques for Geospatial Data : Visualizing Spatial Data - Visualization of Point Data - Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial Data Visualization														
Unit – IV	Time-Oriented and Multivariate Data:													
Visualization Techniques for Time-Oriented: Introduction - Characterizing Time-Oriented Data- Visualizing Time-Oriented Data - TimeBench: A Data Model and Software Library for Visual Analytics of Time-Oriented Data- Visualization Techniques for Multivariate Data: Point-Based Techniques – Line-Based Techniques - Region-Based Techniques - Combinations of Techniques														
Unit – V	Visualizing Distributions:													
Empirical Cumulative Distribution Functions and Q-Q Plots-Visualizing many Distribution at once – Visualizing Proportions – Nested Proportions – Association among Two or More Quantitative Variables – Trends - Uncertainty														
LIST OF EXPERIMENTS / EXERCISES:														
1.	Acquiring and plotting data using various plotting techniques													
2.	Use statistical analysis – such as Multivariate Analysis, PCA, LDA, Correlation regression and analysis of variance for visualizing the data													
3.	Visualize and analysis the financial data set using Histogram,density plots and HeatMap													
4.	Use Time-series and stock market datasets to visualize the data using nested proportions													
5.	Visualization of various massive dataset - Finance - Healthcare - Census - Geospatial													
6.	Design a Visualization on Streaming dataset (Stock market dataset, weather forecasting)													
7.	Using Visualization proportions techniques for Market-Basket Data analysis-visualization													
8.	Show the text visualization using web analytics													
9.	Visualizing a Single Distribution													
10.	Visualizing Multiple Distributions at the Same Time													
Lecture:45, Practical:30, Total:75														
REFERENCES/ MANUAL / SOFTWARE:														
1.	Matthew O. Ward , Georges Grinstein , Daniel Keim “Interactive Data Visualization: Foundations, Techniques, and Applications”, 2 nd Edition, CRC Press, United States, 2015													
2.	Claus O. Wilke, “Fundamentals of Data Visualization”, 1 st Edition, O'Reilly, 2019													
3.	David Baldwin ,”Mastering Tableau”, 1 st Edition, Packt Publishing, Mumbai, 2016													



COURSE OUTCOMES:												BT Mapped (Highest Level)	
On completion of the course, the students will be able to													
CO1 infer data visualization fundamental concepts.												Understanding (K2)	
CO2 experiment with techniques for visualizing hierarchical structures.												Applying (K3) Precision (S3)	
CO3 apply visualization techniques for spatial and geospatial data.												Applying (K3) Precision (S3)	
CO4 inspect visualization techniques for time-oriented and multivariate data.												Analyzing (K4) Manipulation(S2)	
CO5 analyze visualization techniques for data distributions.												Analyzing (K4) Manipulation (S2)	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2										2		2	
CO2	2	2			2						2		2	
CO3	2	2	3		3			1			2	1	2	
CO4	2	2	3		3	1		1			2		2	
CO5	2	2	3		3	1		1			2		2	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	30	70	-	-	-	100
CAT2	--	30	70	-	-	-	100
CAT3	-	20	60	10	10	-	100
ESE	-	20	60	10	10	-	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



22MCF06 - ACCOUNTING AND FINANCIAL MANAGEMENT														
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	3	PE	3	0	2	4							
Preamble	To deal with managing the monetary transactions in an organization that enables in taking useful financial and costing related decisions by accounting tools and techniques.													
Unit – I	Financial Accounting: Meaning and Scope of Accounting – Classifications of Accounts – Accounting Cycle, Golden Rule - Fundamental Concepts and Conventions – Preparation of Journal – Ledger - Trial Balance – Trading, Profit and Loss Account - Balance Sheet.													
Unit – II	Ratio Analysis: Introduction to Financial Statement Analysis – Advantages, Limitations of Ratio Analysis– Classification of Ratios: Profitability and Liquidity Ratio.													
Unit – III	Cost Accounting: Meaning and Objectives – Classification of Cost – Elements of Costs – Preparation and Interpretation of Cost Sheet.													
Unit – IV	Budgetary Control: Introduction – Types of Budgets – Preparation and Interpretation of Functional Budgets: Sales Budget, Production Budget, Cash Budget - Flexible Budget.													
Unit – V	Financial Management: Objectives and Functions of Financial Management – Time Value of Money Concepts – Capital Budgeting: Discounting and Compounding Techniques.													
LIST OF EXPERIMENTS / EXERCISES:														
1.	Creation of Company													
2.	Creation of Voucher													
3.	Voucher Alteration, Delete and Printing reports													
4.	Creation of Journal to record transactions													
5.	Creation of Ledger, Trial Balance and Balance Sheet													
6.	Creation of Group and Stock													
7.	Report Generation with inventory													
8.	Creation of payroll including generation of pay slip, pay head, employee group and salary details													
9.	Payroll voucher													
10.	Report generation of payroll													
Lecture:45, Practical:30, Total:75														
REFERENCES/ MANUAL / SOFTWARE:														
1.	Maheshwari SN, MaheshwariSuneel K, MaheshwariSharad K (CA), "Financial and Management Accounting", 6 th Revised Edition, Sulthan Chand & Sons, 2022.													
2.	I.M.Pandey, "Financial Management", 12 th Edition, Pearson India Education Services Pvt. Ltd., 2021.													
3.	M.N.Arora, "A Textbook of Cost and Management Accounting", 11 th Edition, Vikas Publishing House Pvt. Ltd., 2021.													
4.	Tally Software													



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1	utilize the concepts of journal, ledgers and trial balance, trading account and balance sheet for various transactions.												Applying (K3)
CO2	apply ratio analysis for financial statement.												Applying (K3)
CO3	demonstrate the concepts of cost accounting in preparing cost sheet.												Applying (K3)
CO4	implement the various budgets using budgetary control.												Applying (K3)
CO5	interpret the various functions and techniques in financial management and financial accounting statements in tally.												Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2		1			1	1	1	2	
CO2	2	3	3	2		1	1	1	1	1	2		2	2
CO3	2	2	2	3		2	2	2	2	1		2		
CO4	2	2	2	2	2	2	2	2		2	2		2	
CO5	2	3	3	2	2	2	2	2	2	2	2	2		2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	30	70	-	-	-	100
CAT2	-	30	70	-	-	-	100
CAT3	-	30	70	-	-	-	100
ESE	-	40	60	-	-	-	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



22MCE12 –BIOINFORMATICS														
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	3	PE	3	0	0	3							
Preamble	To understand the usage of R tool as an open source language for learning bioinformatics data processing													
Unit – I	Bioinformatics Fundamentals: Starting Bioinformatics with R – Introduction to Bioconductor – Packages – Annotation – ID conversions- KEGG Annotation - GO Annotation – GO Enrichment - KEGG Enrichment – Bioconductor in cloud													
Unit – II	Sequence Structure Analysis: Introduction- Retrieving a sequence – Reading and Writing FASTA file – Sequence Composition- Pairwise sequence Alignment – Multiple sequence alignment – phylogenetic analysis and tree plotting – BLAST results – Pattern finding													
Unit – III	Protein Structure Analysis: Retrieving a sequence from Uniport - Protein sequence Analysis – Computing Features – PDB File – InterProdomain annotation – Ramachandran plot – searching for similar proteins – secondary structure features – Visualizing the protein structure													
Unit – IV	Analyzing Microarray Data: CEL Files – ExpressionSet Objects – AffyBatch Object – Checking the quality of data – Artificial expression data – Data normalization – Overcoming batch effects – Analysis of data with PCA – Differentially expressed genes – multiple classes - time series data – fold changes – functional enrichment – clustering –co-expression network – Visualization.													
Unit – V	Machine Learning in Bioinformatics: Data clustering – Visualizing clusters – Supervised learning for classification – Probabilistic learning in R with Naïve Bayes – Bootstrapping in machine learning – Cross-validation for classifiers – Measuring the performance of the classifier – ROC curve – Biomarker identification using array data													
Total:45														
REFERENCES:														
1.	Paurush Praveen Sinha , "Bioinformatics with R Cookbook", 1 st Edition, PACKT Publishing, 2014.													
2.	Bryan Bergeron, "Bio Informatics Computing", 1 st Edition, Pearson Education, New Delhi, 2015.													
3.	Yi-Ping Phoebe Chen , "BioInformatics Technologies", 1 st Indian Reprint, Springer Verlag, 2007.													



COURSE OUTCOMES:											BT Mapped (Highest Level)	
On completion of the course, the students will be able to												
CO1	infer the fundamentals of bioinformatics using R and Bioconductor.											Understanding (K2)
CO2	utilize sequence structure analysis techniques using bioinformatics tools.											Applying (K3)
CO3	outline protein structure analysis techniques.											Understanding (K2)
CO4	apply microarray data analysis techniques.											Applying (K3)
CO5	utilize machine learning techniques in bioinformatics.											Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3										2	
CO2			2	3	2	1				1			2	
CO3		2	3			1				1			2	
CO4	2	2	3		2	1				1			2	
CO5	2	2	3			1				1			2	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	30	70	-	-	-	100
CAT2	--	30	70	-	-	-	100
CAT3	--	20	60	10	10	-	100
ESE	--	20	60	10	10	-	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



22MCE13 - BUSINESS INTELLIGENCE																
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit									
Prerequisites	Nil	3	PE	3	0	0	3									
Preamble	To recognize the Business Intelligence as expert information, knowledge and technologies, for the management of organizational and individual business in an efficient manner.															
Unit – I	Overview of Business Intelligence, Analytics and Decision Support:															
Changing Business Environments and Computerized Decision Support - A Framework for Business Intelligence - Intelligence Creation, Use, and BI Governance - Transaction Processing Versus Analytic Processing - Successful BI Implementation - Analytics Overview - Brief Introduction to Big Data Analytics.																
Unit – II	Business Reporting, Visual Analytics and Business Performance Management:															
Business Reporting Definitions and Concepts - Data and Information Visualization – Different Types of Charts and Graphs - The Emergence of Data Visualization and Visual Analytics - Performance Dashboards - Business Performance Management - Performance Measurement - Balanced Scorecards – Six Sigma as a Performance Measurement System.																
Unit – III	Data Mining:															
Data Mining Concepts and Applications - Data Mining Applications - Data Mining Process - Data Mining Methods - Data Mining Software Tools - Data Mining Privacy Issues, Myths and Blunders.																
Unit – IV	Text and Web Analytics:															
Text Analytics and Text Mining Overview - Natural Language Processing - Text Mining Applications - Text Mining Process - Sentiment Analysis - Web Mining Overview - Search Engines - Web Usage Mining - Social Analytics.																
Unit – V	Business Analytics: Emerging Trends and Future Impacts:															
Location Based Analytics for Organizations - Analytics Applications for Consumers - Recommendation Engines - The Web 2.0 Revolution and Online Social Networking - Cloud Computing and BI - Impacts of Analytics in Organizations -Issues of Legality, Privacy and Ethics.																
Total:45																
REFERENCES:																
1.	Ramesh Sharda, DursunDelen and Efraim Turban "Business Intelligence – A Managerial Perspective on Analytics", 3 rd Edition, Pearson Education, India, 2018.															
2.	Efraim Turban, Ramesh Sharda and DursunDelen, "Decision Support and Business Intelligence Systems", 9 th Edition, Pearson Education, India, 2017.															
3.	David Loshin, "Business Intelligence – The Savvy Manager's Guide", 2 nd Edition, Morgan Kaufmann Publishers, USA, 2013.															



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1 outline the overview of analytics and decision support for business applications.												Understanding (K2)	
CO2 design the business reporting, visual analytics and business performance management for business applications.												Applying (K3)	
CO3 utilize the data mining concepts for business intelligence.												Applying (K3)	
CO4 examine the text and web analytics with respect to business intelligence.												Analyzing (K4)	
CO5 analyze the emerging trends and future impacts in business analytics.												Analyzing (K4)	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	2	2			1	2	2	1	2			2	1	2
CO2	2	3	3	2	3	1	2	2			1		2	2	2
CO3	2	2	2	3	2		2	2		2			2	2	1
CO4	3	2	2	3	2		2	1		1				2	2
CO5	3	2	3	3	2		2	2		1			2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	60	40	-	-	-	100
CAT2	--	50	50	-	-	-	100
CAT3	--	40	40	20	-	-	100
ESE	--	45	40	15	-	-	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



22MCE14 - CRYPTOGRAPHY AND NETWORK SECURITY								
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit	
Prerequisites	Nil	3	PE	3	0	0	3	
Preamble	To aim the explosive growth in computer systems and their interconnections via networks, has increased the dependence of both organizations and individuals on the information stored and communication be secure using cryptography techniques.							
Unit – I	Computer and Network Security Concepts:							
Computer Security Concepts – The OSI Security Architecture – Security Attacks – Services and Mechanisms – Model for Network Security – Introduction to Number Theory.								9
Unit – II	Symmetric Ciphers:							
Classical Encryption techniques: model – substitution – Transposition – Rotor machines – Steganography – Block Cipher and Data Encryption Standard - Advanced Encryption Standard								9
Unit – III	Asymmetric Ciphers:							
Public key cryptography and RSA: Principles - RSA Algorithm - The Diffie–Hellman Problem – Elgamal cryptographic systems - An Introduction to Elliptic curve Arithmetic - Cryptography – Application of Cryptographic Hash Functions.								9
Unit – IV	Cryptographic Data Integrity Algorithms:							
Cryptographic hash functions: Applications - Two simple hash functions - Secure Hash Algorithm (SHA) - Message Authentication codes: Requirements – Functions – HMAC – DAA and CMAC – Digital Signatures: Schemes –Key Management and Distribution: Symmetric key distribution using Symmetric and Asymmetric Encryption – Distribution of public keys – X.509 certificates – Public key infrastructures.								9
Unit – V	Network and Internet Security:							
Network Access Control – Cloud computing – Cloud Security Risks and countermeasures – Cloud Security as a service – Wireless network security: Wireless security – Mobile device security – Electronic Mail Security: Internet Mail Architecture – Email Formats – Threats – Pretty Good Privacy.								9
Total:45								
REFERENCES:								
1.	William Stallings, "Cryptography and Network Security: Principles and Practice", 7 th Edition, Pearson India Education Services Pvt., Ltd., 2017.							
2.	AtulKahate, "Cryptography and Network Security", 3 rd Edition ,TataMcGraw Hill Education, 2013.							
3.	Bernard Menezes," Network Security and Cryptography," 2 nd Edition, Cengage Learning, 2011.							



COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand computer and network security concepts, including OSI security architecture, attacks, services, and cryptographic foundations.	Understanding(K2)
CO2	describe classical encryption techniques, including substitution, transposition, steganography, and modern block cipher standards like DES and AES.	Understanding(K2)
CO3	analyze asymmetric ciphers, public key cryptography, RSA, Diffie–Hellman, ElGamal, elliptic curve cryptography, and cryptographic hash functions.	Analysis (K4)
CO4	examine cryptographic hash functions, message authentication codes, digital signatures, and key management techniques for secure communication.	Analysis (K4)
CO5	Interpret network access control, cloud security risks, wireless security, mobile device security, and email security measures.	Understanding(K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2											1
CO2	3	3	2	2		1								2
CO3	3	3	3	2										1
CO4	3	3	3	3		2								
CO5	3	3	3	3		2								

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	50	50	-	-	-	100
CAT2	--	30	45	15	10	-	100
CAT3	--	30	45	15	10	-	100
ESE	--	40	40	15	5	-	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



22MCE15 - ECONOMICS AND MANAGEMENT FOR INFORMATION TECHNOLOGY														
Programme & Branch	MCA	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	3	PE	3	0	0	3							
Preamble	To create fundamental knowledge on management by introducing concepts like economics national income, marketing, operations management, accounting principles.													
Unit – I	Micro Economics: Economics – Basics Concepts and Principles – Demand and Supply –Determinants - Law of demand and Supply Circular Flow of Economic activities and Income. – Market Equilibrium.													
Unit – II	Macro Economics, Business Ownership and Management concepts: National Income and its measurement techniques. Inflation - Causes of Inflation – Controlling Inflation – Business Cycle. Forms of business – Ownership types. Management concepts: Functions of Management - Managerial Skills- Levels of Management - Roles of manager													
Unit – III	Marketing Management : Marketing - Core Concepts of Marketing - Four Ps of Marketing - New product development – Intellectual Property rights (IPR), Product Life Cycle - Pricing Strategies and Decisions.													
Unit – IV	Operations Management : Operations Management - Resources - Types of Production system - Site selection, Plant Layout, Steps in Production Planning and Control - Inventory - EOQ Determination.													
Unit – V	Financial Management: Financial Statements and its uses – Depreciation: Straight Line and Diminishing Balance Method – Break Even Analysis – Capital Budgeting: Significance –Traditional and discounted cash flow methods.– Aggregation													
Total:45														
REFERENCES:														
1.	Compiled by Department of Management Studies, Kongu Engineering College, "Economics and Management for Engineers", 1 st Edition, McGraw Hill Education, Noida, 2017													
2.	Geetika, Piyali Ghosh and Purba Roy Choudhury, "Managerial Economics", 3 rd Edition, McGraw-Hill, New Delhi, 2018.													
3.	William J. Stevenson, "Operations Management", 14 th Edition, McGraw-Hill Education, 2021.													



COURSE OUTCOMES: On completion of the course, the students will be able to													BT Mapped (Highest Level)	
CO1	understand the concepts and principles of micro economics													Understanding (K2)
CO2	design functions of management and managerial skills for their organization													Applying (K3)
CO3	evaluate different New product development ,aware of pricing strategies													Evaluating(K5)
CO4	determine the steps in production planning and control													Evaluating(K5)
CO5	evaluate the financial statements and its uses													Evaluating(K5)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2					1			2	2		2	2
CO2	2	3	3			2		2	2		3		2	3
CO3	3	3	3				3	2	3	3	2	3	2	2
CO4	3	2	2	2			1	2			2		2	3
CO5	3	3	3				2			3		3	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	55	45	-	-	-	100
CAT2	--	35	40	15	10	-	100
CAT3	--	35	40	15	10	-	100
ESE	--	40	35	20	5	-	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



22MCE16 - SOCIAL NETWORK ANALYSIS																
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit									
Prerequisites	Nil	3	PE	3	0	0	3									
Preamble	This course aims to provide core knowledge of Social network analysis along with real world data.															
Unit – I	Social Network Data Analytics: Introduction - Statistical Properties of Social Networks: Preliminaries – Static Properties - Dynamic Properties – Random Walks on Graphs: Background – Random Walk based Proximity Measures - Other Graph-based Proximity Measures – Graph theoretic Measures for Semi-Supervised Learning - Clustering with Random Walk based Measures - Related Work: Applications.															
Unit – II	Community Discovery and Node Classification in Social Networks: Communities in Context - Core Methods: Quality Functions - The Kernighan Lin(KL) Algorithm – Agglomerative / Divisive Algorithms - Spectral Algorithms - Multi-Level Graph Partitioning - Markov Clustering – Emerging Fields and Problems - Node Classification in Social Networks: Problem Formulation - Methods using Local Classifiers - Random Walk based Methods - Applying Node Classification to Large Social Networks -Variations on Node Classification.															
Unit – III	A Survey of Social Influence Analysis, Expert Location and Link Prediction in Social Networks: Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Expert Location in Social Networks: Expert Location without Graph Constraints - Expert Location with Score Propagation – Expert Team Formation – Link Prediction in Social Networks: Feature based Link Prediction - Bayesian Probabilistic Models - Probabilistic Relational Models.															
Unit – IV	Visualizing, Mining and Multimedia Information Networks in Social Media: Introduction – Taxonomy of Visualizations – Data Mining Methods for Social Media - Text Mining in Social Networks: Keyword Search - Classification Algorithms - Clustering Algorithms – Multimedia Information Networks: ontology based Learning- Link from community media – Network of Personal Photo Albums – Network of Geographical Information.															
Unit – V	Social Tagging and Applications: Introduction – Tags – Tag Generation Models – Tagging System Design – Tag Analysis – Visualization of Tags – Tag Recommendations – Applications of Tag – Integration -Tagging Problems.															
Total:45																
REFERENCES:																
1.	Charu C. Aggarwal, "Social Network Data Analytics", 1 st Edition, Springer, US, 2015.															
2.	Peter Mika. "Social Networks and the Semantic Web", 1 st Edition, Springer, New York, 2007															
3.	BorkoFurht. "Handbook of Social Network Technologies and Applications", 1 st Edition, Springer, US, 2012.															



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1 summarize the Statistical properties and various measures of the social network												Understanding (K2)	
CO2 utilize various methods and algorithms in social networks to predict interaction among the different network communities.												Applying (K3)	
CO3 make a survey of social Influence analysis along with expert location and link prediction in social networks												Analyzing (K4)	
CO4 apply visualization, mining and multimedia techniques in social networks												Applying (K3)	
CO5 examine various applications of tags in social networks												Analyzing (K4)	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2						1	1			2
CO2	3	3	3	2	2					1	1			2
CO3	3	3	3	2	2					1	1			2
CO4	3	3	3	2	2					1	1			2
CO5	3	3	3	2	2					1	1			2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	--	60	40	-	-	-	100
CAT2	--	40	50	10	-	-	100
CAT3	--	40	50	10	-	-	100
ESE	--	40	50	10	-	-	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



22GET13 - INNOVATION, ENTREPRENEURSHIP AND VENTURE DEVELOPMENT															
(Common to ME/MTech and MCA Programmes)															
Programme & Branch	All ME/MTech and MCA Programmes	Sem.	Category	L	T	P	Credit								
Prerequisites	Nil	3	PE	3	0	0	3								
Preamble	This course will direct the students on how to employ their innovations towards a successful entrepreneurial venture development.														
Unit – I	Innovation and Entrepreneurship:							9							
Creativity and Innovation – Types of innovation – challenges in innovation- steps in innovation management- Meaning and concept of entrepreneurship - Role of Entrepreneurship in Economic Development - Factors affecting Entrepreneurship – Entrepreneurship vs Intrapreneurship.															
Unit – II	Design Thinking and Product Design:							9							
Design Thinking and Entrepreneurship – Design Thinking Stages: Empathize – Define – Ideate – Prototype – Test. Design thinking tools: Analogies – Brainstorming – Mind mapping. Techniques and tools for concept generation, concept evaluation – Product architecture –Minimum Viable Product (MVP)- Product prototyping – tools and techniques– overview of processes and materials – evaluation tools and techniques for user-product interaction.															
Unit – III	Business Model Canvas (BMC) and Business Plan Preparation:							9							
Lean Canvas and BMC - difference and building blocks- BMC: Patterns – Design – Strategy – Process–Business model failures: Reasons and remedies. Objectives of a Business Plan - Business Planning Process and Preparation.															
Unit – IV	IPR and Commercialization:							9							
Need for Intellectual Property- Basic concepts - Different Types of IPs: Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design– Patent Licensing - Technology Commercialization – Innovation Marketing.															
Unit – V	Venture Planning and Means of Finance:							9							
Startup Stages - Forms of Business Ownership - Sources of Finance – Idea Grant – Seed Fund – Angel & Venture Fund – Institutional Support to Entrepreneurs – Bank and Institutional Finance to Entrepreneurs.															
Total:45															
REFERENCES:															
1.	Gordon E. & Natarajan K., "Entrepreneurship Development", 6 th Edition, Himalaya Publishing House, Mumbai, 2017.														
2.	Sangeeta Sharma, "Entrepreneurship Development", 1 st Edition, PHI Learning Pvt. Ltd., New Delhi, 2017.														
3.	CharantimathPoornima M., "Entrepreneurship Development and Small Business Enterprises", 3 rd Edition, Pearson Education, Noida, 2018.														
4.	Robert D. Hisrich, Michael P. Peters & Dean A. Shepherd, "Entrepreneurship", 10 th Edition, McGraw Hill, Noida, 2018.														



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1	understand the relationship between innovation and entrepreneurship												Understanding (K2)
CO2	inspect and utilize design thinking process during product design and development												Analyzing (K4)
CO3	discover suitable business models as per the requirement of the customers												Analyzing (K4)
CO4	identify the procedures for protection of their ideas IPR												Applying (K3)
CO5	select the suitable types of ventures and modes of finance												Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2		3	3	3	3	3	3	3	3	2
CO2	2	3		2	3	2	3	3	2	2	2	3	3	2
CO3	3	2	3	3		2	3	3	3	2	2	2	2	2
CO4	2	3		2		3	3	3	2	2	2	2	2	2
CO5	2	3		2		3	3	3	2	2	2	2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	40	20				100
CAT2	30	40	30				100
CAT3	30	40	30				100
ESE	30	40	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



22MCB01 -PROBLEM SOLVING TECHNIQUES USING C														
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	1	BC	3	0	0	0							
Preamble	To introduce the basic knowledge of programming fundamentals of C language and problem solving													
Unit – I	Computer Fundamentals and Introduction to Programming, Algorithms and Flowcharts:													
Computer Fundamentals: Evolution, Generations, Classification of Computers – Anatomy – Memory – Operating System. Programs and Programming – Programming Languages – Generations and Classification of programming Languages – Structured Programming – Algorithms – Pseudocode – Flowcharts – Strategy and Tracing Algorithms - Converting Algorithms to Programs.														
Unit – II	Basics of C:													
Introduction – Parts of C program – Variables – Data Types – Statements – Tokens – Operators and Expressions – Lvalues and Rvalues – Type Conversion – Input and Output – Control Statements.														
Unit – III	Arrays and Strings, Functions:													
Arrays: One-dimensional Array – Strings – Multidimensional Arrays. Functions : Using functions – Call by Value – Working with Functions – Passing Array – Scope and Storage Classes – Inline Function – Recursion.														
Unit – IV	Pointers in C:													
Introduction – Pointer – void, Null pointers – Arrays and Pointers – Pointers and strings - Pointer Arithmetic – Pointer to Pointers – Array of Pointers – Pointers to an Array – Pointers to Functions - Dynamic Memory Allocation.														
Unit – V	User-Defined Datatypes:													
Structures : Declaration- Accessing Members- Initialization – typedef – Nesting of Structures – Arrays of Structures – Initializing Arrays of Structures – Arrays within Structures – Structures and Pointers – Structures and Functions – Union – Enumeration – Bitfields.														
Total:45														
REFERENCES:														
1.	PradipDey, Manas Ghosh, “ Programming in C”, 1 st Edition, Oxford University Press, 2018													
2.	Balagurusamy E., “Computing Fundamentals and C Programming”, 2 nd Edition, Tata McGraw-Hill Education Pvt. Ltd., 2017													
3.	YashavantKanetkar , “Let Us C” , BPB Publications, 15 th Edition, July 2016													



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1 summarize the fundamental concepts of problem solving technique.												Understanding (K2)	
CO2 apply basic C programming knowledge to solve simple Logics												Applying (K3)	
CO3 experiment homogeneity of data by array techniques and modularity by functions.												Applying (K3)	
CO4 use pointers to manage computer memory efficiently.												Applying (K3)	
CO5 apply heterogeneous data using structure and union												Applying (K3)	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2											3	2
CO2	3	3	2	3									3	2
CO3	2	1	2	2									3	2
CO4	2	1	2	2									3	2
CO5	2	1	2	2									3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	50	-	-	-	100
CAT2	10	30	60	-	-	-	100
ESE	-	-	-	-	-	-	NA

* ±3% may be varied (CAT 1 & 2 – 50 marks & ESE – NA)



22MCB02 - COMPUTER ORGANIZATION AND DESIGN														
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit							
Prerequisites	Nil	1	BC	3	0	0	0							
Preamble	To provide the basic knowledge necessary to understand the hardware operation of digital computers													
Unit – I	Digital Logic Circuits and Digital Components: Digital Computers – Logic Gates – Boolean Algebra – Map Simplification – Combinational Circuits – Flip-Flops – Sequential Circuits – Decoders – Multiplexers – Registers and Counters													
Unit – II	Digital Representation, Register Transfer and Micro Operations: Data Types and Number Conversion – Complements – Fixed Point Representation – Floating-point Representation - Register Transfer Language – Register Transfer - Bus and Memory Transfer – Arithmetic, Logic and Shift Micro operations.													
Unit – III	Basic Computer Organization and Design, Programming the Basic Computers: Instruction Codes – Computer Registers – Computer Instructions - Timing and Control – Machine and Assembly Language – Programming Arithmetic and Logic Operations.													
Unit – IV	Central Processing Unit: General Register Organization – Stack Organization – Instruction Formats - Addressing Modes - Data Transfer and Manipulation.													
Unit – V	Input-Output and Memory Organization: Input-Output Organization: Peripheral Devices – Asynchronous Data Transfer -Modes of Transfer - Direct Memory Access. Memory Organization: Memory Hierarchy - Main Memory - Auxiliary - Associative - Cache - Virtual Memory.													
Total:45														
REFERENCES:														
1.	Morris Mano M., "Computer System Architecture", 3 rd Edition, Pearson India Education Services Pvt.Ltd.,NewDelhi, 2017.													
2.	Morris Mano M., Michael D.Ciletti, "Digital Design", 5 th Edition, Pearson Education, Delhi, 2013.													
3.	William Stallings, "Computer Organization and Architecture – Designing for Performance", 9 th Edition, Pearson Education, 2012.													



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1 solve digital logic problems using various digital components												Applying (K3)	
CO2 experiment various number system conversions and operations.												Applying (K3)	
CO3 understand the fundamental concepts of machine and assembly language.												Understanding (K2)	
CO4 summarize the components of central processing unit												Understanding (K2)	
CO5 illustrate the organization and architecture of input-output and memory												Understanding (K2)	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2									1	2
CO2	3	2	2	2	2								2	1
CO3	3	2	2	2	2	1							1	
CO4	3	2	2	2	2	1							1	
CO5	3	2	2	2	2	1							1	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40	-	-	-	100
CAT2	40	60	-	-	-	-	100
ESE	-	-	-	-	-	-	NA

* ±3% may be varied (CAT 1 & 2 – 50 marks & ESE – NA)

**22MCB03 - C++ PROGRAMMING**

Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	BC	2	0	2	0

Preamble To learn and apply the object oriented concepts in problem solving

Unit – I Perspective on C++ : **10**

Principles of Object Oriented Programming – Beginning with C++ - Tokens, Expressions and Control structures. Functions: Main Function, Function Prototyping, Call by Value, Call by Reference, Inline Functions, Default Arguments, Const Arguments, Recursion, Function Overloading.

Unit – II Classes, Objects and Operator Overloading: **10**

Classes and Objects – Constructors and Destructors. Operator Overloading: overloading Unary and Binary Operators – overloading Binary Operator using Friend function – Friend Class.

Unit – III Inheritance and Runtime Polymorphism: **10**

Inheritance: Single, Multilevel, Multiple, Hierarchical, Hybrid, Virtual Base Classes, Constructors in Derived classes. Runtime Polymorphism: Pointers, Dynamic Memory Allocation, Virtual Functions and Polymorphism.

LIST OF EXPERIMENTS / EXERCISES:

1.	Simple C++ program for simple Functions, Inline function, default function argument
2.	Program to implement Recursion in simple tasks
3.	C++ program to implement Class and Objects
4.	Program to demonstrate Constructors & Destructors
5.	Design applications using Function overloading
6.	Program to implement Operator overloading in operators.
7.	Program to illustrate Friend Function and Friend Class.
8.	Programs to Implement Inheritance concepts.
9.	Write a program for Function overriding concept.
10.	Use new and delete operators to implement Dynamic memory allocation.

Lecture:30, Practical:15, Total:45

REFERENCES/ MANUAL / SOFTWARE:

1.	Balagurusamy E., "Object-Oriented Programming with C++", 8 th Edition, McGraw Hill EducationPvt.Ltd., 2021.
2.	Herbert Schildt, "C++: The Complete Reference", 4 th Edition, McGraw Hill EducationPvt.Ltd., 2021.
3.	Harvey M. Deitel and Paul J. Deitel, "C++ How to Program", 10 th Edition, Pearson Education, 2022.



COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1 infer the fundamentals of the Object Oriented concepts and C++ features												Understanding (K2)	
CO2 make use of Constructor, Destructor, Friend function and Operator Overloading to solve the problems												Applying (K3) Manipulation (S2)	
CO3 solve various scenarios using the Concepts of the Inheritance and Polymorphism												Applying (K3) Manipulation (S2)	
CO4 model the applications for demonstrating basic C++ features												Applying (K3) Precision (S3)	
CO5 experiment the working of Inheritance, Polymorphism and Exception Handling under various circumstances												Applying (K3) Precision (S3)	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2				2						2	
CO2	3	3	3	2	3		2						3	
CO3	3	2	3	2	3		2						3	
CO4	3	3	3	2	3		2						3	
CO5	3	3	2	2	3		2						3	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40	-	-	-	100
CAT2	20	40	40	-	-	-	100
ESE	-	-	-	-	-	-	NA

* ±3% may be varied (CAT 1 & 2 – 50 marks & ESE – NA)



22MCB04 - OPERATING SYSTEMS																
Programme & Branch	MCA & Computer Applications	Sem.	Category	L	T	P	Credit									
Prerequisites	Nil	2	BC	3	0	0	0									
Preamble	To get understanding of the internal processes that a computer performs															
Unit – I	Operating Systems Overview: Introduction: Computer System Organization – Architecture – Operations – OS Structures: OS Services – System Calls: – Process Control – File – Device Management – Information Maintenance – Communication – Protection.															
Unit – II	Process Management: Processes: Process concepts – Scheduling - Operations on Process – Inter Process Communication - Threads Multithreading Models – Synchronization: Peterson's Solution – Semaphores–CPU Scheduling: Scheduling Criteria – Algorithms: FCFS – SJF – Priority – Round Robin.															
Unit – III	Deadlock: Characterization: Conditions – Resource Allocation Graph – Methods for Handling Deadlocks: Deadlock Prevention – Deadlock Avoidance: Banker's Algorithm – Deadlock Detection – Recovery from Deadlock.															
Unit – IV	Memory Management: Main Memory: Contiguous Memory Allocation – Segmentation - Paging – Structure of Page Table – Swapping –Virtual Memory:Demand Paging - Page Replacement Algorithms: FIFO, Optimal and LRU .															
Unit – V	Storage Management: Overview of Mass Storage Structure: Disk Structure – Attachment – Scheduling Algorithms: FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK– Management - File System: Concepts – Access Methods – Directory Structure.															
Total:45																
REFERENCES:																
1.	Abraham Silberschatz, Greg Gagne, Peter B. Galvin, "Operating System Concepts", 9 th Edition, John Wiley & Sons Inc., USA, 2018.															
2.	Andrew S. Tanenbaum, Herbert Bos, "Modern Operating Systems", 8 th Edition, Pearson Education India, 2022.															
3.	William Stallings, "Operating Systems: Internals and Design Principles", 9 th Edition, Pearson Education India, 2017.															



COURSE OUTCOMES:												BT Mapped (Highest Level)	
On completion of the course, the students will be able to													
CO1	understand the knowledge of system organization and its structure												Understanding (K2)
CO2	make use of various scheduling algorithm to solve a problem												Applying (K3)
CO3	analyze the system state by applying different methods and algorithms												Analyzing (K4)
CO4	apply the principles of memory management techniques and various strategies												Applying (K3)
CO5	examine the disc scheduling policies in light of various storage structures.												Analyzing (K4)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2								1		3	
CO2	3	3	2	2							1		3	
CO3	3	3	2	2							1		3	
CO4	3	3	2	2							1		3	
CO5	3	3	2	2							1		3	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	40	10	-	-	100
CAT2	10	40	40	10	-	-	100
ESE	-	-	-	-	-	-	NA

* ±3% may be varied (CAT 1 & 2 – 50 marks & ESE – NA)