DEPARTMENT OF COMPUTER SCIENCE

COURSE STRUCTURE & SYLLABI
(For the students admitted from year 2023-2024 onwards)

Programme : Master of Computer Applications (MCA)

JAMAL MOHAMED COLLEGE (AUTONOMOUS)
Accredited with A++ Grade by NAAC (4th Cycle) with CGPA 3.69 out of 4.0
(Affiliated to Bharathidasan University)
TIRUCHIRAPPALLI – 620 020

M.C.A

Sem	Subject Code	Course Category	Subject Title	Hrs/Week	Credit	CIA	ESE	Total
I	23MCA1CC1	Core - I	Programming in Java	4	3	25	75	100
	23MCA1CC2	Core - II	Computer System Architecture	4	3	25	75	100
	23MCA1CC3	Core - III	Database Systems	4	3	25	75	100
	23MCA1CC4	Core - IV	Resource Management Techniques	4	3	25	75	100
	23MCA1CC5	Core - V	Management Information Systems	4	3	25	75	100
	23MCA1CC6P	Core - VI	Java Programming Lab - Practical	4	3	20	80	100
	23MCA1CC7P	Core - VII	RDBMS Lab - Practical	4	3	20	80	100
	23MCA1SE1	Skill Enhancement Course - I	Communication Skills *	2	2	-	100	100
			Total	**30**	**23**			**800**
II	23MCA2CC8	Core - VIII	Data Structures and Algorithms	4	3	25	75	100
	23MCA2CC9	Core - IX	R Programming with Statistics	4	3	25	75	100
	23MCA2CC10	Core - X	Operating Systems	4	3	25	75	100
	23MCA2DE1A/B/C	Discipline Specific Elective - I		4	4	25	75	100
	23MCA2DE2A/B/C	Discipline Specific Elective - II		4	4	25	75	100
	23MCA2CC11P	Core - XI	Data Structures Lab - Practical	4	3	20	80	100
	23MCA2CC12P	Core - XII	R Programming Lab - Practical	4	3	20	80	100
	23MCA2SE2	Skill Enhancement Course - II	Quantitative Aptitude *	2	2	-	100	100
	23MCA2EC1	Extra Credit Course - I	Summer Internship #	-	2	-	-	-
			Total	**30**	**25**			**800**
III	23MCA3CC13	Core - XIII	Python Programming	4	3	25	75	100
	23MCA3CC14	Core - XIV	Web Programming	4	3	25	75	100
	23MCA3CC15	Core - XV	Artificial Intelligence and Machine Learning	4	3	25	75	100
	23MCA3DE3A/B/C	Discipline Specific Elective - III		4	4	25	75	100
	23MCA3DE4A/B/C	Discipline Specific Elective - IV		4	4	25	75	100
	23MCA3CC16P	Core - XVI	Python Programming Lab - Practical	4	3	20	80	100
	23MCA3CC17P	Core - XVII	Web Programming Lab - Practical	4	3	20	80	100
	23MCA3SE3	Skill Enhancement Course - III	Innovation and Startup Skills *	2	2	-	100	100
	23MCA3EC2	Extra Credit Course - II	Online Certificate Course #	-	1	-	-	-
			Total	**30**	**25**			**800**
IV	23MCA4CC18	Core - XVIII	Distributed Technology	4	3	25	75	100
	23MCA4DE5A/B/C	Discipline Specific Elective - V		4	4	25	75	100
	23MCA4CC19P	Core - XIX	Distributed Technology Lab - Practical	4	3	20	80	100
	23MCA4PW	Project Work	Industrial Experience and Project Work	18	12	25	75	100
	23MCA4EC3	Extra Credit Course - III	Online Certificate Course #	-	1	-	-	-
	23PCNOC	Mandatory Online Course**	Online Course	-	1	-	100	100
	23PCN4EC3	Extra Credit Course - III +	Innovation and Intellectual Property Rights	-	+	-	-	-
	# Not considered for Grand Total and CGPA *** Paper fully Internal** **** Any Course in Online with Credits** **+ Course for Enhancing IPR Skills**		**Total**	**30**	**23**			**500**
			Grand Total		**96**			**2900**

* DISCIPLINE SPECIFIC ELECTIVES

Semester	Course Category	Course Code	Course Title
II	Discipline Specific Electives - I	23MCA2DE1A	Computer Networks
		23MCA2DE1B	Network Security and Cryptography
		23MCA2DE1C	Mobile Application Development
	Discipline Specific Electives - II	23MCA2DE2A	Data Science
		23MCA2DE2B	Big Data Analytics
		23MCA2DE2C	Microprocessors, Interfacing and Applications
III	Discipline Specific Electives - III	23MCA3DE3A	Parallel Processing
		23MCA3DE3B	Quantum Computing
		23MCA3DE3C	Cloud Computing
	Discipline Specific Electives - IV	23MCA3DE4A	Software Testing
		23MCA3DE4B	Internet of Things
		23MCA3DE4C	Compiler Design
IV	Discipline Specific Electives - V	23MCA4DE5A	Organizational Dynamics
		23MCA4DE5B	Accounting and Financial Management
		23MCA4DE5C	Human Resource Management

MANDATORY BRIDGE COURSES FOR NON - COMPUTER SCIENCE STREAM STUDENTS - 30 CREDITS

Sem	Subject Code	Course	Subject Title	Hrs/ Week	Credit	CIA	ESE	Total Mark
I	23MCA1ACC1	ADDL. Core - I	Computer Programming & Utilization**	-	5	100	-	100
	23MCA1ACC2P	ADDL. Core - II	Computer Programming & Utilization Lab - Practical**	-	5	100	-	100
			Total	**-**	**10**	**200**		**200**
II	23MCA2ACC3	ADDL. Core - III	Web Design**	-	5	100	-	100
	23MCA2ACC4P	ADDL. Core - IV	HTML and JavaScript Lab - Practical**	-	5	100	-	100
			Total	**-**	**10**	**200**	**-**	**200**
III	23MCA3ACC5	ADDL. Core - V	Computer Graphics**	-	5	100	-	100
	23MCA3ACC6P	ADDL. Core - VI	Animation Lab - Practical**	-	5	100	-	100
	** Course Fully Internal and in Self-study Mode		**Total**	**-**	**10**	**200**	**-**	**200**

Extra Credit Courses	Semester	Credits
Summer Internship	End of II	2
Online Certificate Course	III	1
Online Certificate Course	IV	1
Total		**4**

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MCA1CC1	CORE – I	4	3	25	75	100

Course Title	Programming In Java

SYLLABUS

Unit	Contents	Hours
I	Java Buzzwords – Class Fundamentals – Declaring Objects – Introducing Methods – Constructors – This keyword – Garbage Collection – Overloading Methods – Argument Passing – Recursion – Access Control Understanding static – final. Inheritance Basics – Using super – Method overriding – Dynamic Method Dispatch – Using Abstract Classes – * Final with Inheritance * – Object class.	12
II	Defining a Package– Access Protection – Importing Packages – Interfaces. Exception Handling Fundamentals – Exception Types – Using try and catch– Multiple catch Clauses – Nested try Statements– throw – throws – finally – Java's Built-in Exceptions – * Creating Own Exception Subclasses *. The Java Thread Model – Creating a Thread – Creating Multiple Threads-Thread Priorities– Synchronization – Inter-thread Communication.	12
III	String Handling – The lang package: Primitive Type Wrappers. The Collections Framework: List, Set – ArrayList – LinkedList – Vector – Stack– HashTable – StringBuilder – Date – Calendar - Random – Scanner. The I/O Classes and Interfaces - File – The Byte Streams: InputStream – OutputStream – *FileInputStream – File Output Stream* – Print Stream– DataOutputStream – DataInputStream –The Character Streams: Reader– Writer – FileReader – FileWriter – PrintWriter – Serialization.	12
IV	Networking Basics – InetAddress –TCP/IP Client Sockets – URL – URLConnection – *TCP/IP Server Sockets* – Datagrams – Java Database Connectivity: Establishing a connection – Creation of Data Tables – Entering Data into Tables – Table Updating – Use of PreparedStatement – Obtaining Metadata.	12
V	Event Handling: Delegation Event Model – Event Classes – Event Listener Interfaces – Layout Managers - Components and Containers – The Swing Packages – Exploring Swing: JLabel and ImageIcon – *JTextField – JButton – Check boxes* - Radio Buttons –- JTabbedPane– JScrollPane – JList – JComboBox – Jtrees - JTable.	12
VI	**Current Trends (For CIA only) –** Contemporary developments related to the course during the semester concerned.	

…… Self Study

Text Book(s):
1. Herbert Schildt, Java The Complete Reference, Eleventh Edition, McGraw-Hill Education,2019. 2. C. Muthu, Programming with Java, Vijay Nicole imprints private Limited, 2004(for JDBC only).
Reference Book(s):
1. Sachin Malhotra and Saurabh Chaudhary, Programming in Java, Oxford University Press, 2018. 2. Daniel Liang, Introduction to Java Programming,Tenth Edition, Pearson, 2015.
Web Resource(s):
1. https://www.javatpoint.com/java-tutorial 2. https://in.coursera.org/specializations/java-programming

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Remembering the fundamental concept of OOPs in Java language	K1
CO2	Illustrate the concepts like packages, interfaces, exception handling, multithreading, Collection, I/O and Networking classes and database connectivity.	K2
CO3	Apply appropriate problem solving strategies	K3
CO4	Design GUI based applications.	K5
CO5	Create the Java applications to solve the real time problems.	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	2	3	2	3	2	2.4
CO2	2	0	3	3	0	3	2	0	3	3	1.9
CO3	2	3	3	0	3	2	0	3	2	3	2.1
CO4	3	3	3	3	3	3	2	3	2	2	2.7
CO5	2	0	3	2	2	3	3	3	3	2	2.3
									Mean Overall Score		2.28
									Correlation		Medium

Mean Overall Score = Sum of Mean Score of COs / Total Number of Cos

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. M. Mohamed Surputheen

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MCA1CC2	CORE – II	4	3	25	75	100

Course Title	Computer System Architecture

SYLLABUS

Unit	Contents	Hours
I	Number Systems – Decimal, Binary, Octal and Hexadecimal Systems – Addition, Subtraction, Multiplication and Division (whole numbers) – Conversion from one system to another – Binary Codes – BCD codes – Weighted codes, Reflected code, Self-complementing codes – Alphanumeric Codes – *Error Detection Codes*.	12
II	Boolean Algebra – Boolean Laws and Theorems – De Morgan's Theorems – Complement of a Function - *Duality* – Logic Gates – Universal Logic – Boolean Expressions – Sum of Products – Product of Sums – Simplification of Boolean Expressions – Algebraic Method – Karnaugh Map Method (up to 4 Variables) – Implementation of Boolean Expressions using Gate Networks.	12
III	Combinational Circuits – Multiplexers – Demultiplexers – Decoders – Encoders – Arithmetic Building Blocks – Half and Full Adders – Half and Full Subtractors – Parallel adder – 2's Complement Adder/Subtractor – *BCD Adder*.	12
IV	Sequential Circuits – Flip Flops – RS, Clocked RS, D, JK, T and *Master-Slave Flip Flops* – Shift Register – Counters – Asynchronous and Synchronous Counters – Mod n Counter - BCD Counter – Ring Counter – Shift Counter.	12
V	Central Processing Unit: General Register Organization – Stack Organization – Instruction Formats – Addressing Modes – Data Transfer and Manipulation – Program Control - Status Bit Conditions, Conditional Branch Instructions, Subroutine Call and Return, Program Interrupt, Types of Interrupts – *Reduced Instruction Set Computer: CISC and RISC Characteristics*	12
VI	**Current Trends (For CIA only):** Harvard Architecture, Instruction Set Architecture	

…… Self Study

Text Book(s):
1. Donald P. Leach, Albert Paul Malvino and GoutamSaha, Digital Principles and Applications, Tata McGraw Hill, Sixth Edition, 2007
2. Morris Mano M, Computer System Architecture, Prentice Hall of India, Third Edition, 2008
Reference Book(s):
1. Thomas C. Bartee, Digital Computer Fundamentals, Tata McGraw-Hill, Sixth Edition, 2006
2. Morris Mano M, Digital Logic and Computer Design, Prentice Hall of India, 2008
Web Resource(s):
1. https://www.tutorialspoint.com/Computer-System-Architecture
2. https://www.javatpoint.com/computer-organization-and-architecture-tutorial

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Examine and classify the various number systems, binary codes, Boolean laws and theorems and logic gates	K1, K2
CO2	Perform number conversions and simplify Boolean expressions	K3
CO3	Design logic circuits	K6
CO4	Analyze the architecture and organization of a Central Processing Unit.	K4
CO5	Explain the important concepts in a computer system architecture	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	0	0	3	3	0	0	0	3	1.5
CO2	3	3	2	3	2	3	2	3	2	0	2.3
CO3	3	2	3	2	3	2	3	2	3	2	2.5
CO4	2	3	2	2	3	3	3	0	2	2	2.2
CO5	3	2	1	3	1	3	2	1	3	3	2.1
									Mean Overall Score		2.12
									Correlation		Medium

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. T. Abdul Razak

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MCA1CC3	CORE – III	4	3	25	75	100

Course Title	Database Systems

SYLLABUS		
Unit	Contents	Hours
I	Introduction: Database System Applications – Purpose of Database Systems – Views of Data – Database Languages – Data Storage and Querying – Database Users and Administrator – Structure of Relational Database – Keys – Formal Relational Query Languages – *Relational Algebra* – The Tuple Relational Calculus – The Domain Relational Calculus.	12
II	Introduction to SQL: Overview of SQL – SQL Definition – Basic Structure of SQL Queries – Additional Basic Operations – Set Operations – Aggregate Functions– Nested Sub-queries – Modification of the database – Intermediate SQL: Join Expression – Views. Database Design: Entity-Relationship Model – *Constraints* – Entity- Relationship Diagram.	12
III	Normalization: Purpose of Normalization – How Normalization Supports Database Design – *Data Redundancy and Update Anomalies* – Functional Dependencies – First Normal Form – Second Normal Form – Third Normal Form. Advanced Normalization: More on Functional Dependencies – BCNF – 4NF – 5NF.	12
IV	Storage and File Structure: Overview of Physical Storage – RAID – File Organization – *Data Dictionary Storage* – Indexing and Hashing – Basic Concepts – Ordered Indices – B + -Tree Index Files – Structure of a B+ -Tree – Static Hashing – Dynamic Hashing	12
V	Transaction: Transaction Concept – A simple Transaction Model – Storage Structure – Transaction Atomicity and Durability – Transaction Isolation – Serializability – Concurrency Control: Lock-Based Protocol –Timestamp-Based Protocol – Validation-Based Protocol– Recovery Systems: *Failure Classification* – Recovery and Atomicity.	12
VI	**Current Trends (For CIA only):** Cloud-based DBMS, Parallel and distributed database systems	

…… Self Study

Text Book(s):

1. Abraham Silberschatz, Hendry F. Korth and S. Sudarshan, Database System Concepts, 6th Edition, McGraw- Hill International Edition 2011.
2. Thomas M. Connolly, Carolyn E. Begg., Database Systems A Practical Approach to Design, Implementation and Management, 4th Edition, Pearson Education, Fifth Impression, 2012.

Reference Book(s):

1. C.J. Date, A. Kannan and S. Swaminathan, An Introduction to Database Systems, 8th Edition, Pearson Education Asia, 2009.
2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 5th Edition, Pearson Education Ltd., 2009.

Web Resource(s):

1. https://dl.ebooksworld.ir/motoman/Pearson.Database.Systems.
2. http://dl.booktolearn.com/ebooks2/computer/databases/9781260515046_Database_System_Concepts

		Course Outcomes		
Upon successful completion of this course, the student will be able to:				
CO No.	**CO Statement**			**Cognitive Level (K-Level)**
CO1	Understand the basic concepts and various data models in the database			K1, K2
CO2	Apply ER diagrams for real-time applications, populate and query a database by SQL			K3
CO3	Acquire knowledge of basic database storage structures and access techniques			K5
CO4	Design the database effectively by using normalization techniques			K4
CO5	Illustrate the concepts of transaction, Concurrency, and Recovery techniques in database			K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	2	1	3	0	2	2	1	1.9
CO2	3	3	2	3	1	3	2	3	3	2	2.5
CO3	3	3	0	2	3	2	3	2	3	1	2.2
CO4	2	3	3	1	3	3	3	3	0	2	2.3
CO5	3	2	3	3	1	3	2	0	3	3	2.3
Mean Overall Score											2.24
Correlation											Medium

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Mr. S. Syed Ibrahim

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MCA1CC4	CORE – IV	4	3	25	75	100

Course Title	Resource Management Techniques

SYLLABUS		
Unit	Contents	Hours
I	Operations Research – Nature and Features of O.R. – Definitions of O.R. – Applications of O.R. – Linear Programming Problem – Mathematical Formulation of the Problem – Graphical Solution Method – Some Exceptional Cases – Simplex Method – The Computational Procedure – Use of Artificial Variables – *Two-Phase Method* – Big-M Method.	12
II	Transportation Problem – *Linear Programming Formulation of the Transportation Problem* – Finding an Initial BFS – North-West Corner Rule – Matrix Minima Method – Vogel's Approximation Method – Test for Optimality – Assignment Problem – Mathematical Formulation of the problem – Hungarian Assignment Method – Special Cases in Assignment Problems – The Travelling Salesman Problem.	12
III	Network Scheduling by PERT / CPM – Network: Basic Components – Logical Sequencing – Rules for Network Construction – Concurrent Activities – Critical Path Analysis – Probability Considerations in PERT – *Distinction between PERT and CPM* – Applications of Network Techniques.	12
IV	Inventory Control – Types of Inventories – Reasons for Carrying Inventories – The Inventory Decisions – Objectives of Scientific Inventory Control – Costs Associated with Inventories – *Factors Affecting Inventory Control* – An Inventory Control Problem – The Concept of EOQ – Deterministic Inventory Problems with No Shortages – Deterministic Inventory Problems with Shortages – ABC Analysis (Always, Better, Control) Technique.	12
V	Queueing Theory – Queueing System – Elements of a Queuing System – Operating Characteristics of a Queueing System – Classification of Queuing Models – *Definition of Transient and Steady States* – Queueing Models – $(M/M/1):(\infty /FIFO)$ – $(M/M/1):(N/FIFO)$ – $(M/M/C):(\infty/FIFO)$ – $(M/M/C):(N/FIFO)$. .	12
VI	**Current Trends (For CIA only):** Recent Trends in Optimization Techniques	

…… Self Study

Text Book:
Kanti Swarup, P.K. Gupta and Man Mohan, *Operations Research*, Sultan Chand & Sons Educational Publishers, New Delhi, Sixteenth Edition, Reprint 2013.
Reference Book(s):
1. Hamdy A. Taha, *Operations Research : An Introduction*, PHI, New Delhi, 8th Edition, 2008. 2. A. Ravindran, Don T. Phillips, James J. Solberg, *Operations Research Principles and Practice*, John Wiley & Sons, Second Edition, Third Reprint, 2007.
Web Resource(s):
1. https://www.tutorialsduniya.com/notes/operational-research-notes/ 2.https://www.researchgate.net/publication/313880623_Introduction_to_Operations_Research_Theory_and_Applications 3. https://archive.nptel.ac.in/courses/111/105/111105039/ 4. https://archive.nptel.ac.in/courses/112/106/112106134/

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall the fundamental concepts involved in various Optimization Methods	K1
CO2	Summarize the procedure for solving different Operations Research Problems	K2
CO3	Apply the concept of selected resource management techniques to solve the real-life problems	K3
CO4	Analyze and Examine the steps involved in decision-making problems in management	K4
CO5	Design, Develop and Explain the suitable optimization technique and then solve the real-world scientific and business problems	K5 & K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	1	1	3	3	2	2	2	3	2.3
CO2	3	3	3	3	2	3	3	3	2	0	2.5
CO3	3	3	3	3	3	2	3	3	2	2	2.7
CO4	2	3	2	2	3	3	3	1	2	2	2.3
CO5	3	3	3	3	2	2	3	3	3	3	2.8
									Mean Overall Score		2.52
									Correlation		High

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. O.A. Mohamed Jafar

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MCA1CC5	CORE – V	4	3	25	75	100

Course Title	Management Information Systems

SYLLABUS

Unit	Contents	Hours
I	**Foundation Concepts:** Information Systems in Business–Fundamental Roles of IS in Business – Trends in IS – Roles of e-Business in Business – Managerial Challenges of Information Technology – Components of Information Systems-Information Systems resources – IS Activities. **Fundamentals of Strategic Advantages:** Competitive Strategy Concepts- Competitive Forces and Strategies– Strategic uses of IT – Building a Customer Focused Business –Value Chain and Strategic IS –Re-engineering Business Processes *Virtual Company – Building a Knowledge Creating Company*.	12
II	**e-Business Systems:** Cross Functional Enterprise Applications – Enterprise Applications Architecture- Enterprise Application Integration – Transaction Processing Systems - TP cycle – Enterprise Collaboration Systems. **Functional Business Systems:** IT in Business- Marketing Systems – Manufacturing Systems – Human Resources Systems –Accounting Systems– Financial Management Systems. **Enterprise Business Systems:** CRM – Phases of CRM – Benefits, Challenges and Failure. **Enterprise Resource Planning:** ERP – Benefits, Challenges and Trends. ***Supply Chain Management:** SCM –Roles, Benefits and Trends*	12
III	**e-Commerce Fundamentals:** Introduction to e-Commerce –Scope of e-Commerce –e-Com Technologies – Essential of e-Commerce Processes –Electronic payment processes – e-Commerce Applications and Issues – e- Com Success Factors – Web Store requirements- Business–to–Business e-Commerce – e – Commerce market Places – Clicks and Bricks in e-Commerce. **Security and Ethical Challenges:** Ethical Responsibility of Business Professionals –Challenges of Working in IT– *Computer Crimes- Privacy Issues– Current State of Cyber Law*	12
IV	**Decision Support Systems:** Decision Support in Business– Information, Decision and Management–Information Quality – Decision Structure – Decision Support trends – DSS Components – MIS – Online Analytical Processing – Uses of DSS – EIS – Enterprise Portals and Decision Support. **Artificial Intelligence Technologies in Business:** Overview of A.I – Domains of AI – Expert Systems – Developing Expert Systems –Neural Networks – Fuzzy Logic Systems – *Genetic Algorithms – Virtual Reality – Intelligent Agents *.	12
V	**Enterprise and Global Management of Information Technology: Managing Information Technology:** Business and IT- Managing Information Technology-Business/IT Planning – Information Technology Architecture – Managing the IT functions - Organizing IT – Outsourcing and Offshoring – Failures in IT Management. *****Security Management of IT:** Introduction - Tools of Security Management – Inter Networked Security Defenses – Other Security Measures – System Control and Audits*	12
VI	**Current Trends (For CIA only)** Latest Trends in Marketing, e-Commerce, Business Intelligence and Security Systems.	

…… Self Study

Text Book(s):
James A. O 'Brien and George M. Marakas, Ramesh Behl,*Management Information Systems*, Tata McGraw Hill PublishingCompany Limited, Eleventh Edition, 2019
Reference Book(s):
1. Kenneth C. Laudon and Jane P. Laudon, *Management Information Systems: Managing the Digital Firm*,Pearson, Sixteenth Edition, 2020.   2. W.S. Jawadekar, *Management Information Systems*, Tata McGraw Hill Publishing Company Limited,1998.
Web Resource(s):
1. https://www.academia.edu   2. https://www.tutorialspoint.com/management_information_system/mis_tutorial.pdf

Relationship Matrix:

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Compare and classify various Information systems and their uses.	K1, K2
CO2	Construct and Build Functional Business systems such as TPS, ERP, CRM and SCM.	K3
CO3	Compare and Contrast E-Commerce and DSS Systems and their Implementation.	K5
CO4	Analyse the significance of Security Systems for Information Systems.	K4
CO5	Design of Enterprise and Global Management of Information Technology for Information Systems	K6

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	0	0	3	3	0	0	2	3	1.7
CO2	3	3	2	3	2	3	2	2	2	0	2.2
CO3	3	2	3	2	3	2	3	3	3	3	2.7
CO4	2	3	2	2	3	3	3	2	2	2	2.4
CO5	3	2	1	3	3	3	2	1	3	3	2.4
										Mean Overall Score	2.28
										Correlation	Medium

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. A.R. Mohamed Shanavas

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MCA1CC6P	CORE – VI	4	3	20	80	100

Course Title	Java Programming Lab - Practical

1. Write Java Applications for the following:

(a) Find the even and odd numbers for 1 to 1000 and count them using else…if statements.
(b) Find the sum of sum of digits of a given number.

2. Class and Object

(a) Program for library information system using suitable fields. (Read and Display book details)
(b) Program to find the area of rectangle, triangle, square and circle using method overloading.

3. Inheritance

(a) Program to calculate salary of an employee using single inheritance.
(b) Program to demonstrate method overriding.

4. Packages and Interfaces

(a) Prepare a banking application using the package concept
(b) Program to demonstrate interface

5. Exception Handling

(a) Program to demonstrate using multiple catch clauses
(b) Program to create Threads using extends Thread class and implement Runnable interface

6. String Handling - Program to perform following operations:

(a) Program to count the number of upper case letters, lower case letters, white spaces and digits of a given sentence
(b) Program to reverse each word using a given sentence

7. Utility Classes

(a) Program to prepare the students' progress report using vector class
(b) Program to print the system date and time. (hours, minutes and seconds & day, month and year separately)

8. I/O Streams and Networking
(a) Program for displaying contents of a given file and find the size, length and create date of a file
(b) Program to create a directory at server and get a message "Successfully Created'. If the given directory is already created in server, send message to client "Already Exist". (Server Socket and Socket classes

9. Database Application

(a) Menu driven program for Employee details. (insert, delete, update and search operations)
(b) Create an Inventory table with suitable fields and insert records through swing components

Course Outcomes

CO No.	CO Statement	Cognitive Level (K-Level)
	Upon successful completion of this course, the student will be able to:	
CO1	Apply the control statements to solve the simple problems	**K3**
CO2	Develop the day to day applications using Inheritance, Packages, and Interface	**K3**
CO3	Illustrate the exception handling and string class methods for simple applications	**K2**
CO4	Solve the errors in the computer laboratory using I/O and networking concepts.	**K3**
CO5	Create an application for automation of real time problems using database	**K6**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	2	2	3	2	3	0	2	3	2.2
CO2	3	3	0	2	3	0	2	3	2	3	2.1
CO3	3	2	3	2	3	3	0	2	3	3	2.4
CO4	2	2	3	0	2	3	2	3	3	3	2.3
CO5	2	2	2	2	3	2	3	0	2	3	2.1
Mean Overall Score											2.22
Correlation											Medium

Mean Overall Score = Sum of Mean Score of COs / Total Number of Cos

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. M. Mohamed Surputheen

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MCA1CC7P	CORE – VII	4	3	20	80	100

Course Title	RDBMS Lab – Practical

I. Data Definition Languages

1. Create the following relations

          Customer (customer-Id (Primary key), customer-name, address)

          Account (account-number (Primary key), branch-name, and balance)

          Loan (loan-number (Primary key), branch-name, and amount)

          Branch (branch-name, branch-city, assets)

          Depositor (customer-name, account-number)

          Borrower (customer-name, loan-number)

          Supplier (supplier-number, part-number, color, quantity) use candidate key

2. Unique and Check constraints

3. Write DDL query to perform foreign key with on delete cascade - A foreign key with cascade delete means that if a record in the parent table is deleted, then the corresponding records in the child table will automatically be deleted.

4. Alter with three options

          Add – add columns in the existing table

          Add – constraints

          Modify – modify the data type and size in the existing table

          Drop – delete column from existing table

II. Data Manipulation Language

1. Insertion

2. Arithmetic, Logical, Comparison operations

3. String Operations

       (a) Finds any values that start with "a"

       (b) Finds any values that end with "a"

       (c) Finds any values that have "ar" in any position

       (d) Finds any values that have "r" in the second position

       (e) Finds any values that start with "a" and are at least 2 characters in length

       (f) Finds any values that start with "a" and are at least 3 characters in length

       (g) Finds any values that start with "J" and ends with "y"

4. Tuple Variables

       Using branch relation, Find the names of all branches that have assets greater than at least one branch located in a city (any city)

5. Ordering of Tuples

       (a) To list in alphabetic order all customers who have loan at a branch

       (b) To list customer names in descending order.

6. Set Operation – (union, Intersect, minus)

       (a) Find all customers having a loan, an account or both at the bank.

       (b) Find all customers who have both a loan and account at the bank.

       (c) Find all customers who have an account but no loan at the bank.

       (d) Find all customers who have a loan but not an account at the bank.

7. Aggregate functions – (average, minimum, maximum, total, and count)

       (a) Find average account balance at a branch.

       (b) Find the minimum balance at a branch. Find the maximum balance at a branch.

       (c) Find the total balance at a branch Find the number of accounts in a branch.

       (d) Find the 3rd highest balance of account number's

8. Aggregate functions with group by and having clause)

       (a) Find the average account balance at each branch.

       (b) Find branch names those branches where the total balance is more than Rs.100000

       (c) Find the branches those branches where the total accounts are more than 3.

9. Nested sub-queries. Membership (in and notin)

(a) Find all customers who have both a loan and account at the bank.

(b) Find all customers who have an account but no loan at the bank.

Set Comparison (some, all)

(c) Using branch relation, Find the names of all branches that have asset value greater than at least one branch located in a city (any city)

(d) Find the names of all branches that have asset value greater than that of each branch located in a city (any city)

10. Views

Create the view consisting of customer-names and branch-names who have either loan or an account at the branch.

11. Deletion

(a) Delete the tuples of all accounts with balances below the average at the bank

(b) Delete all accounts tuples at every branch located in a city (any city)

12. Updates

(a) All balances are to be increased by 5 percent.

(b) Update with case statements All accounts with balances over 10000 receives 10 percent interest where as others receive 5 percent

13. Join Operations

(a) Inner join – Find the customer-names who have loan from a branch (KK nagar)

(b) Left outer join – Show the relation, which loan not buy a single customer.

(c) Right outer join – Show the relation, which customers bought loan, that loan details not in the loan relation

(d) Full outer join

III. PL/SQL Procedure

1. Reverse the string.
2. Student Mark Sheet Preparation
3. Pay Roll preparation
4. Find factorial number using recursive function.
5. Find Fibonacci series using recursive function.
6. Exception Handling

IV. SQL Forms

1. Student Mark System
2. Pay Roll Preparation
3. Income Tax Calculation

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Demonstrate the various operations performed using DDL statements	K2
CO2	Construct the programs using Data Manipulation Languages statements	K3
CO3	Analyze the programs using the Views and Join Operations	K4
CO4	Evaluate and Interpret the PL/SQL procedure's	K5
CO5	Create and Develop programs using SQL forms and real-world problems	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	2	2	3	2	3	0	2	3	2.2
CO2	3	3	0	2	3	0	2	3	2	3	2.1
CO3	3	2	3	2	3	3	0	2	3	3	2.4
CO4	2	2	3	0	2	3	2	3	3	3	2.3
CO5	2	2	2	2	3	2	3	0	2	3	2.1
									Mean Overall Score		2.22
									Correlation		Medium

Mean Overall Score = Sum of Mean Score of COs / Total Number of Cos

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Co-ordinator: S. Syed Ibrahim

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MCA1SE1	Skill Enhancement Course – 1	2	2	-	100	100

Course Title	Communication Skills

SYLLABUS		
Unit	**Contents**	**Hours**
I	Listening Comprehension: Global as well as local comprehension based on the listening to audio cassettes; A communicative interaction is to be set up in the class room. Testing accuracy of comprehension by asking 'yes' or 'no' questions. Meaning of words the students find difficult, is to be given. Pronunciation and intonation of words and sentences Materials used: 1. Sweet and Salty – A Folk Tale 2.The Magic Vessels – A Folk Tale 3. The Crows and Serpent – A Karadi Tale 4. The Monkey and Crocodile – A Karadi Tale 5) Keep up your English – Cassette 3 6. Tiger's Eye – Cassette 1 7. Tiger's Eye– Cassette 2 8. Tiger's Eye– Cassette 3	6
II	Video Viewing: Introducing students to foreign accent Interaction based on certain important aspects of the clipping used Discussion of the theme and moral aspects in an interactive way Materials used: 1. The King and I 2. Beethovan's 2nd 3. Titanic 4. The Sound of Music 5. Mrs. Doubtfire	6
III	Grammar and Reading Comprehension: i. Rules on usage are to be explained clearly ii. Examples apart from the ones in the text are to be given iii. Students are made to answer the exercise following the rules on usage iv. The Comprehension questions following the reading passage are to be answered v. To improve the usage of rules pertaining to the topic, a guided composition exercise is to be done.	6
IV	Speech Practice and Presentation Skills: • Speech Preparation: Writing out the speech / Presentation materials with coherence and cohesion • Delivery and speech presentation Installing confidence and getting ride of stage fear by asking students speak in front of the class • Adhering to the policy of – Fluency first and accuracy gradually • Building up learner confidence through encouragement and appreciation	6
V	Interview Skills – Preparation, Presentation and Post Presentation Group Dynamics / Discussion	6

Reference Book(s):

1. Larry L. Barker, Communication, Prentice Hall, London,3rd Edition, 1984.
2. Mohan, Krishna and Meera Banerji, Developing Communication Skills, Macmillan, Delhi, 1990.
3. Stanton, Nicky, Mastering Communication, Hampshire: Pal grave, 1982.
4. H.M. Prasad, Group Discussion and Interview, Tata McGraw Hill Publishing Company Limited, New Delhi, 2001.
5. Edgar Thorpe and Showick Thorpe, Winning at Interviews, Pearson Education, New Delhi, 2004.
6. Hemant Goswami, How to be successful in Interviews and get a job, Chandika Press Ltd, Chandigarh, 2001.
7. G. Ravindran, S.P. Benjamin Ilango and L. Arockiam, Success Through Soft Skills, IFCOT Publications, 2008.

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Compare & Classify the various listening comprehension and its activities	K1, K2
CO2	Perform according to the videos in an interactive way	K3
CO3	Design using grammar and reading comprehension	K6
CO4	Analyse the given topic using speech practice and presentation skills	K4
CO5	Determine the interview and group discussion skills	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	0	0	3	3	0	0	0	3	1.5
CO2	3	3	2	3	2	3	2	3	2	0	2.3
CO3	3	2	3	2	3	2	3	2	3	2	2.5
CO4	2	3	3	2	2	3	3	0	2	2	2.2
CO5	3	2	2	3	2	3	2	1	3	3	2.4
									Mean Overall Score		2.18
									Correlation		Medium

Mean Overall Score = Sum of Mean Score of COs / Total Number of Cos

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Mr. S. Akbar Ali

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MCA1ACC1	ADDL.CORE - I	-	5	100	-	100

Course Title	Computer Programming & Utilization

SYLLABUS

Unit	Contents
I	Overview of C – Importance of C – Basic Structure of C Programs – Constants – Variables – Data Types in C – Operators in C – Expressions – Managing Input and Output Operations – Decision Making and Branching –* Various Forms of IF Statements* – The Switch Statement – The ?: Operator – The GO TO Statement.
II	Decision Making and Looping – The WHILE Statement– The DO Statement – The FOR Statement – Arrays – Types of Arrays – Need for User-Defined Functions – The Form of C Functions – Category of Functions – *Call by Value – Call by Reference*.
III	Basic concepts of OOP – Structure of C++ Program – Operators and Data Types in C++ – Manipulators – Inline Functions – Default Arguments – Recursion – Function Overloading – Classes and Objects – Arrays of Objects – Objects as Function Arguments – *Friendly Functions – Returning Objects*.
IV	Constructors and Destructors – Constructors - Parameterized Constructors – Multiple Constructors in a Class – Copy Constructors – Destructors – Operator Overloading – Defining Operator Overloading – Overloading Unary Operators – Overloading Binary Operators – Overloading Binary Operators using Friends – Rules for Overloading Operators – Inheritance: Extending Classes – Defining Derived Classes – Single Inheritance – *Multilevel Inheritance – Multiple Inheritance*.
V	Pointers, Virtual Functions and Polymorphism – Pointers – Pointers to Objects – *this Pointer* – Pointers to Derived Classes – Virtual Functions – Pure Virtual Functions – Managing Console I/O Operations – C++ Streams – C++ Stream Classes – Unformatted I/O Operations – Formatted Console I/O Operations – Working with Files.
VI	**Current Trends (For CIA only):** Developing C / C++ coding for simple real world application problems

…… Self Study

Text Book(s):
1. E. Balagurusamy, *Programming in ANSI C*, Tata McGraw Hill Education Private Ltd., New Delhi, Fifth Edition, 2011. 2. E. Balagurusamy, *Object Oriented Programming with C++*, Tata McGraw Hill Education Private Ltd., New Delhi, Fifth Edition, 2011.
Reference Book(s):
1. Yashavant Kanetkar, *Let Us C*, BPB Publications, New Delhi, Thirteenth Edition, 2013. 2. Bjarne Stroustrup, *The C++ Programming Language*, Addison-Wesley, New York, Third Edition, Eighth Impression, 2012.
Web Resource(s):
1. https://www.programiz.com/c-programming 2. https://www.geeksforgeeks.org/object-oriented-programming-in-cpp/ 3. https://onlinecourses.nptel.ac.in/noc22_cs40/preview 4. https://archive.nptel.ac.in/courses/106/105/106105151/ 5. https://nptel.ac.in/courses/106105151

	Course Outcomes	
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Recall the basic concept of procedure and object-oriented programming	K1
CO2	Illustrate the fundamental definitions and concepts of C and C++ Programming	K2
CO3	Apply the concept of decision-making, looping, arrays, functions and OOP concepts	K3
CO4	Analyze various programming constructs of C and C++	K4
CO5	Evaluate and Discuss the suitable logic and principles of C and C++ Programming for solving real-time application problems	K5, K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	1	3	1	3	2	2	2	2	2.1
CO2	3	3	2	2	1	3	2	2	2	2	2.2
CO3	3	3	1	3	2	3	3	3	3	3	2.7
CO4	3	3	3	3	3	3	3	3	3	2	2.9
CO5	3	3	3	3	2	3	3	3	3	2	2.8
									Mean Overall Score		2.54
									Correlation		High

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. O.A. Mohamed Jafar

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MCA1ACC2P	ADDL. CORE - II	-	5	100	-	100

Course Title	Computer Programming & Utilization Lab - Practical

Develop a C and C++Program to illustrate the use of

1. Arithmetic Statements

2. Different forms of if statements *(if, if-else and nested if-elses)*

3. Various Loop Control Structures *(while, do-while and for loop)*

4. Case Control Structure *(switch)*

5. Arrays

6. Call by Value and Call by Reference

7. Class and Object

8.   a) Inline Function

       b) Friend Function

9. Function Overloading

10. Arrays of Objects

11. Constructors

12. Operator Overloading

13. Inheritance

14. Pointers

15. File

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Demonstrate the evaluation of expressions and compare the various decision-making and looping statements	K2
CO2	Construct Object-Oriented Programs using class, objects and functions	K3
CO3	Analyze and Examine the result of the function overloading, operator overloading and constructors	K4
CO4	Compare the result of different Inheritance Programs	K5
CO5	Develop Object-Oriented Programs to solve real-life application problems	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	1	3	1	3	2	2	2	2	2.1
CO2	3	3	2	2	1	3	2	2	2	2	2.2
CO3	3	3	1	3	2	3	3	3	3	3	2.7
CO4	3	3	3	3	3	3	3	3	3	2	2.9
CO5	3	3	3	3	2	3	3	3	3	2	2.8
Mean Overall Score											2.54
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. O.A. Mohamed Jafar

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23MCA2CC8	CORE – VIII	4	3	25	75	100

Course Title	Data Structures and Algorithms

SYLLABUS		
Unit	**Contents**	**Hours**
I	Introduction – Definitions, Structures and Properties of Algorithms – Analysis of Algorithms – Arrays – Array Operations – Representation of Arrays in Memory – Stacks – Stack Operations – Queues – Operations on Queues – *Circular Queues* – Linked List – Singly Linked Lists – Circularly Linked Lists – Doubly Linked Lists – Applications.	12
II	Trees: Definition and Basic Terminologies – Representation of Trees – Binary Trees and Representation – Binary Tree Traversals – Binary Search Trees and AVL Trees – B-Trees and Tries – Hash Tables – Hash Table Structure – Hash Functions – *Linear Open Addressing*.	12
III	Graphs Algorithms – Definition and Basic Terminologies – Representation of Graphs – Graph Traversals – Applications: Single-source Shortest Path Problem – Minimum Cost Spanning Trees – Prim's Algorithm – Searching – Internal Sorting: Bubble Sort – Insertion Sort – Selection Sort – *Heap Sort*.	12
IV	**Divide and Conquer:** The General method – Binary Search – Finding the Maximum and Minimum – Merge Sort – Quick Sort – Strassen's Matrix Multiplication – **The Greedy Method:** The General Method – Knapsack Problem – *Job Sequencing with Deadlines*.	12
V	**Dynamic Programming:** The General Method – Multistage Graphs – 0/1 Knapsack – The Travelling Salesperson Problem – **Backtracking:** The General Method – The 8-Queen's Problem – *Sum of Subsets* – Graph Coloring.	12
VI	**Current Trends (For CIA only):** Complexity Analysis and Latest Trends of some algorithms	

…… Self Study

Text Book(s):

1. G.A. Vijayalakshmi Pai, *Data Structures and Algorithms, Concepts, Techniques and Applications*, Tata McGraw-Hill Education Private Limited, New Delhi, Third Reprint 2009.
2. Ellis Horowitz, Sartag Sahni and Sanguthevar Rajasekaran, *Fundamentals of Computer Algorithms*, Universities Press (India) Private Limited, Second Edition, Reprint 2011.

Reference Book(s):

1. J.P. Tremblay and P.G. Sorenson, *An Introduction to Data Structures with Applications*, Tata McGraw-Hill Publishing Company Limited, New Delhi, Second Edition, 26th Reprint, 2004.
2. V. Aho, J. E. Hopcroft, and J. D. Ullman, *Data Structures and Algorithms*, Pearson Education, 1983.

Web Resource(s):

1. https://www.cs.bham.ac.uk/~jxb/DSA/dsa.pdf
2. https://www.programiz.com/dsa
3. https://nptel.ac.in/courses/106102064
4. https://archive.nptel.ac.in/courses/106/106/106106127/

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall and Summarize the concept of data structures and algorithms	K1, K2
CO2	Identify and Apply the linear, non-linear data structures and the algorithm for performing various operations	K3
CO3	Analyze the data structures, algorithmic strategies, searching and sorting techniques for different application problems	K4
CO4	Evaluate and Explain the operations in data structures and design techniques	K5
CO5	Create and Discuss the suitable data structure and algorithm for solving mathematical and real-world problems	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	1	2	1	3	2	2	2	2	2.0
CO2	3	2	1	2	1	3	2	2	3	2	2.1
CO3	3	3	2	3	3	3	3	3	2	3	2.8
CO4	3	3	3	3	3	3	3	3	3	2	2.9
CO5	3	3	3	3	2	3	3	3	3	3	2.9
									Mean Overall Score		2.54
									Correlation		High

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. O.A. Mohamed Jafar

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23MCA2CC9	CORE – IX	4	3	25	75	100

Course Title	R Programming with Statistics

SYLLABUS		
Unit	**Contents**	**Hours**
I	Introduction to R –Downloading and installing R and R studio –How to Run R – A First R Session (use of R data set)– Data Types – Variables – Getting Help– R packages – Control Statements– Basic R Operators – Arithmetic, Relational and Boolean Operators – R Data structures– Vectors – Declarations–Recycling– Common Vector Operations – Using all () and any ()– Vectorized Operations–NA and NULL Values– Filtering– Testing Vector Equality–*Vector Element Names*.	12
II	Matrices and Arrays – Creating Matrices– General Matrix Operations–Applying Functions to Matrix Rows and Columns– Adding and Deleting Matrix Rows and Columns– More on the Vector/Matrix Distinction– Naming Matrix Rows and Columns– Higher-Dimensional Arrays – Lists – Creating Lists–General List Operations– Accessing List Components and Values– Applying Functions to Lists– Recursive Lists– Data Frames– Creating Data Frames– Other Matrix– Like Operations – Merging Data Frames– *Applying Functions to Data Frames*.	12
III	Factors and Tables – Factors and Levels – Common Functions Used with Factors – Working with Tables – Other Factor– and Table-Related Functions– R Programming Structures– Introduction to Functions – Variable Scope – Default Arguments – Return Values– Functions are Objects – No Pointers in R – Recursion –Replacement Functions – Anonymous Functions – Object-Oriented Programming – S3 Classes – S4 Classes– S3 Versus S4–*Managing Your Objects*.	12
IV	Input/ Output–Accessing the Keyboard and Monitor–Reading and Writing Files –String Manipulation - String-Manipulation Functions –Regular expressions – Graphics, Creating Graphics – Customizing Graphs– *Saving Graphs to Files*.	12
V	Doing Math and Simulations in R – Math Functions – Sorting – Set Operations – Simulation Programming in R – Generation of Pseudorandom Numbers – Built-in Random Variate Generators – Performing Statistical Calculations in R –Basic Statistical Measures: Mean –Median –Mode – Variance –Standard Deviation – *Correlation*– Regression–Functions for Statistical Distributions– Probability Distributions in R – Binomial – Poisson – Normal Distributions	12
VI	**Current Trends (For CIA only):** Importance of R in Data Science Professionals, How R is used for Data Analysis?	

…… Self Study

Text Book(s):
1. Norman Matloff, *The Art of R Programming: A Tour of Statistical Software Design*, No Starch Press, OREILLY & Associates Inc.
2. 2. Kandethody M. Ramachandran and Chris P.Tsokos, *Mathematical Statistics with Applications inR, Academic Press*, Second Edition, 2015.

Reference Book(s):
1. Seema Acharya : Data analytics using R, McGraw Hill Education (India) Private Limited,2018.
2. Jared P. Lander, *R for Everyone*, Pearson.

Web Resource(s):
1.https://www.geeksforgeeks.org/r-statistics/
2.https://www.w3schools.com/r

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	The main objective of the course is to understand the basics in R programming in terms of constructs, control statements and common vector operations.	K1, K2
CO2	Apply functions into lists and data frames	K3
CO3	Implementing the usage of R functions in Analytics Industry	K6
CO4	Creation of graphics in R	K4
CO5	Performing statistical operations in R	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	0	0	3	3	0	0	0	3	1.5
CO2	3	3	2	3	2	3	2	3	2	0	2.3
CO3	3	2	3	2	3	2	3	2	3	2	2.5
CO4	2	3	2	2	3	3	3	0	2	2	2.2
CO5	3	2	1	3	1	3	2	1	3	3	2.1
Mean Overall Score											2.12
Correlation											Medium

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

`**Course Coordinator: Dr. M. Mohamed Surputheen**

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23MCA2CC10	CORE – X	4	3	25	75	100

Course Title	Operating Systems

SYLLABUS		
Unit	**Contents**	**Hours**
I	Operating Systems Objectives and Functions – Operating System and User / Computer Interface, Operating System as a Resource Manager: Evolution of Operating Systems – Serial Processing, Sample Batch Systems, Multi Programmed Batch Systems, Time Sharing Systems – *Virtual Machines* – OS Design consideration for Multiprocessor and Multicore	12
II	Process – Process States - Process Description, Process Control – Processes and Threads, Concurrency – Principles of Concurrency, Mutual Exclusion – Deadlock Prevention, Deadlock Detection, Deadlock Avoidance. Memory Management – *Memory Management Requirements* – Memory Partitioning – Paging System – Segmentation	12
III	Virtual Memory – Paging – Address Translation in a Paging System, Segmentation – Organization, Address Translation in a Segmentation System – Combined Paging and Segmentation – *Virtual Memory* – Operating System Software – Fetch Policy, Placement Policy and Replacement Policy.	12
IV	Scheduling – Types of Scheduling, Scheduling Algorithms, Scheduling Criteria, FCFS, Round Robin, Shortest Process Next, Shortest Remaining Time, *Feedback Scheduling*	12
V	I/O Management and disk scheduling – Organization of the I/O function – the Evaluation of the I/O Function, Logical Structure of the I/O Function, I/O Buffering, Disk I/O – Disk Scheduling Policies, Disk Cache. File Management – Files, File Management Systems, Secondary Storage Management – *File Allocation*	12
VI	**Current Trends (For CIA only):** Importance of Scheduling and I/O management	

…… Self Study

Text Book(s):
William Stallings, Operating Systems – Internals and Design Principles, Seventh Edition, Prentice Hall, 2012

Reference Book(s):
1. Ann McIver McHoes and Ida M. Flynn, Understanding Operating Systems, Sixth Edition, Course Technology, Cengage Learning, 2011 2. Ann McHoes, Ida M. Flynn, Understanding Operating Systems, Seventh Edition, Cengage Learning, 2013. 3. Deital H.M., An Introduction to Operating Systems, Addison Wesley Publishing, 1998 4. Silberchatz A., Peterson J.L., Galvan P., Operating System Concepts, Third Edition, Addison Wesley Publishing Co., 1992

Web Resource(s):
https://repository.dinus.ac.id/docs/ajar/Operating_System.pdf

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Illustrate the services provided by the OS and the design of an operating system	K1 & K2
CO2	Make use of the different approaches to memory management	K3
CO3	Analyze the process scheduling and synchronization mechanisms	K4
CO4	Evaluate the structure and organization of the file system	K5
CO5	Discuss an understanding of different I/O techniques	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	1	3	1	3	3	2	1	1	2.1
CO2	3	3	2	3	3	3	3	3	2	2	2.7
CO3	3	3	3	2	2	3	3	2	2	3	2.6
CO4	3	3	1	3	3	3	3	2	3	2	2.6
CO5	3	3	3	3	2	3	3	3	3	2	2.8
Mean Overall Score											2.56
Correlation											High

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. D.I. George Amalarethinam

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23MCA2DE1A	DSE – I	4	4	25	75	100

Course Title	Computer Networks

SYLLABUS

Unit	Contents	Hours
I	Introduction – Uses of Computer Networks – Network Hardware: Personal Area Networks – Local Area Networks–Metropolitan Area Networks– Wide Area Networks – Internetworks. Network Software: Protocol Hierarchies – Design Issues for the Layers – Connection-Oriented Versus Connectionless service – Service Primitives. Reference Models: The OSI Reference Model–- The TCP/IP Reference Model. The Physical Layer: Guided Transmission Media. The Public Switched Telephone Network: Structure of the Telephone System – *Switching*.	12
II	The Data Link Layer: Data Link Layer Design Issues: Services Provided to the Network Layer – Framing - Error Control – Flow Control. Error Detection and Correction – Elementary Data Link Protocols – Sliding Window Protocols– The Medium Access Control Sub-layer Multiple Access Protocols: Carrier Sense Multiple Access Protocols – Collision-Free Protocols – *BLUETOOTH*– Data Link Layer Switching: Uses of Bridges-Learning Bridges – Spanning Tree Bridges – Repeaters, Hubs, Bridges, Switches, Routers, and Gateways.	12
III	The Network Layer: Network Layer Design Issues – Routing Algorithms: The Optimality Principle– Shortest Path Algorithm– Distance Vector Routing– Link State Routing– Hierarchical Routing – Broadcast Routing – Congestion Control Algorithms – The Network Layer in the Internet– The IP Version 4 Protocol– *IP Addresses*– IPv6.	12
IV	The Transport Layer: The Transport Service: Services Provided to the Upper layers – Transport Service Primitives – Berkeley Sockets – Elements of Transport Protocols – The Internet Transport Protocols: UDP – Introduction to UDP –*Remote Procedure Call* – TCP: Introduction to TCP – The TCP Service Model – The TCP Protocol – The TCP Segment Header.	12
V	The Application Layer: DNS: The Domain Name System– The DNS Name Space – Domain Resource Records Electronic Mail: Architecture and Services – The User Agent – Network Security: Cryptography – Introduction – Substitution & Transposition Ciphers – DES – RSA– Symmetric-Key Signatures – Public- Key Signatures – Communication Security: Firewalls– VPN– Authentication Protocols– Authentication Based on a Shared Secret Key – Establishing a Shared Key: *The Diffie-Hellman Key Exchange*.	12
VI	**Current Trends (For CIA only):** Cryptography, Internetworking Device and Internet	

…… Self Study

Text Book(s):
Andrew S. Tanenbaum and David J. Wetherall, *Computer Networks*, PHI, Fifth Edition, 2019.

Reference Book(s):
1. William Stallings, *Data and Computer Communication*, PHI, Eighth Edition, 2013. 2. Behrouz A. Forouzan, *Data Communication and Networking*, Fourth Eredition, Tata McGrawHill, 2007

Web Resource(s):
1. https://www.slideshare.net/pawan1809/computer-networks-a-tanenbaum-5th-edition

Course Outcomes

Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Recall the types of computer networks and their characteristics	K1
CO2	Understand the key design issues, principles and functions of network software, hardware, and reference models	K2
CO3	Apply the concepts of routing algorithms and congestion control techniques and knowledge of the transport layer and its services	K3
CO4	Analyze the error detection and correction techniques and multiple access protocols	K4
CO5	Evaluate the cryptography techniques and the effectiveness of authentication protocols and firewall techniques. Design and implement a basic network and solutions for network congestion control and error handling	K5,K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	0	0	3	3	0	0	0	3	1.5
CO2	3	3	3	3	2	3	3	3	2	0	2.5
CO3	3	2	3	2	3	2	3	3	3	2	2.6
CO4	2	3	2	2	3	3	3	0	2	2	2.2
CO5	3	3	3	3	3	3	2	3	3	3	2.9
Mean Overall Score											2.34
Correlation											Medium

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. G. Ravi

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23MCA2DE1B	DSE – I	4	4	25	75	100

Course Title	Network Security and Cryptography

SYLLABUS		
Unit	**Contents**	**Hours**
I	Introduction: Security Trends –The OSI Security Architecture –Security Attacks– Security Services – Security Mechanisms–A Model for Network Security– Symmetric Ciphers: Classical Encryption Techniques–Symmetric Cipher Model- Substitution Techniques–Transposition Techniques– Rotor Machines– *Steganography*.	12
II	Block Ciphers and the Data Encryption Standard: Block Cipher Principles–The Data Encryption Standard–The Strength of DES–Differential and Linear Cryptanalysis–Block Cipher Design Principles– Public-Key Encryption and Hash Functions: Introduction to Number Theory–Prime Numbers –*Fermat's and Euler's Theorems*– Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems –The RSA Algorithm.	12
III	Digital Signatures and Authentication Protocols: Digital Signatures–Authentication Protocols– Authentication Protocols. Network Security Applications: Authentication Applications–*Kerberos*– X.509 Authentication Service–Public-Key Infrastructure. Electronic Mail Security: Pretty Good Privacy –S/MIME.	12
IV	IP Security: IP Security Overview–IP Security Architecture –Authentication Header–Encapsulating Security Payload –Combining Security Associations–Key Management– Web Security: Web Security Considerations–Secure Socket Layer and Transport Layer Security–*Secure Electronic Transaction*	12
V	System Security: Intruders –Intruders –Intrusion Detection –Password Management – Malicious Software: Viruses and Related Threats–Virus Countermeasures –Distributed Denial of Service Attacks. Firewalls: Firewall Design Principles–*Trusted Systems*–Common Criteria for Information Technology Security Evaluation	12
VI	**Current Trends (For CIA only):** Security Management in the CLOUD	

…… Self Study

Text Book(s):
William Stallings, Cryptography and Network Security-Principles and Practices, Prentice-Hall, 4th edition, 2005
Reference Book(s):
1. Joseph Migga Kizza, Guide to Computer Network Security, Springer 2015.   2. AtulKahate, Cryptography and Network Security, Tata McGraw Hill, 2007.
Web Resource(s):
http://uru.ac.in/uruonlinelibrary/Cyber_Security/Cryptography_and_Network_Security.pdf

Course Outcomes

	Upon successful completion of this course, the student will be able to:	
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Analyze and design classical encryption techniques and block ciphers	K1, K2
CO2	Evaluate the authentication and public-key cryptography	K3
CO3	Demonstrate the IP Sec, Firewall, Web Security, and Email Security	K6
CO4	Comprehend the usage of firewalls and Intrusion Detection Systems for securing data	K4
CO5	Analyze and compare different security mechanisms and services	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	0	3	3	1	2	1	3	2.1
CO2	3	3	0	3	2	3	2	3	2	1	2.2
CO3	3	2	3	1	3	2	3	2	3	2	2.4
CO4	2	3	0	2	3	3	3	3	1	2	2.2
CO5	3	2	1	3	1	3	2	3	3	3	2.1
										Mean Overall Score	2.2
										Correlation	Medium

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Mr. S. Syed Ibrahim

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23MCA2DE1C	DSE – I	4	4	25	75	100

Course Title	Mobile Application Development

SYLLABUS		
Unit	**Contents**	**Hours**
I	**Getting to Know Android:** Why Android – Android Execution Environment – Components of an Android Application – Android Activity Lifecycle – *Android Service Lifecycle *.	12
II	**Setting Up Your Development Environment:** Creating an Android Development Environment – Starting a New Android Application: Hello World – Writing Hell World – *Running Hello World*.	12
III	**Debugging Android Applications:** The Tools – Eclipse Java Editor – Java Errors – Debugger – Logcat – Android Debug Bridge – *DDMS* – Traceview. **Building a View:** Android GUI Architecture – The Model – The View – The Controller.	12
IV	**Building a View:** Assembling a Graphical Interface – Writing Up the Controller – Listening to Model – Listening for Touch Events – Listening for Key Events – *Alternative Ways to Handle Events*.	12
V	**A Widget Bestiary:** Android Views – TextView – EditText – Button – ImageButton – Adapters – AdapterViews – CheckBoxes – RadioButtons – Spinners. ViewGroups – Layouts – Frame – Linear – Table – *Absolute – Relative*.	12
VI	**Current Trends (For CIA only):** Drawing 2D and 3D Graphics.	

…… Self Study

Text Book(s):
Rick Rogers, John Lombardo, Zigurd Mednieks, and Blake Meike, Android Application Development, Shroff Publishers & Distributors Pvt. Ltd. (O'Reilly), First Edition, 2014.

Reference Book(s):
Michael Burton and Donn Felker, Android Application Development for Dummies, John Wiley & Sons, 2nd Edition, 2014.

Web Resource(s):
1. https://www.tutorialspoint.com/android/android_studio.htm 2. https://www.javatpoint.com/android-tutorial 3. https://www.geeksforgeeks.org/android-tutorial/

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Outline the android development and execution environments.	K1
CO2	Analyse debugging android applications.	K4
CO3	Explain the Android GUI architecture.	K2
CO4	Design mobile Apps.	K6
CO5	Illustrate various event handlings.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	0	0	4	2	3	0	0	1.7
CO2	2	3	2	0	0	3	2	2	0	0	1.4
CO3	3	3	2	0	0	3	2	2	0	0	1.5
CO4	1	4	4	2	5	1	2	3	4	5	3.1
CO5	1	4	4	3	5	1	4	4	4	5	3.5
									Mean Overall Score		2.24
									Correlation		Medium

Mean Overall Score = Sum of Mean Score of COs / Total Number of Cos

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. K. Nafees Ahmed

Semester	Course Code	Course Category	Hours/	Credits	Marks for Evaluation

			Week		**CIA**	**ESE**	**Total**
II	23MCA2DE2A	DSE – II	4	4	25	75	100

Course Title	Data Science

SYLLABUS

Unit	Contents	Hours
I	Data Science in a big data world: Benefits and uses of data science and big data – Facets of data – The data science process – The big data ecosystem and data science– *An introductory working example of Hadoop* – The data science process: Overview of the data science process – Defining research goals and creating a project character – Retrieving data – Cleansing, integrating and transforming data–Exploratory data analysis – Build the models – Presenting findings and building applications on top of them.	12
II	Machine Learning: What is machine learning and why should you care about it – The modeling process – Types of machine learning – Semi-supervised learning – Handling large data on a single computer: The problems you face when handling large data – General techniques for handling large volumes of data – General programming tips for dealing with large datasets – Case Studies: Predicting malicious URLs – *Building a recommender system inside a database*.	12
III	First step in big data: Distributing data storage and processing with frameworks – *Case study: Assessing risk when loaning money* – Join the NoSQL movement: Introduction to NoSQL – Case study: What disease is that?	12
IV	The rise of graph databases: Introducing connected data and graph databases – Introducing Neo4j: a graph database – Connected data example: a recipe recommendation engine – Text mining and text analytics: Text mining in the real world – Text mining techniques – *Case study: Classifying Reddit posts*.	12
V	Data visualization to the end user: Data visualization options – Cross filter, the JavaScript MapReducelibrary – *Creating an interactive dashboard with dc.js* – Dashboard development tools– Data Ethics: Introduction – Building Bad Data Products – Trading Off Accuracy and Fairness – Collaboration – Interpretability – Recommendations – Biased Data – Data Protection – Go Forth and do Data Science: IPython – Mathematics – Not from Scratch – Find Data – Do Data Science.	12
VI	**Current Trends (For CIA only):** Tiny ML, Auto ML	

…… Self Study

Text Book(s):
1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Introducing Data Science, Manning Publications Co., First Edition, 2016. 2. Joel Grus, O'Reilly, Data Science from Scratch, Shroff Publishers & Distributors Pvt. Ltd, New Delhi, Second Edition, May 2019.
Reference Book(s):
J Valliappa Lakshmanan, O'Reilly, Data Science on the Google Cloud Platform, Shroff Publishers & Distributors Pvt. Ltd, New Delhi, Second Indian Reprint, June 2018.
Web Resource(s):
1. https://www.javatpoint.com/data-science 2. https://www.kaggle.com/kanncaa1/data-sciencetutorial-for-beginners

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand the fundamentals concepts and process of data science	K1, K2
CO2	Apply suitable machine learning techniques for handling large volume of data	K3
CO3	Analyse distributing data storage and NoSQL concepts	K4
CO4	Choose text mining techniques and make use of graph databases	K5
CO5	Design effective data visualizations and learn the basics of data ethics	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	0	3	3	2	3	3	3	5.2
CO2	3	3	2	3	3	3	3	3	0	3	5.2
CO3	3	3	2	3	3	3	0	3	2	3	5
CO4	3	3	3	3	2	3	3	0	2	3	5
CO5	3	3	2	3	3	0	3	3	0	3	4.6
Mean Overall Score											2.5
Correlation											High

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. S. A. Jameel

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23MCA2DE2B	DSE – II	4	4	25	75	100

Course Title	Big Data Analytics

SYLLABUS

Unit	Contents	Hours
I	Fundamentals of Big Data : The Evolution of Data Management – Understanding the waves of Managing Data – Defining Big Data – Building a Successful Big Data Management Architecture – Examining Big Data Types : Defining Structured Data – Defining Unstructured Data – Looking at Real Time and Non Real Time Requirements - Digging into Big Data Technology Components : Exploring the Big Data Stack – Redundant Physical Infrastructure – Security Infrastructure – Operational Databases – organizing data Services and Tools – *Analytical Data Warehouses* – Big Data Analytics – Big Data Applications.	12
II	Defining Big Data Analytics : Using Big Data to get Results – Modifying Business Intelligence Products to Handle Big Data – Studying Big Data Analytics Examples – Big Data Analytics Solutions – Understanding Text Analytics and Big Data : Exploring Unstructured Data – Analysis and Extraction Techniques – Putting Results Together with Structured Data – Putting Big Data to use – Text Analytics Tools for Big Data – Customized Approaches for Analysis of Big Data : Building New Models and Approaches to Support Big Data - *Understanding Different Approaches to Big Data Analysis*- Characteristics of a Big Data Analysis Framework.	12
III	Operationalizing Big Data : Making Big Data a Part of Your Operational Process - Integrating Big Data - Incorporating big data into the diagnosis of diseases - Understanding Big Data Workflows - Workload in context to the business problem - Ensuring the Validity, Veracity, and Volatility of Big Data - *Security and Governance* for Big Data Environments : Security in Context with Big Data - Understanding Data Protection Options - The Data Governance Challenge - Putting the Right Organizational Structure in Place - Developing a Well-Governed and Secure Big Data Environment.	12
IV	Appliances and Big Data Warehouses : Integrating Big Data with the Traditional Data Warehouse - Big Data Analysis and the Data Warehouse - Changing the Role of the Data Warehouse - Changing Deployment Models in the Big Data Era - Examining the Future of Data Warehouses - Examining the Cloud and Big Data : Defining the Cloud in the Context of Big Data - Understanding Cloud Deployment and Delivery Models - The Cloud as an Imperative for Big Data - *Making Use of the Cloud for Big Data* - Providers in the Big Data Cloud Market.	12
V	MapReduce Fundamentals : Tracing the Origins of MapReduce - Understanding the map Function - Adding the reduce Function - Putting map and reduce Together - Optimizing MapReduce Tasks - Exploring the World of Hadoop : Explaining Hadoop - Understanding the Hadoop Distributed File System – Hadoop Map Reduce - The Hadoop Foundation and Ecosystem - Building a Big Data Foundation with the Hadoop Ecosystem - Managing Resources and Applications with Hadoop YARN - *Storing Big Data with HBase* - Mining Big Data with Hive - Interacting with the Hadoop Ecosystem.	12

* …………..* Self Study

Text Book(s):
1.Judith Hurwitz, Alan Nugent, Dr. Fern Halper and Marcia Kaufman, "Big Data", Wiley Publications, 2013.
Reference Book(s):
Soumendra Mohanty, Madhu Jagadeesh and Harsha Srivatsa, Big Data Imperatives : Enterprise Big Data Warehouse, BI Implementations and Analytics" Apress Media, Springer Science+Business Media New York, 2013.
Web Resource(s):
www.it-ebooks.info

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Define big data and its technology components and Find the big data types and Acquire the knowledge of big data	K1,K2
CO2	Classify the big data analytics and Explain the big data Text Analytics	K2
CO3	Identify the Security and Governance for Big Data Environments and Making use of Operationalizing Big Data	K3
CO4	Appliances and Big Data Warehouses and Examining the Cloud and Big Data	K4
CO5	Explain Hadoop Distributed File System and Develop Managing Resources and Applications with Hadoop YARN and Interacting with the Hadoop.	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	2	3	3	2	0	2	3	2.3
CO2	3	2	3	3	2	3	2	2	2	3	2.5
CO3	3	2	3	2	3	3	2	2	2	2	2.4
CO4	2	3	2	2	3	3	2	2	0	2	2.1
CO5	2	3	2	1	2	3	2	2	2	3	2.2
									Mean Overall Score		2.3
									Correlation		Medium

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator : M. Abdullah

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23MCA2DE2C	DSE – II	4	4	25	75	100

Course Title	Microprocessors, Interfacing and Applications

SYLLABUS		
Unit	**Contents**	**Hours**
I	Overview of Microcomputer Systems – Hardware - Addresses – General Operation of a Computer - Intel 8086 CPU Architecture – Internal Operation –Machine Language Instructions – Addressing Modes – Instruction Formats – *Instruction Execution Timing* – Pin Configuration of 8086: Minimum Mode, Maximum Mode.	12
II	Assembler Language Programming – Assembler Instruction Format – Data Transfer Instructions – Arithmetic Instructions – Branch Instructions – Loop Instructions – Flag Manipulation Instructions – Logical Instructions – Shift and Rotate Instructions – Stack Instructions – Call and Return Instructions – *Macros* – String Instructions – REP Prefix – IN and OUT Instructions.	12
III	Assembly Language Programs – Addition, Subtraction, Multiplication and Division – Multibyte Addition and Subtraction – Complements – Assembly and Disassembly of a Word – Sum of a Series – Block Data Transfer – Finding the Smallest and the Biggest Number in an Array – *Arranging a Series of Numbers in Descending and Ascending Order* – Length of a String – Number of Occurrences of a Character in a String.	12
IV	I/O Interfaces – Functions – Address Space Partitioning: Memory Mapped I/O Scheme, I/O Mapped I/O Scheme – Memory and I/O Interfacing – Data Transfer Schemes – I/O Ports – Programmable Peripheral Interface – *Programmable DMA Controller*.	12
V	Microprocessor Applications – Delay Subroutines – Seven Segment Displays – *Frequency Measurement* – Temperature Measurement – Water Level Indicator and Controller – Traffic Lights Control.	12
VI	**Current Trends (For CIA only):** Recent advances in microprocessor technology	

...... Self Study

Text Book(s):
1. Yu-cheng Liu and Glenn A. Gibson, Microcomputer Systems–The 8086/8088 Family – Architecture, Programming and Design, Prentice Hall of India, Second Edition, 2011.   2. B. Ram, Fundamentals of Microprocessors and Microcontrollers, Dhanpat Rai Publications, Seventh Edition, 2011.
Reference Book(s):
1. Douglas V. Hall, Microprocessors and Interfacing – Programming and Hardware, Tata McGraw Hill, Revised Second Edition, 2006.   2. K Bhurchandi, Advanced Microprocessor and Peripherals, McGraw Hill Education, Third Edition, 2017.
Web Resource(s):
1. https://www.javatpoint.com/8086-microprocessor   2. https://www.tutorialspoint.com/microprocessor/microprocessor_io_interfacing_overview.htm

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand the architecture and functionality of a microprocessor and peripheral devices	K1, K2
CO2	Classify the instruction set of a microprocessor and distinguish the functions of different instructions	K3
CO3	Identify the different ways of interfacing memory and I/O with microprocessors.	K4
CO4	Demonstrate programming proficiency by developing assembly language programs	K5
CO5	Design microprocessor-based systems for real time applications	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	2	3	3	2	2	2	2	2.4
CO2	3	3	2	3	2	3	2	3	2	2	2.5
CO3	3	3	2	3	3	3	2	2	2	3	2.6
CO4	3	3	2	3	3	3	3	2	1	3	2.6
CO5	3	2	3	2	2	3	2	3	3	2	2.5
										Mean Overall Score	2.52
										Correlation	High

Mean Overall Score = Sum of Mean Score of COs / Total Number of Cos

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. T. Abdul Razak

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23MCA2CC11P	CORE – XI	4	3	20	80	100

Course Title	Data Structures Lab - Practical

Develop a C/C++ Program to implement:

1. Insert and Delete Operations in an Array

2. Push and Pop operations on Stack.

3. Convert infix expression into postfix expression using Stack.

4. Evaluate postfix expression by using Stack

6. Insert and Delete operations on Queue

7. Insert and Delete operations on a Linked List

8. Preorder, Inorder and Postorder Traversal of a Binary Tree

9. Dijkstra's Algorithm to find Shortest Path

10. Prim's Algorithm to find Minimum-Cost Spanning Tree

11. i) Linear Search
    ii) Binary Search

12. i) Bubble Sort
    ii) Insertion Sort

13. i) Selection Sort
    ii) Quick Sort

14. Merge Sort

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Demonstrate the various operations performed in linear data structure	K2
CO2	Construct the programs to perform some applications of stack	K3
CO3	Analyze the programs using the data structures, algorithmic strategies, searching and sorting techniques for different application problems	K4
CO4	Evaluate and Interpret the results of different traversals and shortest path algorithms	K5
CO5	Create and Develop programs using suitable data structure and algorithmic techniques for solving mathematical and real-world problems	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	1	2	1	3	2	2	2	2	2.0
CO2	3	2	1	2	1	3	2	2	3	2	2.1
CO3	3	3	2	3	3	3	3	3	2	3	2.8
CO4	3	3	3	3	3	3	3	3	3	2	2.9
CO5	3	3	3	3	2	3	3	3	3	3	2.9
Mean Overall Score											2.54
Correlation											High

Mean Overall Score = Sum of Mean Score of COs / Total Number of Cos

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. O.A. Mohamed Jafar

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23MCA2CC12P	CORE – XII	4	3	20	80	100

Course Title	R Programming Lab - Practical

Develop R program to

1. a) Demonstrate some Built-in mathematical and statistical functions.
   b) Take input from the keyboard (name and age) and display the values
   c)   Display the message "Welcome to MCA Course" using
                 i) print function ii) cat function

2. Demonstrate control statements

3. a) Create a vector using i) c command ii): operator and iii) seq() function.
   b) Sort a Vector in ascending and descending order.
   c) Find a second-highest value in a given vector

4. a) Merge two given lists into one list.
   b) Convert a given matrix to a list.
   c) Count the number of objects in a given list.

5. a) Create two 3x3 matrices and perform addition, subtraction, multiplication, division operations
   b) Read a matrix and perform various operations like Transpose, inverse, row sum,
       column sum andtrace
   c) Solve a linear system of equations

6. a) Get the statistical summary and nature of the data of a given data frame.
   b) Implement data frames in R. Write a program to add columns and rows in a data frame using
       bind () and bind () in R.
   c) Find the elements which are present in two given data frames

7, a) Create an ordered factor from data consisting of the names of months.
    b) Concatenate two given factors in a single factor.
    c) Change the first level of a factor with another level of a given factor.

8. a) Count the odd numbers in a vector of integers using a function named 'odd count ()'.
   b) Create a function named 'sum' to perform the addition of three numbers by passing
                 i)   arguments ii) default arguments
   c) Print the multiplication table for any given number.

9. a) Test whether a given string is a palindrome or not using the function
   b) Create, read, and display i) CSV file   ii) excel file
   c) Create a simple bar chart, pie chart, and scatter plots of five subject's marks
         (Use any pre-defined data set)

10. a) Perform the various operations on set.
    b) Generate random numbers from the uniform distribution.
    c) Compute the various statistical measures like mean, median, mode variance,
        standard deviation,and correlation. (use any data set)
    d) Calculate probabilities for Binomial, Poisson, and Normal distributions.

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Demonstrate the various built-in mathematical and statistical functions	K2
CO2	Construct the programs to create a vector and matrices	K3
CO3	Analyze the programs using the statistical summary and data frames	K4
CO4	Evaluate the simple charts using pie, scatter plots and random numbers	K5
CO5	Create and Develop programs using various operations on set, random numbers from the uniform distributions, binomial and Poisson distribution	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	3	3	2	0	2	3	2.3
CO2	3	2	3	3	2	3	2	2	2	3	2.5
CO3	3	2	3	2	3	3	2	2	2	2	2.4
CO4	2	3	2	2	3	3	2	2	0	2	2.1
CO5	2	3	2	1	2	3	2	2	2	3	2.2
									Mean Overall Score		2.3
									Correlation		Medium

Mean Overall Score = Sum of Mean Score of COs / Total Number of Cos

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. M. Mohamed Surputheen

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total

II	23MCA2SE2	Skill Enhancement Course – II	2	2	-	100	100

Course Title	Quantitative Aptitude

SYLLABUS

Unit	Contents	Hours
I	Numbers, HCF, LCM, Decimal Fractions, Simplification, Square Roots, Cube Roots, *Averages*, Problems in numbers and ages.	6
II	Surds, Indices, Percentages, Profit and Loss, Ratio and Proportion, Partnership, Chain Rule, *Time and Work*, Pipes and Distances.	6
III	Time and distance, Problems on Trains, Boats and Streams, Alligation, Simple Interest, Compound Interest, *Logarithms, Area*	6
IV	Volume and Surface Area, Races and Games of Skill, Calendar, Clocks, Stocks and Shares Permutation and Combination, *Probability*.	6
V	True discount, Banker's Discount, Height and Distances, Odd man out and Series, Tabulation, Bar graphs, *Pie charts, Line Graphs*.	6
VI	**Current Trends (For CIA only):** Prepare Computer Programs to solve scientific and the mathematical problems.	

…… Self Study

Text Book(s):
R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S.Chand and Co. Ltd, 2020.

Reference Book(s):
Barron's, Guide for GMAT, Galgotia Publications, 2018.

Web Resource(s):
1. https://www.placementpreparation.io/quantitative-aptitude/   2. https://www.indiabix.com/aptitude/questions-and-answers/

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Compare & Classify The Various Mathematical Theorems & Formulae	K1, K2
CO2	Perform Calculations Using Formulae	K3
CO3	Design Methods To Solve Problems	K6
CO4	Analyse The Given Problems And Select The Method To Solve	K4
CO5	Determine The Methods To Solve The Given Problem	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	0	0	3	3	0	0	0	3	1.5
CO2	3	3	2	3	2	3	2	3	2	0	2.3
CO3	3	2	3	2	3	2	3	2	3	2	2.5
CO4	2	3	3	2	2	3	3	0	2	2	2.2
CO5	3	2	2	3	2	3	2	1	3	3	2.4
										Mean Overall Score	2.18
										Correlation	Medium

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. A. R. Mohamed Shanavas

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23MCA2ACC3	ADDL.CORE - III	-	5	100	-	100

Course Title	Web Design

SYLLABUS		
Unit	**Contents**	**Hours**
I	Introduction to the Internet – Computers in Business– Networking– Internet– E-Mail– Resource Sharing– Gopher– World Wide Web– Usenet–Telnet– Bulletin Board Service– Wide Area Information Service – Internet Technologies– Modem– Internet Addressing– Physical Connections– Telephone Lines– *Internet Browsers – Internet Explorer*– Netscape Navigator.	15
II	Introduction to HTML – *History of HTML*– HTML Documents– Anchor Tag– Hyper Links – Head and Body Sections – Header Section – Title– Prologue– Links– Colorful Web Page– Comment Lines.	15
III	Designing the Body Section – Heading Printing– Aligning the Headings– Horizontal Rule –Paragraph–Tab Settings– Ordered and Unordered Lists – Lists – Unordered Lists– Ordered Lists – Nested Lists – Table Handling – Tables –* Table Creation in HTML* – Width of the table and cells.	15
IV	JavaScript: JavaScript in Web Page–The advantage of Java Script–Writing JavaScript into HTML–Basic programming Techniques – Data types and Literal – Type Casting–JavaScript Arrays– *Operators and Expressions*.	15
V	Functions–User defined functions–Placing text in a browser–Dialog Boxes–Form object's methods – *Built-in objects–User defined Objects*.	15
VI	**Current Trends (For CIA only):** Developing HTML and JavaScript coding for simple real world problems.	

…… Self Study

Text Book(s):
1. C. Xavier, World Wide Web Design with HTML, Tata McGraw Hill Company Limited, New Delhi, 2017. 2. Ivan Bayross, HTML, DHTML, JavaScript, Perl, CGI, BPB, Third Revised Edition, 2006.
Reference Book(s):
1. Thomas A. Powell, The Completer reference HTML, Tata McHill, Second Edition, 2000. 2. John Pollock, JavaScript a Beginners Guide, Fifth Edition, Tata McGraw Hill, 2019.
Web Resource(s):
1. https://www.programiz.com/c-programming 2. https://www.geeksforgeeks.org/object-oriented-programming-in-cpp/

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall the fundamental concepts of Internet and its technologies	K1
CO2	Illustrate the knowledge of HTML	K2
CO3	Apply the knowledge of JavaScript	K3
CO4	Analyze and evaluate the different functions and their uses	K4, K5
CO5	Develop and Explain the web pages for real world problems	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	3	1	3	2	3	2	2	2.4
CO2	3	3	3	3	2	3	2	3	2	2	2.6
CO3	3	3	1	3	1	3	2	3	3	3	2.5
CO4	3	3	3	2	2	3	3	3	3	2	2.7
CO5	3	3	3	3	2	3	3	3	3	2	2.8
									Mean Overall Score		2.6
									Correlation		High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. S.A. Jameel

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23MCA2ACC4P	ADDL. CORE - IV	-	5	100	-	100

Course Title	HTML and JavaScript Lab – Practical

1. Develop a HTML document and perform the basic alignments on the headers and format the document using suitable tags.

2. Develop a HTML document to display the Chemical equations.

3. Develop a HTML document to display the advantages and disadvantages of Internet using ordered and unordered list tags facilities.

4. Develop a home page for your company with suitable name, logo, pictures, back ground design and color text with links.

5. Design a web page of your meals menu for a week using table tag with its attributes.

6. Develop a simple application by using frame controls.

7. Develop a web page to display the Resume registration form with suitable controls.

8. Develop a JavaScript to compute the sum of an array of Integers.

9. Develop a JavaScript to perform multiplication & division of two numbers by getting from user

10. Develop a JavaScript that reads five integers and determines the largest and the smallest integers in the group.

11. Develop a JavaScript for a recursive function to calculate the Fibonacci value of a given number.

12. Develop a JavaScript function to display current date and time using date object.

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Demonstrate the basic alignments and chemical equations	K2
CO2	Construct a home page for a company	K3
CO3	Analyze and Examine the result of the sum of array of integers, perform multiplication and division of two numbers	K4
CO4	Compare the result of recursive function	K5
CO5	Develop a web page to display resume registration with suitable controls	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	1	3	1	3	2	2	2	2	2.1
CO2	3	3	2	2	1	3	2	2	2	2	2.2
CO3	3	3	1	3	2	3	3	3	3	3	2.7
CO4	3	3	3	3	3	3	3	3	3	2	2.9
CO5	3	3	3	3	2	3	3	3	3	2	2.8
Mean Overall Score											2.54
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. S.A. Jameel

Semester	Course Code	Course Category	Hours/	Credits	Marks for Evaluation

			Week		CIA	ESE	Total
III	23MCA3CC13	CORE – XIII	4	3	25	75	100

Course Title	PYTHON PROGRAMMING

SYLLABUS		
Unit	**Contents**	**Hours**
I	Basics of Python programming: Features of Python - History of python - The Future of python – Literals and Constants - Variables and Identifiers – Datatypes - Input Operation-Comments - Reserved Words – Indentation - Operators and Expressions -Expressions in python - Type conversion. Decision Control Statements: Introduction to Decision Control Statements -Selection/conditional Branching Statements.	12
II	Basic Loop Structure/Iterative Statements - Nested loops - The Break Statement - The continue statement - The pass statement - The else statement used with loops. Functions and Modules: Introduction - Function Definition - Function call - Variable Scope and Lifetime - The return statement - * Recursive functions – Modules *.	12
III	Python Strings: Introduction: Concatenating, Appending and multiplying Strings - Built-in String Methods and Functions - Slice operation - Comparing Strings. File handling: Introduction - File path - Types of Files-Opening and closing files - Reading and writing files - Renaming and deleting files - Directory Methods - Data * Structures: Sequence – Lists - Tuple-Sets – Dictionaries *	12
IV	Error and Exception Handling: Introduction to Errors and exceptions- Handling Exceptions-Handling Exceptions in Invoked Functions-Built-in User defined Exceptions - Finally Block - pre-defined Clean-up Action - Re-raising Exception. Python - File Handling - Write to File - Read Files - * Renaming and Deleting Files – Directories * - File Methods - OS File/Directory.	12
V	MySQL Database Access: What is MySQL – Database Connection – Creating Database Table – Performing Transactions –Disconnecting database. Network Programming: What is Socket – The Socket module – Server Socket Methods – * Client Socket Methods – General Socket Methods * – A Simple Server – A Simple Client. Introduction to Django – The basics dynamics web pages.	12
VI	**Current Trends (For CIA only) –** Contemporary developments related to the course during the semester concerned.	

……… Self Study

Text Book(s):
1. Reema Thareja. "Python Programming", Oxford University Press, 2021 2. Adrian Holovaty, Jacob K. Moss, Django, 4th Edition, 2008
Reference Book(s):
1. Bill Lubanovi, Introducing Python, Shroff Publishers & Distributors PVT. LTD., First edition, 2015
Web Resource(s):
1. https://www.python.org
2. https://www.programiz.com/python-programming
3. https://www.w3schools.com/python/python_intro.asp

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand the building blocks of python programming	K1, K2
CO2	Apply the various control structures and functions to real time problems	K3
CO3	Perform the List, Tuple and Dictionary concepts	K4
CO4	Implement the MySQL queries and File handling operations with applications	K5
CO5	Design and develop Client Server network applications using the GUI components	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	3	2	3	2	2	2	3	2	2.3
CO2	3	3	2	2	2	2	2	2	2	2	2.2
CO3	2	2	3	2	3	2	2	2	3	3	2.4
CO4	2	2	2	3	2	2	2	3	2	3	2.3
CO5	3	2	3	2	3	2	2	2	3	2	2.4
									Mean Overall Score		**2.30**
									Correlation		**Medium**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator   Mr. M. Kamal

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23MCA3CC14	CORE – XIV	4	3	25	75	100

Course Title	WEB PROGRAMMING

SYLLABUS

Unit	Contents	Hours
I	What is C#? – Why C#? – Evolution of C# - Characteristics of C# - Applications of C# - How does C# differ from C++ & Java – The origin of .Net Technology – The .Net framework – The Common Language Runtime - .Net Languages – Benefits of the .Net Approach – C# and the .Net – Literals – Variables – Data Types – Declaration and initialization of variables – Constant variables – Scope of Variables – * Boxing and unboxing *	12
II	Operators in C - Expressions in C - Decision making with if statement – Simple if statement – if..else statement – nested if..else statement – else if ladder – switch statement – ?: operator – while statement – do statement – for statement – foreach statement – jumps in loops – Declaring methods – main methods – invoking methods – nesting of methods – pass by value – pass by reference – * Handling arrays in C# *	12
III	Evolution of .NET – Benefits – Architecture of .NET Framework – Common Language Runtime - .NET Framework Class Library – Common Language Specification – Common Type System – Features of ASP.NET – The ASP.NET technologies – The ASP.NET Life Cycle – * Snapshot of .NET related technologies *	12
IV	Specifying a location for a web application – File types – Understanding ASP.NET Page Directives – Web Forms: Standard Controls – Navigation Controls – Validation Controls – * HTML Controls *	12
V	Working with Database Controls – LINQ Queries: Introduction – Standard Query Operators – LINQ to Objects – LINQ to ADO.NET – Exploring ADO.NET entity framework – Features – * Understanding the Entity Data Model – The EDM types* – Understanding Entity SQL language – ADO.NET Metadata	12
VI	**Current Trends (For CIA only):** .NET game development, web-based apps using .NET, .NET for IoT networks	

……… Self Study

Text Book:
1. "Programming in C#", E. Balagurusamy, Tata McGraw-Hill, 2006. 2. Kogent Learning Solutions, "ASP.NET 3.5 Black Book", Reprint 2010, Dreamtech Press.
Reference Book(s):
1. Matthew MacDonald, "The Complete Reference ASP.NET", Tata McGraw-Hill Edition, Fifteenth Reprint, 2006 2. Kogent Solutions Inc. "ASP.NET 3.5 Black Book", Dreamtech Press, 2010
Web Resource(s):
1. https://dotnettutorials.net/course/csharp-dot-net-tutorials/ 2. https://www.javatpoint.com/asp-net-tutorial

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Remembering the fundamental concept of .NET languages	K1
CO2	Illustrate the concepts like validation controls and creating web pages	K2
CO3	Apply appropriate problem-solving strategies	K3
CO4	Design web-based application using databases	K5
CO5	Create a ASP.NET applications to solve the real time problems	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	3	3	3	2	1	2	2.4
CO2	3	3	3	2	1	3	3	3	2	2	2.5
CO3	3	2	3	2	3	2	3	3	3	2	2.6
CO4	2	3	2	2	3	3	3	2	2	2	2.4
CO5	3	3	3	3	3	1	2	2	2	2	2.4
									Mean Overall Score		**2.46**
									Correlation		**Medium**

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. S. Mohamed Iliyas

Semester	Course Code	Course Category	Hours/	Credits	Marks for Evaluation

			Week		**CIA**	**ESE**	**Total**
III	23MCA3CC15	CORE – XV	4	3	25	75	100

Course Title	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

SYLLABUS		
Unit	**Contents**	**Hours**
I	Introduction – Definition of AI- AI Problems – Underlying Assumption – Al Technique – Level of the Model - Criteria for Success. Problems, Problem Spaces, Search: Defining the Problem as State Space Search - Production Systems - Problem Characteristics – Production System Characteristics - * Issues in the Design of Search Programs *.	12
II	Heuristic Search Techniques: Generate and Test - Hill Climbing- Best-First-Problem –Problem Reduction- Constraint Satisfaction- Means-end analysis. Game Playing: Minimax Search Procedure – Adding Alpha-beta Cut-offs – Additional Refinements. Knowledge Representation Issues: Representations and Mappings - Approaches to Knowledge Representations -Issues in Knowledge Representations - * Frame Problem *.	12
III	Predicate logic: Representing Simple Facts in Logic - Representing Instance and ISA Relationships - Computable Functions and Predicates - Resolution - Natural Deduction. Representing Knowledge Using Rules: Procedural Versus Declarative knowledge – Logic programming - * Forward Versus Backward reasoning *- Matching - Control knowledge.	12
IV	Learning: Types of Learning - Machine Learning - Intelligent Agents. Clustering: k-Means Clustering - Fuzzy clustering - Hierarchical clustering - Cluster similarity - Case Studies. Reinforcement learning: Markov Decision Problem - *Q-learning* - Temporal Difference Learning - Case Studies	12
V	Artificial Neural Nets: ANN Basics - ANN Learning Process-Types of Networks – Perceptron-RBF Networks- Case Studies. Supervised Learning: Support Vector Machines – Inductive Logic Programming –*Case-based Reasoning* -Nearest Neighbourhood - Fuzzy Network- Case Studies. Unsupervised Learning: Expectation Maximization – Self-organizing Maps - Adaptive Resonance Theory – Case Studies.	12
VI	**Current Trends (For CIA only) –** Low code and No code Machine Learning – General Adversarial Networks – Multimodal Machine Learning – Automated Machine Learning	

……… Self Study

Text Book(s):

1. Elaine Rich, Kevin Knight, Shivashankar B Nair, Artificial Intelligence, Tata McGraw-Hill Education Private Limited, Third Edition, Seventh Reprint 2011.
2. Vinod Chandra S.S and Anand Hareendran S, Artificial Intelligence and Machine Learning, PHI Learning Private Limited, 2014.

Reference Book(s):

1. Stuart J. Russell and Norvig, Artificial Intelligence – A Modern Approach, Second Edition, Pearson Education, 2007
2. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publishing House, 1992
3. Tom M. Mitchell, Machine Learning, McGraw Hill Education (India) Private Limited, 2018.
4. Ethem Alpaydin, Introduction to Machine Learning, Third Edition, PHI Learning Private Limited, 2018.
5. Peter Flash, Machine Learning, Cambridge University Press, 2019

Web Resource(s):

1. Welcome To Artificial Intelligence by Udemy
2. AI for Everyone by IBM on Coursera
3. Knowledge-Based AI: Cognitive Systems by Udacity

	Course Outcomes	
	Upon successful completion of this course, the student will be able to:	
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Understand the problem-solving methods using state space search	K1,K2
CO2	Recognize the heuristic techniques and issues in knowledge representation	K3
CO3	Apply the formal knowledge representation and reasoning for a problem	K4
CO4	Implement and apply the clustering and reinforcement machine learning algorithms	K5
CO5	Implement and apply the supervised and unsupervised machine leaning algorithms	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	3	3	0	2	3	3	3	2	2.4
CO2	3	3	3	2	2	3	3	2	3	0	2.4
CO3	3	2	0	3	3	2	3	2	0	2	2.0
CO4	2	3	3	0	2	2	3	0	2	2	1.9
CO5	3	2	3	2	0	3	2	3	3	0	2.1
									Mean Overall Score		2.10
									Correlation		Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. G. Ravi

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23MCA3DE3A	DSE – III	4	4	25	75	100

Course Title	PARALLEL PROCESSING

SYLLABUS		
Unit	**Contents**	**Hours**
I	Introduction to Parallel Processing – Evolution of Computer Systems – Parallelism in Uniprocessor Systems - Parallel Computer Structures - *Architectural Classification Schemes* - Parallel Processing Applications.	12
II	Memory and Input-Output Subsystems – *Hierarchical Memory Structure* – Virtual Memory System – Memory Allocation and Management – Cache Memories and Management – Input-Output Subsystems.	12
III	Principles of Pipelining and Vector Processing – Pipelining: An Overlapped Parallelism – Instruction and Arithmetic Pipelines – Principles of Designing Pipelined Processors – Vector Processing Requirements.	12
IV	Vectorization and Optimization methods – Parallel Languages for Vector Processing –Design of Vectorizing Compiler – Optimization of Vector Functions – SIMD Array Processors – SIMD Interconnection Networks – *Associative Array Processing*.	12
V	Multiprocessors Architecture and Programming – Functional Structures – Interconnection Networks - Parallel Memory Organizations – Multiprocessor Operating Systems – Language Features to Exploit Parallelism – Multiprocessor Scheduling Strategies.	12
VI	**Current Trends (For CIA only):** Convergence of HPC, AI and Big Data, Containerization and Orchestration, Energy efficiency and sustainability	

……… Self Study

Text Book:
Kai Hwang and Faye A. Briggs, Computer Architecture and Parallel Processing, McGraw Hill India, Edition, 2014.
Reference Book(s):
1. Introduction To Parallel Processing, By M. Sasikumar, Dinesh Shikhare, Ravi P.Prakash, Eastern Economy Edition,2014   2. Computer Architecture and Parallel Processing, Kai Hwang and Baye
Web Resource(s):
1. https://www.geeksforgeeks.org/introduction-to-parallel-computing/   2. https://archive.nptel.ac.in/courses/106/102/106102163/

	Course Outcomes	
	Upon successful completion of this course, the student will be able to:	
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Summarize on structures, classifications and applications of parallel processing	K2
CO2	Apply the knowledge of memory and input-output subsystems	K3
CO3	Examine the principles of Pipelining and Vector processing.	K4
CO4	Evaluate the knowledge about SIMD Array processors and Optimization methods.	K5
CO5	Discuss the concepts of Multiprocessor systems.	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	3	2	3	3	3	2	3	3	2.7
CO2	3	3	3	2	1	3	3	3	2	2	2.5
CO3	3	2	3	2	3	2	3	3	3	2	2.6
CO4	2	3	2	2	3	3	3	2	2	2	2.4
CO5	3	3	3	3	3	3	2	2	2	2	2.6
										Mean Overall Score	**2.56**
										Correlation	**High**

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. D.I. George Amalarethinam

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23MCA3DE3B	DSE – III	4	4	25	75	100

Course Title	QUANTUM COMPUTING

SYLLABUS		
Unit	**Contents**	**Hours**
I	Overview of traditional computing – Church-Turing thesis – circuit model of computation – reversible computation – quantum physics – quantum physics and computation – *Dirac notation and Hilbert Spaces* – dual vectors – operators – the spectral theorem – functions of operators – tensor products – Schmidt decomposition theorem	12
II	State of a quantum system – time evolution of a closed system – composite systems – measurement – mixed states and general quantum operations – quantum circuit model – quantum gates – universal sets of quantum gates – unitary transformations – *quantum circuits*	12
III	Superdense coding – quantum teleportation – applications of teleportation – probabilistic versus quantum algorithms – phase kick-back – the Deutsch algorithm – the Deutsch - Jozsa algorithm – Simon's algorithm – Quantum phase estimation and quantum Fourier Transform – *eigenvalue estimation*	12
IV	Order-finding problem – eigenvalue estimation approach to order finding – Shor's algorithm for order finding – finding discrete logarithms – hidden subgroups – Grover's quantum search algorithm – amplitude amplification – quantum amplitude estimation – quantum counting – *searching without knowing the success probability*	12
V	Computational complexity – black-box model – lower bounds for searching – general black-box lower bounds – polynomial method – block sensitivity – adversary methods – classical error correction – classical three-bit code – fault tolerance – quantum error correction – three- and nine-qubit quantum codes – fault-*tolerant quantum computation*	12
VI	**Current Trends (For CIA only):** Increasing qubit count and coherence times in quantum devices, Development of new quantum algorithms and optimization techniques	

……… Self Study

Text Book:
P. Kaye, R. Laflamme, and M. Mosca, "An introduction to Quantum Computing", Oxford University Press, 1999.

Reference Book(s):
V. Sahni, "Quantum Computing", Tata McGraw-Hill Publishing Company, 2007.

Web Resource(s):
1. https://www.geeksforgeeks.org/introduction-quantum-computing/ 2. https://www.javatpoint.com/what-is-quantum-computing 3. https://nptel.ac.in/courses/106106232

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Summarize on quantum physics and computation	K2
CO2	Apply the qubits and quantum model of computation	K3
CO3	Examine the principles quantum algorithms	K4
CO4	Evaluate the knowledge quantum amplitude estimation	K5
CO5	Discuss the concepts of fault tolerant quantum computation	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	3	2	3	3	3	2	3	3	2.7
CO2	3	3	3	2	1	3	3	3	2	2	2.5
CO3	3	2	3	2	3	2	3	3	3	2	2.6
CO4	2	3	2	2	3	3	3	2	2	2	2.4
CO5	3	3	3	3	3	3	2	2	2	2	2.6
									Mean Overall Score		2.56
									Correlation		High

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. D.I. George Amalarethinam

Semester	Course Code	Course Category		Credits	Marks for Evaluation

			Hours/Week		CIA	ESE	Total
III	23MCA3DE3C	DSE - 3	4	4	25	75	100

Course Title	CLOUD COMPUTING

SYLLABUS

Unit	Contents	Hours
I	Introduction to Cloud Computing: Roots of Cloud Computing - Layers and Types of Cloud - Features of a cloud -Infrastructure Management-Infrastructure as a Service Providers-Platform as a Service Providers Challenges and Risks. Broad Approaches to Migrating into the Cloud - *Seven Step Model ofMigration into a Cloud*.	12
II	The Evolution of SaaS-The Challenges of SaaS Paradigm- Approaching the SaaS Integration Enigma- New Integration Scenarios- The Integration Methodologies- SaaS Integration Products, Platforms and ServicesB2Bi Services -. Background of Enterprise cloud computing paradigm- Issues for Enterprise Applications on the Cloud- Transition Challenges- Enterprise Cloud Technology and Market Evolution-Business drivers toward a marketplace for Enterprise cloud computing- *The Cloud Supply Chain*.	12
III	The Anatomy of Cloud Infrastructure- Distributed Management of Virtual Infrastructures-Scheduling Techniques for Advance Reservation of Capacity- RVWS Design - Cluster as a Service: The Logical Design - Cloud Storage: from LANs TO WANs- *Technologies for Data Security in Cloud Computing*.	12
IV	Workflow Management Systems and Clouds - Architecture of Workflow Management Systems Utilizing Clouds for Workflow Execution- A Classification of Scientific Applications and Services inthe Cloud SAGA based Scientific Applications that Utilize Clouds. Map Reduce Programming Model-Major Map Reduce Implementations for the Cloud- Map Reduce Impacts and Research Directions. AModel for Federated Cloud Computing - Traditional Approaches to SLO Management- Types of SLA-Life Cycle of SLA - SLA Management in Cloud- *Automated Policy based Management*.	12
V	Grid and Cloud- HPC in the Cloud: Performance related Issues -Data Security in the Cloud-The CurrentState of Data Security in the Cloud- Homo Sapiens and Digital Information-Risk- Identity- The Cloud,Digital Identity and Data Security - Content Level Security : Pros and Cons- Legal Issues in Cloud Computing - Data Privacy and Security Issues- *Cloud on tracting models*- Case Studies : Aneka and Comet Cloud.	12
VI	**Current Trends (For CIA only):** AI and ML, Data Security, Multi and Hybrid Cloud Deployment, Edge Computing	

……… Self Study

Text Book(s):
1. Rajkumar Buyya, James Broberg, and Andrzej Goscinski, Cloud Computing - Principles and Paradigms,2011
Reference Book(s):
1. George Reese, ISBN: 184047142, Shroff/O'Reilly, Cloud Application Architectures,2009.
Web Resource(s):
1. https://www.tutorialspoint.com/management_concepts/supply_chain_management.htm   2. https://www.tutorialspoint.com/cloud_computing/cloud_computing_security.htm   3. https://www.tutorialspoint.com/cloud_computing/cloud_computing_tutorial.pdf

Course Outcomes

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

CO No.	CO Statement	Cognitive Level K-Leve1
CO1	To understand the Roots of the Cloud computing.	K1,K2
C02	To analyse the evolution of Cloud Paradigms.	K3
C03	To Discuss the anatomy of Cloud Infrastructure.	K4
C04	To explore the workflow management systems and Clouds	K5
C05	To identify the various issues in cloud and some Case studies	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOS)					Mean Score of COs
	PO1	P02	P03	P04	P05	PSOI	PS02	PS03	PS04	PS05	
CO1	2	2	2	3	3	2	3	2	3	2	2.4
C02	2	3	2	2	2	3	2	3	2	3	2.4
C03	2	1	3	2	2	3	2	1	3	1	2.0
C04	1	1	3	2	2	3	1	3	2	2	2.0
C05	2	3	3	2	2	2	2	1	2	3	2.2
Mean Overall Score											**2.20**
Correlation											**Medium**

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs : Medium

Mean Overall Score	Correlation
< 1.5	Low
> 1.5 and < 2.5	Medium
> 2.5	High

Course Coordinator: M. Abdullah

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23MCA3DE4A	DSE - IV	4	4	25	75	100

Course Title	SOFTWARE TESTING

SYLLABUS

Unit	Contents	Hours
I	Software Development Lifecycle Models: Phases of Software Project Life Cycle Models Testing Concepts, Issues, and Techniques: Purposes, Activities, Processes, and Context Questions about Testing Functional vs. Structural Testing-Coverage Based vs. Usage Based Testing Test Activities, Management, and Automation: Test Planning and Preparation Test Execution, Result Checking, and Measurement Analysis and Follow up-Activities, People, and *Management Test Automation*.	12
II	White Box Testing: Meaning Static Testing Structural Testing Challenges Black Box Testing: Meaning When & How to do Black Box Testing Integration Testing: Meaning Integration Testing as type of Testing As a Phase of Testing Scenario Testing Defect Bash.	12
III	System and Acceptance Testing: Overview Functional vs. Non-Functional Testing Functional System Testing Non-Functional Testing Acceptance Testing Summary of Testing Phases Performance Testing: Introduction *Factors Governing Performance Testing Methodology Tools Process* - Regression Testing: Meaning Types When & How to do Regression Testing Best Practices.	12
IV	Testing of Object Oriented Systems: Introduction Primer on Object Oriented Software Differences in OO Testing Usability and Acceptance Testing: Meaning Approach - Quality Factors for Usability Aesthetics Testing Accessibility Testing Tools for Usability - *Test Roles for Usability*.	12
V	Software Quality: Perspectives and Expectations-Quality Frame Works and ISO 9126 Correctness and Defects Historical Perspective of Quality Assurance: Classification Defect Prevention Defect Reduction Defect Containment- Quality Assurance in Context: Handling Discovered Defect During QA Activities QA Activities in Software Processes Quality Engineering: Activities and Process Quality Planning: *Goal Setting and Strategy Formation*-Quality Assessment and Improvement-Quality Engineering in Software Processes	12
VI	**Current Trends (For CIA only):** DevOps, Artificial Intelligence, Low code No code automation, Robotic process automation	

……… Self Study

Text Book(s):
1. Srinivasan Desikan and Gopalaswamy Ramesh, Software Testing Principles and Practices, Pearson Education, 2007.   2. Jeff Tian, Software Quality Engineering: Testing, Quality Assurance, And Quantifiable Improvement, Wiley India Edition, 2005.
Reference Book(s):
Advanced Software Testing, Rex Black, Jamie L Mitchell, published by Rocky Nook, 2011.
Web Resource(s):
1.https://www.tutorialspoint.com/software_engineering/software_development_life_cycle.htm   2. https://www.tutorialspoint.com/difference-between-functional-and-non-functional-testing   3.https://www.tutorialspoint.com/software_quality_management/software_quality_management_factors.htm

	Course Outcomes	
	Course Outcomes	
	Upon successful completion of this course, the student will be able to:	
CO No.	**CO Statement**	**Cognitive Level K-Leve1**
CO1	Identify the Models in Software Life Cycle.	K1,K2
C02	Clarify the Testing Methods.	K3
C03	Understand the concepts of System, Acceptance, Performance testing and its Practices.	K4
C04	Clarify the Testing of Object Oriented Systems.	K5
C05	Infer the Perspectives of software quality errors in software Processes	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOS)					Mean Score of COs
	PO1	**P02**	**P03**	**P04**	**P05**	**PSOI**	**PS02**	**PS03**	**PS04**	**PS05**	
CO1	2	2	2	3	3	2	3	2	3	2	2.4
C02	2	3	2	2	2	3	2	3	2	3	2.4
C03	2	1	3	2	2	3	2	1	3	1	2.0
C04	1	1	3	2	2	3	1	3	2	2	2.0
C05	2	3	3	2	2	2	2	1	2	3	2.2
										Mean Overall Score	**2.20**
										Correlation	**Medium**

Mean Overall Score	Correlation
< 1.5	Low
> 1.5 and < 2.5	Medium
> 2.5	High

Course Coordinator : M. Abdullah

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23MCA3DE4B	DSE – IV	4	4	25	75	100

Course Title	INTERNET OF THINGS

SYLLABUS		
Unit	**Contents**	**Hours**
I	Introduction: Definition and Characteristics of IoT-Things in IoT-IoT Protocols-IoT Functional Blocks-IoT Communication Models-IoT Communication APIs.	12
II	IoT Enabling Technologies: Wireless Sensor Networks-Cloud Computing- *Big Data Analytics* -Communication Protocols-Embedded System. IoT & M2M: Machine to Machine-Difference between IoT and M2M-SDN and NFV for IoT.	12
III	Domain Specific IoTs: Home Automation-Cities-Environment-Retail-Logistics- *Agriculture* -Industry-Health & Lifestyle.	12
IV	Developing IoTs: IoT Design Methodology. IoT Physical Devices & Endpoints: What is an IoT Device-Exemplary Device: Raspberry Pi-Linux on Raspberry Pi- *Other IoT Devices*	12
V	Python Packages of Interest for IoT: JSON-XML-HTTPLib & URLLib-SMTPLib. Case Studies: Home Automation- *Productivity Applications*.	12
VI	**Current Trends (For CIA only):** IoT supply chain issues, AI support for IoT data analytics, New chip design and standards	

……… Self Study

Text Book:
Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-On Approach", Universities Press (India) Private Limited, 1st Edition, 2015.

Reference Book(s):
Cuno Pfister, "Getting started with the internet of things", O'Rielly Publication.

Web Resource(s):
1. http://www.internet-of-things-book.com 2. https://www.tutorialspoint.com/internet_of_things/index.htm 3. https://data-flair.training/blogs/iot-tutorial

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Summarize on the underlying concepts of Internet of Things.	K2
CO2	Apply the various IoT enabling technologies and comprehend the idea of M2M.	K3
CO3	Examine the principles of IoT in real world scenarios.	K4
CO4	Evaluate the IoT design methodology and IoT devices	K5
CO5	Discuss the concepts IoT applications using Python packages.	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	3	3	3	2	3	3	2.7
CO2	3	3	3	2	1	3	3	3	2	2	2.5
CO3	3	2	3	2	3	2	3	3	3	2	2.6
CO4	2	3	2	2	3	3	3	2	2	2	2.4
CO5	3	3	3	3	3	3	2	2	2	2	2.6
Mean Overall Score											2.56
Correlation											High

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. K. Nafees Ahmed

Semester	Course Code	Course Category	Hours/	Credits	Marks for Evaluation

			Week		**CIA**	**ESE**	**Total**
III	23MCA3DE4C	DSE – IV	4	4	25	75	100

Course Title	COMPILER DESIGN

SYLLABUS		
Unit	**Contents**	**Hours**
I	Introduction to Compilers: Compilers and Translators – The Structure of a Compiler – Lexical Analysis – Syntax Analysis – Intermediate Code Generation – Optimization – Code Generation. Finite Automata and Lexical Analysis: *The Role of Lexical analyzer Regular Expressions* – Finite Automata – From a regular expression to Finite Automata – Minimizing the Number of States of a DFA.	**12**
II	The Syntactic Specification of Programming Languages: Context-free grammars – Derivations and parse trees. Basic Parsing Techniques: Parsers – Shift-reduce Parsing - Operator precedence parsing – Top-down Parsing – Predictive Parsers. Automatic Construction of Efficient Parsers: LR Parsers – The Canonical Collection of LR(0) items – Constructing SLR Parsing Tables - *Constructing canonical LR Parsing Tables*	**12**
III	Syntax Directed Translation: Syntax Directed Translation schemes: Implementation of Syntax Directed Translation - Intermediate code – Postfix Notation – Parse Trees and Syntax Trees – Three-address Code, Quadruples and Triples – Boolean Expressions	**12**
IV	Symbol Tables: The Contents of Symbol table – Data Structures for Symbol tables – Representing scope information - Runtime storage Administration: Implementation of a Simple Stack allocation scheme - Implementation of a Block Structured Languages. Error Detection and Recovery: Errors – Lexical-phase Errors - **Syntactic-phase Errors** – Semantic Errors	**12**
V	Introduction to Code Optimization: The Principal Sources of Optimization – Loop Optimization – The DAG Representation of Basic Blocks. Code Generation: Problems in Code Generation – A Machine Model – *A Simple Code Generator* – Register allocation and Assignment – Peephole optimization	**12**
VI	**Current Trends (For CIA only):** Optimization for Parallelism	

……… Self Study

Text Book:
Alfred V. Aho and Jeffrey D. Ullman, Principles of Compiler Design, Twenty fifth Reprint, Narosa Publishing House, New Delhi, 2002   **UNIT I** : Chapter 1(1.1,1.3–1.8) Chapter 3 (3.1, 3.3 – 3.6)\   **UNIT II** : Chapter 4 (4.1 – 4.2) Chapter 5 (5.1 – 5.5) and Chapter 6 (6.1 – 6.5)   **UNIT III** : Chapter 7 (7.1 – 7.6 and 7.8)   **UNIT IV** : Chapter 9 (9.1 – 9.3) Chapter 10 (10 1– 10.2) and Chapter 11 (11.1-11.4)   **UNIT V** : Chapter 12 (12.1 – 12.3) Chapter 15 (15.2– 15.5 and 15.7)

Books for Reference:
1. Dr. M. Joseph, Elements of Complier Design, University Science Press, 2011

Web Resource(s):
1. https://www.tutorialspoint.com/compiler_design/index.htm   2. https://onlinecourses.nptel.ac.in/noc21_cs07/preview   3. https://www.geeksforgeeks.org/compiler-design-tutorials/   4. https://karkare.github.io/cs738/

	Course Outcomes	
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
	Upon successful completion of this course, the student will be able to:	
CO1	Evaluate and analyse the lexical, syntactic and semantic structures of advanced language features	K1, K2
CO2	Apply the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation	K3
CO3	Understanding a scanner, parser, and semantic analyzer without the aid of automatic generators	K4
CO4	Analyse the techniques for intermediate code and machine code optimization	K5
CO5	Create the structures and support required for compiling advanced language features.	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	1	3	3	3	3	3	1	1	2.1
CO2	3	3	2	3	3	3	3	3	2	2	2.7
CO3	3	3	3	2	2	3	3	2	2	3	2.6
CO4	3	3	1	3	3	3	3	2	3	2	2.6
CO5	3	3	3	3	2	3	3	3	3	2	2.8
									Mean Overall Score		**2.56**
									Correlation		**High**

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. S. A. Jameel

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23MCA3CC16P	Core - XVI	4	3	20	80	100

Course Title	PYTHON PROGRAMMING LAB - PRACTICAL

Develop the programs using Python and MySQL

1. Develop a program that returns the second last digit of the given number. The second last digit is referring to the digit in the tens place in the given number

2. Develop a program that takes four inputs, extracts the biggest digits from the first two inputs, and the smallest digits from the last two inputs, and then adds these two sets of digits together.

3. Develop a program that takes a positive number as input and performs a digit sum of only the even and odd numbers in the given digits.

4. Develop a program that takes a string as input and returns its second word in uppercase. If the given input has fewer than two words, return 'INVALID STRING'.

5. Develop a program to find which digit occurs most frequently across the four given inputs.

6. Write a program to solve the following: Input = 865
   Output = (8 + 6 + 5) + (6 + 5) + 5 = 35

7. Write a program to find the number of vowels, consonants, and digits using string functions of given a string.

8. Develop a Menu driven program using various functions in List in Python

9. Develop a Menu driven program using various functions in Tuples in Python

10. Develop a Menu driven program using various functions in Dictionaries in Python

11. Develop a program to copy file contents from one file to another.

12. Develop a program for chatting applications using Sockets.

13. Develop a program to demonstrate exception handling.

14. Develop a program to perform database operations such as creating tables, inserting records, deleting data, and updating records using MySQL.

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	3	3	2	2	3	3	2	2.6
CO2	2	3	3	2	3	2	2	3	2	2	2.4
CO3	3	2	3	3	3	2	2	2	3	3	2.6
CO4	2	2	3	3	3	2	2	3	2	3	2.5
CO5	3	2	3	2	3	2	2	3	3	2	2.5
Mean Overall Score											2.50
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator   Mr. M. Kamal

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total

III	23MCA3CC17P	CORE – XVII	4	3	20	80	100

Course Title	WEB PROGRAMMING LAB – PRACTICAL

1. Write a C# program to read two integer values using the methods Console. ReadLine() and int.Parse() and then display their
- Sum
- Difference
- Product
- Integer Division
- Modulus Division

2. Programs in C# using if statement, if..else statement, nested if..else statement

3. Write a C# program to print the multiplication table using do..while loop

4. Programs in C# using pass by value and pass by reference methods.

5. Write a C# program that uses a method to sort an array of integers.

6. Write a program to display the following feedback form. The different options for the list box must be ASP-XML, DotNET, JavaPro and Unix,C,C++. When the Submit Form button is clicked after entering the data, a message as seen in the last line of the above figure must be displayed.

7. Write a program containing the following controls:
A ListBox, a Button, an Image, a Label
The listbox is used to list items available in a store. When the user clicks on an item in the listbox, its image is displayed in the image control. When the user clicks the button, the cost of the selected item is displayed in the control.

8. a) Write a program to get a user input such as the boiling point of water and test it to the appropriate value using CompareValidator.
   b) Write a program that uses a textbox for a user input name and validate it for RequiredField Validation.

9. Write a program that gets user input such as the user name, mode of payment, appropriate credit card. After the user enters the appropriate values the Validation button validates the values entered.

10. Write a program using AdRotator Control

11. a) Create a user control that contains a list of colors. Add a button to the Web Form which when clicked changes the color of the Form to the color selected from the list.
   b) Create a user control that displays the current date and time. Include it in a Web Form and refresh it each time a button is clicked.

12. Develop a project to update and delete few records using Disconnected Access.

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Demonstrate the ASP.NET concepts and techniques	K2
CO2	Construct and create web application using validation controls	K3
CO3	Apply the basic syntax of AdRotator Control	K5
CO4	Examine the results of database connections	K4
CO5	Make use of ASP.NET concepts to solve real-life application problems	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	3	2	3	2	2	2	2	2.4
CO2	3	3	3	2	2	3	3	3	2	2	2.6
CO3	3	2	3	2	3	2	3	3	3	0	2.4
CO4	2	3	2	2	3	3	3	2	2	2	2.4
CO5	3	3	3	3	3	3	2	3	3	3	2.9
Mean Overall Score											2.54
Correlation											High

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. S. Mohamed Iliyas

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total

III	23MCA3SE3	SEC – III	2	2	25	75	100

Course Title	INNOVATION AND STARTUP SKILLS

SYLLABUS		
Unit	**Contents**	**Hours**
I	Evolution of the Concept of Entrepreneur – Characteristics, Functions and types of an Entrepreneur – Corporate entrepreneurship –Indigenous entrepreneurship – women entrepreneurship– entrepreneurship in backward regions; – International entrepreneurship – *Entrepreneur biographies*	6
II	Strategies, resources and capabilities–identifying attributes of strategic resources – * Opportunity Analysis –SWOT analysis* – Business model- Pricing strategy.	6
III	Concept of innovation - difference between innovation and invention – Objectives of innovation - process of innovation- *creative problem solving* - organizational features that facilitate innovation	6
IV	Idea generation - discovery process for opportunities - idea generation process - methods for discovering opportunities - *Innovation and intellectual property rights* - Prototypes – Types of Prototypes.	6
V	Innovation in organizations- Types of innovation-decisions- Incentives for Innovating- organizing external innovators - Internal Policy- Policy Development – Attributes- *Adoption*	6
VI	**Current Trends (For CIA only):** Artificial Intelligence and virtual avatars, marketing in the metaverse, Blockchain, Decentralization	

……… Self Study

Text Book(s):
1. Carayannis, Elias G., Elpida T. Samara, and Yannis L. Bakouros. Innovation and entrepreneurship: theory, policy and practice. Springer, 2015. For UNIT I : Chapter 6, 7 2.   2. Furr, Nathan, and Jeff Dyer. The Innovator's Method: Bringing the Lean Start-Up Into Your Organization. Harvard Business Review Press, 2014. For UNIT II : Chapter 3, 6,7, 8 3.   3. Rogers, Everett M. Diffusion of innovations. Simon and Schuster, 2010. For UNIT III, IV & V : Chapter 1,5,7
Reference Book(s):
Hargadon, A. "How Breakthroughs Happen (Harvard Business School Press, Boston)." (2003).

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall the basic principles of entrepreneurship	K1
CO2	Explain and evaluate Business model and strategy	K2
CO3	Apply knowledge about innovation and creative problem solving	K3
CO4	Examine the idea generation and Intellectual Property Rights.	K4
CO5	Evaluate knowledge regarding Internal Policy and Organizational Culture.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	3	3	3	3	3	3	2.8
CO2	3	3	3	3	3	3	3	3	1	3	2.8
CO3	2	3	2	3	2	3	2	3	3	3	2.6
CO4	3	2	3	2	3	2	2	2	3	3	2.5
CO5	3	2	3	3	1	3	3	2	3	3	2.6
									Mean Overall Score		2.66
									Correlation		High

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. A. Jainullabdeen

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total

| III | 23MCA3ACC5 | ADDL. CORE – V | - | 5 | 100 | - | 100 |

| **Course Title** | COMPUTER GRAPHICS |

SYLLABUS		
Unit	**Contents**	**Hours**
I	Overview of Computer Graphics System: Video Display Devices –Raster Scan Systems–Random – Scan Systems -Graphics Monitors and Workstations – Input Devices –Hardcopy Devices –Graphics Software.	15
II	Output Primitives: Line Drawing Algorithms –Loading the Frame Buffer –Line Function –Circle – Generating Algorithms. Attributes of Output Primitives: Line Attributes –Curve Attributes – Color and Grayscale levels –Area fill Attributes –Character Attributes – Bundled Attributes –Inquiry Functions.	15
III	2D Geometric Transformations: Basic Transformation –Matrix Representations –Composite Transformations –Window to View port Co-Ordinate Transformations. Clipping: Point Clipping –Line Clipping –Cohen-Sutherland Line Clipping –Liang Barsky Line Clipping –Polygon Clipping – Sutherland –Hodgman Polygon Clipping –Curve Clipping –Text Clipping	15
IV	Graphical User Interfaces and Interactive Input Methods: The User Dialogue –Input of Graphical Data –Input Functions –Interactive Picture Construction Techniques. Three Dimensional Concepts: 3DDisplay Methods – Three-Dimensional Graphics Packages	15
V	3D Geometric and Modeling Transformations: Translation –Scaling –Rotation –Other Transformations. Visible Surface Detection Methods: Classification of Visible Surface Detection Algorithm –Backface Detection – Depth-Buffer Method – A-Buffer Method –Scan-Line Method – Applications of Computer Graphics.	15
VI	**Current Trends (For CIA only):** Introduction of Graphics Processing Unit, Virtual reality and augmented reality	

Text Book(s):
Donald Hearn M. Pauline Baker, Computer Graphics, Second Edition, Prentice Hall of India, New Delhi, 2005
Reference Book(s):
William M. Newman, Robert F. Sproull, Principles of Interactive Computer Graphics, Second Edition, Tata McGraw Hill, 26th Reprint, 2011.

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**

CO1	Define the basic concepts of computer graphics.	K1
CO2	Demonstrate the various output primitives and its attributes	K2
CO3	Apply the knowledge about 2D geometric transformation	K3
CO4	Analyze the various graphical user interface and interactive input methods.	K4
CO5	Determine the knowledge about 3D geometric and various modelling transformations.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	3	3	3	3	3	3	2.8
CO2	3	3	3	3	3	3	3	3	1	3	2.8
CO3	2	3	2	3	2	3	2	3	3	3	2.6
CO4	3	2	3	2	3	2	2	2	3	3	2.5
CO5	3	2	3	3	1	3	3	2	3	3	2.6
										Mean Overall Score	**2.66**
										Correlation	**High**

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. A.R. Mohamed Shanavas

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23MCA3ACC6P	ADDL. CORE – VI	-	5	100	-	100

Course Title	ANIMATION LAB – PRACTICAL

Develop the following programs using PENCIL and GIMP (Open-Source Animation Tools)

1. Use different tools and types of tweens to create a simple animation. (bouncing ball, bud blooming (morphing) into a flower)

2. Draw two Scenes for any Animation of your choice

3. Create an Animated Birthday Card

4. Create an animated advertisement

5. Create a simple story with a moral

6. Create an interactive Photo Album

7. Redesign any existing scenery giving it different effects. (waterfall, smoky night, rainbow colour, or fire effect)

8. Design a Brochure for a College.

9. Design an Invitation for an event.

10. Create a collage.

Course Outcomes		
Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Define the basic concepts of simple animation	K1
CO2	Demonstrate the various animated advertisement	K2
CO3	Apply the knowledge interactive photo album	K3
CO4	Analyze the design for creating brochure	K4
CO5	Choose the appropriate collage for an event	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	2	3	3	3	3	3	3	2.8
CO2	3	3	3	3	3	3	3	3	1	3	2.8
CO3	2	3	2	3	2	3	2	3	3	3	2.6
CO4	3	2	3	2	3	2	2	2	3	3	2.5
CO5	3	2	3	3	1	3	3	2	3	3	2.6
									Mean Overall Score		**2.66**
									Correlation		**High**

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. A. R. Mohamed Shanavas

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23MCA4CC18	Core - XVIII	4	3	25	75	100

Course Title	DISTRIBUTED TECHNOLOGY

SYLLABUS		
Unit	Contents	Hours
I	Distributed Component Architecture: Introduction- Methods of Distribution: Sockets, RPC, DCE, RMI, CORBA, DCOM-Multi-tier Architecture -Component Concepts-Characteristics- RMI: Basic concepts- Server side and Client side processes.	12
II	Introduction to Node.js- Features of Node.js – Environment Setup – REPL – NPM-Callback Concepts- Event Driven Programming-*Streams-File System* – Utility Modules	12
III	Presentation Techniques: Java Servlets – Reading Data from Client and HTTP Request Header-Sending Data to a Client and writing the HTTP Response Header-Working with Cookies- Tracking Sessions. Java Server Pages- JSP Tags – Tomcat-*Session objects*.	12
IV	Interconnection Techniques: Java Mail API: Send Email Message-Retrieving Email Messages- Deleting Email Messages-*Replaying and Forwarding an Email Message*. Java Messaging Services- JMS fundamentals- Components-Sending and Receiving Message on Queue-Compiling and running the Publisher and Subscriber.	12
V	Component Programming: Enterprise Java Beans - Deployment Descriptors-Session Java Bean - Life cycle of Session Beans - Entity Java Bean – Life cycle of Entity Bean – Message Driven Bean- Life cycle of Message Driven Bean –*The JAR file*.	12
VI	**Current Trends (For CIA only):** Developing distributed Java applications for simple real world problems	

……… Self Study

Text Book(s):

1. G. SudhaSadasivam, Distributed Component Architecture, Wiley India Pvt. Ltd, 2008.
   UNIT I : Chapter 1 – 1.1, 1.3, 1.5 & 1.6
2. Jim Keogh, J2EE-The Complete Reference, Tata McGraw Hill Education Pvt. Ltd, 2010
   UNIT I : Chapter 6   **UNIT III** : Chapter 10,11
    UNIT IV: Chapter 13,15 and 16   **UNIT V**: Chapter 12

Reference Book(s):
Richard Monson Haefel, Enterprise Java Beans, O 'Reilly Fourth Edition, 2004

Web Resource(s):
1. http://www.tutorialspoint.com/nodejs/nodejs_quick_guide.htm

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Remember the fundamental concepts of two tier and three-tier technologies in Java	K1
CO2	Understand the fundamental definitions and concepts of distributed programming	K2
CO3	Apply the concept of COM technologies in the real-world problems	K3
CO4	Analyze various technologies and their significances	K4
CO5	Design & Develop the simple web based applications using RMI, JavaMail API and JMS	K5 & K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	3	3	3	3	3	3	2.8
CO2	3	3	3	3	3	3	3	3	1	3	2.8
CO3	2	3	2	3	2	3	2	3	3	3	2.6
CO4	3	2	3	2	3	2	2	2	3	3	2.5
CO5	3	2	3	3	1	3	3	2	3	3	2.6
										Mean Overall Score	**2.66**
										Correlation	**High**

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. S. Abdul Saleem

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23MCA4DE5A	DSE – V	4	4	25	75	100

Course Title	ORGANIZATIONAL DYNAMICS

SYLLABUS		
Unit	**Contents**	**Hours**
I	Fundamentals of Organization Behavior: – Understanding Organization Behavior – Fundamental Concepts – Contingency Approach – Limitation of Organization Behavior – An Organization Behavior System – Model of Organization Behavior. Managing Communications: Communications Fundamentals – *Upward and Downward Communication* – Other Forms of Communication – Informal Communication	12
II	Perception and Attribution: The Nature and Importance of Perception – Social Perception – Attribution – Personality: Meaning of Personality – Motivational Needs and Processes: Meaning of Motivation – Primary and General Motives – Secondary Motives – The Content Theories of Work Motivation – The Process of Theories of Work motivation.	12
III	Effective Leadership Processes: What is Perception? – Modern Theoretical Processes of Leadership – The Roles and Activities of Leadership – Leadership Skills. Attitudes: The Nature and dimensions of Attitudes – Job Satisfaction – Organizational Commitment.	12
IV	Organizations and Individuals: Rights to Privacy – Discipline – QWL –Individual Responsibilities. Informal and Formal Groups: Group Dynamics – *Nature of Informal Group* –Formal Group. Team and Team Building: Organizational Context for Teams – Teamwork – Team Building	12
V	Change and its Effects: Change at Work- Resistance to Change – Implementing Change Successfully – Understanding Organization Development. Stress and counselling: Employee Stress – *Employee Counselling – Types of counselling*.	12
VI	**Current Trends (For CIA only):** Creative Collaborations, Innovative Work Assignments.	

……… Self Study

Text Book(s):

1. John W Newstrom, ―Organizational Behavior: Human Behavior at Work‖, 12th Edition, Tata McGraw Hill Education Private Limited. **(Unit I, IV, V)**
2. Organizational Behavior, Fred Luthans,10th Edition, McGraw-Hill International Edition Education Private Limited, 2005. (**Unit II, III**)

Reference Book(s):

1 Stephen P. Robbins, Timothy A. Judge and Seema Sanghi, Organizational Behavior, 13th Edition, PHI Pvt Ltd, New Delhi, 2009.
2. L M Prasad, Organizational Behaviour, Sultan Chand & Sons New Delhi, Fifth Edition 2011.

Web Resource(s):

3. https://bdpad.files.wordpress.com/2015/05/fred-luthans-organizational-behavior-_-an-evidence-based-approach-twelfth-edition-mcgraw-hill_irwin-2010.pdf
4. https://www.homeworkforyou.com/static_media/uploadedfiles/1644962096_7651377__918..pdf

Course Outcomes

CO No.	CO Statement	Cognitive Level (K-Level)
	Upon successful completion of this course, the student will be able to:	
CO1	Understand the basic principles of organizational behavior	K1, K2
CO2	Acquire knowledge about leadership skills and interpersonal behavior	K3
CO3	Enrich knowledge regarding change at workplace, overcoming stress	K5
CO4	Understand about the Attitude, Perception, and aspects of personality.	K3, K4
CO5	Ascertain group, group behaviour, Team & Team building with its key role in organization	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	3	3	2	2	3	2	2.5
CO2	3	3	2	3	2	3	2	3	3	2	2.6
CO3	3	3	1	2	3	2	3	2	3	1	2.3
CO4	2	3	3	2	3	3	3	3	2	2	2.6
CO5	3	2	3	3	2	3	2	1	3	3	2.5
									Mean Overall Score		2.50
									Correlation		High

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: S. Syed Ibrahim

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total

IV	23MCA4DE5B	DSE – V	4	4	25	75	100

Course Title	ACCOUNTING AND FINANCIAL MANAGEMENT

SYLLABUS

Unit	Contents	Hours
I	Accounting Principles and Concepts – Double Entry Book Keeping – Income and Expenditure – Accounting Record and System – *Assets and Liabilities*	12
II	Journal – Ledger – *Trial Balance* – Trading, Manufacturing and Profit and Loss Account – Balance Sheet with simple Adjustments	12
III	Analysis and Interpretation of Financial Statements with Ratios: – Ratio Analysis-Meaning – Importance – Classifications of ratio- Analysis and Computation of Ratios	12
IV	Marginal Costing – Definition - Advantages and Limitations – Marginal Cost statement - Cost Volume – Profit Analysis – Break Even Analysis – *Standard Costing* – Variance Analysis (Material and Labour variances only)	12
V	Budgeting and Budgetary Control – Types of Budgets – Preparation of Various Functional Budgets – Preparations of Cash Budgets – Flexible Budgets – *Advantages of Budgeting and Budgetary Control*	12
VI	**Current Trends (For CIA only):** Remote Workforce, Advisory accounting services and holistic advisors, Value-based pricing	

……… Self Study

Text Book:
1. K.L. Nagarajan, N. Vinayakam, P.L. Mani, *Principles of Accountancy,* EURASIA Publishing House (PVT) Ltd., Revised Edition, 2002.   2. S.N. Maheswari, *Principles of Management Accounting*, Sultan Chand & Sons, 2001.
Reference Book(s):
1. M.C. Shukla, T.S. Grewal, *Advanced Accounts*, S.Chand & Company Pvt., Ltd, Eleventh Edition, Reprinted, 1988.   2. M.Y. Khan and P.K. Jain, Financial Management: Text, Problems *and Cases*, Tata McGraw Hill, Fourth Edition, 2007.   3. S.K.Guptha and R.K.Sharma "Practical Problems in Management Accounting" Recent Edition
Web Resource(s):
1. https://www.tutorialspoint.com/accounting_basics/index.htm   2. https://www.studocu.com/row/document/papua-new-guinea-university-of-technology/accounting-theory/financial-management-tutorial/2331766

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Summarize on basics of accounting principles	K2
CO2	Apply the knowledge of accounting principles, journal, Ledger, Trial Balance, and final accounts.	K3
CO3	Examine the financial statements and ratios.	K4
CO4	Evaluate the knowledge in the areas of application of managerial costing technique	K5
CO5	Discuss the different methodologies to prepare the budgets and integrate the skills for preparation of budgets.	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	3	3	3	2	3	3	2.7
CO2	3	3	3	2	1	3	3	3	2	2	2.5
CO3	3	2	3	2	3	2	3	3	3	2	2.6
CO4	2	3	2	2	3	3	3	2	2	2	2.4
CO5	3	3	3	3	3	3	2	2	2	2	2.6
Mean Overall Score											2.56
Correlation											High

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. U. Jahir Hussain

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total

| IV | 23MCA4DE5C | DSE – V | 4 | 4 | 25 | 75 | 100 |

| Course Title | HUMAN RESOURCE MANAGEMENT |

SYLLABUS

Unit	Contents	Hours
I	HRM: Meaning – Nature - Significance – Objectives- Scope and Functions – *Evolution of Human Resource Management* – Role of Human Resource Manager – Human Resource Policies.	12
II	Human Resource Planning: Importance – Need for HRP – HRP Process – Determinants of HRP-Job analysis, Job Description and Job specification: Definition- Need - advantages - Importance of Recruitment – Internal and External sources – Selection – Meaning -*Selection process* – Retention of Employees	12
III	Training: Definition - Purpose- Types – *Steps in Training Program* – Evaluation of Training Program– Career Planning - Career Development Stages – Performance Appraisal – *Meaning- Need- Importance- Objectives* - Methods - Problems – Requisites of Good appraisal Plan- Performance metrics.	12
IV	Employee Remuneration: Components – *Factors Influencing Employee compensation*– Types of Benefits: Fringe Benefits, Monetary and Non-Monetary Benefits.	12
V	International HR Management– *Model of IHRM* - HR Accounting - HR Auditing- Green HRM–Meaning – Need, Benefits - E–Learning – Meaning, Aims- Developing e-learning processes.	12
VI	**Current Trends (For CIA only):** Continuous learning, flexible requirements, Artificial Intelligence in recruitment, Diversity, inclusion and equity	

……… Self Study

Text Book:
1. Aswathappa.K, Human Resource Management- Text and Cases 8th Edition Tata McGraw-Hill Education Private Ltd. New Delhi, 2017 2. Gary Dessler and BijuVarkkey, Human Resource Management 15th Edition Pearson Education New Delhi. 2017
Reference Book(s):
1. L. M. Prasad, Human Resource Management, Sultan and Sons, 2018 2. UdayKuamrHaldar- JuthikaSarkar- Human Resource Management- Oxford University Press, 2013 3. Biswajeet Pattnayak- Human Resource Management 5th edition Prentice Hall of India, New Delhi 2018
Web Resource(s):
1. https://www.tutorialspoint.com/human_resource_management/index.htm 2. https://www.w3schools.blog/hr-tutorial

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Summarize on human resource management concept to organization relevance	K2
CO2	Apply the new strategic issues and strategies required to select and develop manpower resources.	K3
CO3	Examine the training strategies and specifications for the delivery of training programs	K4
CO4	Evaluate job-based compensation scheme with organizational goals, mission, values and linked to the labor market	K5
CO5	Discuss the change in global scenario and summarize the causes and context of emerging changes.	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	3	3	3	2	3	3	2.7
CO2	3	3	3	2	1	3	3	3	2	2	2.5
CO3	3	2	3	2	3	2	3	3	3	2	2.6
CO4	2	3	2	2	3	3	3	2	2	2	2.4
CO5	3	3	3	3	3	3	2	2	2	2	2.6
										Mean Overall Score	2.56
										Correlation	**High**

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. P.L. Senthil

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23MCA4CC19P	Core - XIX	4	3	20	80	100

Course Title	DISTRIBUTED TECHNOLOGY LAB - PRACTICAL

Develop the applications using Eclipse IDE:

1. Creation, insertion, deletion and modification of records in a database

   using Prepared Statement Interface in Java

2. Simple RMI application for downloading and uploading files on the server by

   using multiple clients

3. Simple application to display the current date and time on the browser window using Node.js

4. Server side application by extending HttpServlet class

5. Session Tracking application in Servlet

a) using HttpSession class   b) using Cookies

6. Simple application for database manipulation using Servlet program.

7. JSP code for checking number of times a particular page is visited using Cookies

8. Application for sending E-Mail using JavaMail API

9. Application for sending and receiving messages using JMS

10. Application to display factorial of a given number using Stateless Session Bean

11. Application to display the result of a student using Stateful Session Bean

12. Simple Banking application using Entity Bean

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall the basic concepts of two tier and three-tier technologies in Java	K1
CO2	Understand the fundamental concepts of distributed technologies	K2
CO3	Apply the concept of COM technologies in the real-world problems	K3
CO4	Analyze various technologies and their significances	K4
CO5	Design & Develop the simple web based applications using RMI, JavaMail API and JMS	K5 & K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	3	3	3	3	3	3	2.8
CO2	3	3	3	3	3	3	3	3	1	3	2.8
CO3	2	3	2	3	2	3	3	3	3	3	2.7
CO4	3	2	3	2	3	2	3	2	3	3	2.6
CO5	3	3	3	3	1	3	3	2	3	3	2.7
									Mean Overall Score		2.72
									Correlation		High

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. S. Abdul Saleem

					Marks for Evaluation

Semester	Course Code	Course Category	Hours/Week	Credits	CIA	ESE	Total
IV	23MCA4PW	Project Work	18	12	25	75	100

Course Title	INDUSTRIAL EXPERIENCE AND PROJECT WORK

Students should carry out a project nearly two months in Software Development Companies

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23PCNOC	Mandatory Online Course	-	1	-	100	100

Course Title	ONLINE COURSE

- Students should undergo an online course for a minimum of 30 days during the course of study.

- The course certificate is to be submitted to the department before the end of IV Semester

- The course certificate is compulsory for completing the degree.

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total

Course Title	ONLINE COURSE