MASTER OF COMPUTER APPLICATIONS
Course Scheme and Scheme of Examinations
(For students admitted from 2021-2022 & onwards)
Scholastic Courses

Part	Category	Course Code	Title of the Course	Contact Hrs/ week	Exam Duration hrs.	Max. Marks			Credits
						CIA	ESE	Total marks	
SEMESTER-I									
III	Core: I	21CAP01	Advanced Java Programming	4	3	50	50	100	4
III	Core: II	21CAP02	Relational Database Management System	4	3	50	50	100	4
III	Core: III	21CAP03	Computer Networks	4	3	50	50	100	4
III	Core: IV	21CAP04	Operations Research	4	3	50	50	100	4
III	Core: V Elective: I	21CAP05A/ 21CAP05B/ 21CAP05C/ 21CAP05D	Mobile Computing/ Business Intelligence/ Cloud Computing/ Service Oriented Architecture	4	3	50	50	100	3
III	Core: VI Practical: I	21CAP06	Advanced Java Programming – Practical	5	3	50	50	100	3
III	Core: VII Practical: II	21CAP07	Relational Database Management System– Practical	5	3	50	50	100	3
			TOTAL	**30**				**700**	**25**
SEMESTER-II									
III	Core: VIII	21CAP08	Data Structures and Algorithms	4	3	50	50	100	4
III	Core: IX	21CAP09	Web Programming	4	3	50	50	100	4
III	Core: X	21CAP10	Software Project Management	4	3	50	50	100	4
III	Core: XI	21CAP11	Operating System	4	3	50	50	100	4
III	Core: XII Elective: II	21CAP12A/ 21CAP12B/ 21CAP12C/ 21CAP12D	Artificial Intelligence/ Adhoc and Sensor Networks/ Digital Image Processing/ Virtual Reality Systems	4	3	50	50	100	3
III	Core: XIII Practical: III	21CAP13	Data Structures And Algorithms Using Java-Practical	4	3	50	50	100	2
III	Core: XIV Practical: IV	21CAP14	Web Programming - Practical	4	3	50	50	100	2
IV	Ability Enhancement	21AEP01	Cyber Security	2	-	100	-	100	2
			TOTAL	**30**				**800**	**25**

SEMESTER-III									
III	Core: XV	21CAP15	Data Mining and Big Data Analytics	5	3	50	50	100	4
III	Core: XVI	21CAP16	Machine Learning using Python	4	3	50	50	100	4
III	Core: XVII	21CAP17	Network Security and Cryptography	5	3	50	50	100	4
III	Core: XVIII Elective: III	21CAP18A/ 21CAP18B/ 21CAP18C/ 21CAP18D	Internet of Things/ Soft Computing/ Theory of Computation/ Research Methodology	4	3	50	50	100	3
III	Core :XIX Practical: V	21CAP19	Data Mining and Big Data Analytics - Practical	4	3	50	50	100	2
III	Core :XX Project: I	21CAP20	Mini Project and Viva voce	5	-	50	50	100	3
III	Core: XXI	21CAP21	Open Elective offered for students of other PG Programmes/Departments	3	3	50	50	100	2
V	Proficiency Enhancement	21PEP01	Management Information System (Self Study)	-	3	-	-	100	2
			TOTAL	**30**				**800**	**24**
SEMESTER-IV									
III	Core: XXII Project: II	21CAP22	Major Project and Viva-voce	-	-	100	100	200	12
V	Competency Enhancement		Online Course / Learning Object Repository(LOR)		SEMESTER I-IV				2
			Certificate Course		SEMESTER I-IV				2
			TOTAL	**-**	**-**	**-**	**-**	**2500**	**90**

COURSE CONTENT

(For those admitted from the academic year 2021 and onwards)

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART–III	CORE: I	21CAP01	ADVANCED JAVA PROGRAMMING	48	4

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	I	50	50	100

Preamble

To understand the java class & objects, packages, threads, interfaces and Advanced Java programming concepts.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Outline the concepts of Java Programming Language	K1
CO2	Explain the concepts of packages and multithreads, Java collections, Networking , JDBC and Servlets	K2
CO3	Summarizes the concepts of event handling and graphics programming	K3
CO4	Analyze the networking concepts and socket programming	K4
CO5	Applying the java programming techniques for solving the given problem	K5
CO6	Develop simple projects for the real time applications	K6

K1-Remember; K2-Understand; K3-Apply;
K4-Analyze; K5-Evaluate; K6-Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	3
CO2	9	9	9	9	3	9	3
CO3	9	9	9	9	3	9	3
CO4	9	9	9	9	3	9	3
CO5	9	9	9	9	3	9	1
CO6	9	9	9	9	3	9	1
Total contribution of COs to POs	54	54	54	54	18	54	14
Weighted Percentage COs Contribution to POs	4.2	4.5	4.6	4.7	2.8	5.4	2.4

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT

UNIT I: Overview of Java (8 Hours)

Introducing Classes: Class Fundamentals – Declaring Objects – Introducing Methods – Constructors – The this keyword – Garbage Collection – Overloading Methods - Understanding static – final. Inheritance: Inheritance Basics – Using super – Method overriding –Dynamic Method Dispatch- Using Abstract Class

UNIT II: Java Packages & Threads (10 Hours)

Packages and Interfaces: Declaring Packages – Access Protection – Importing Packages – Defining, Implementing, Applying Interfaces - Exception Handling: Exception Types – try, catch – throw – throws – finally – Creating User-defined Exceptions. Multithreaded Programming: The Java Thread Model – Creating a Thread – Thread Priorities - String Handling

UNIT III: The Collections Framework (10 Hours)

The Collection Interfaces - Collection Classes - StringTokenizer – Date classes. IO Classes and interfaces - File – StreamClass – ByteStream -CharacterStream

UNIT IV: Networking (10 Hours)

Networking: Networking Basics – InetAddress- TCP/IP Client and Server Sockets–URL-Datagrams. Java Database Connectivity: Establishing a connection – Creation of data tables – Entering data into table – Table Updating – Use of PreparedStatement – obtaining metadata – using transactions.

UNIT V: Event Handling (10 Hours)

Event Handling: Event Model – Event Classes – Event Listeners and Interfaces. – Working with Windows,Graphics, and text- The Tour of Swing Component classes: Icons and JLabels - JText Fields – JButtons - JCombo boxes - JTabbed and JScroll Panes – JTrees– JTables - Servlets

REFERENCE BOOKS:

1. Herbert Schildt, The Complete Reference Java 2, Fifth Edition, TMH Education Pvt. Ltd., 2002
2. C. Muthu, Programming with Java, Vijay Nicole imprints private Limited, 2004
3. Herbert Schildt with Joe O' Neil, Java – Programmer's Reference, TMH, 2004

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: II	21CAP02	RELATIONAL DATABASE MANAGEMENT SYSTEM	48	4

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	I	50	50	100

Preamble:

This course covers the basic concepts of database management systems, relational database design, SQL, PL/ SQL and emphasize methods to organize, maintain and retrieve information efficiently and effectively.

Course Outcomes:

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the basic concepts of database system	K1
CO2	Learn about basics of oracle9i and creation of tables	K2
CO3	Apply various DML commands and functions on tables	K3
CO4	Explore PL/SQL programming concepts using simple programs	K4
CO5	Illustrate the advanced concepts of PL/SQL	K5
CO6	Formulate solutions to a broad range of query and data update Problems	K6

K1-Remember; K2-Understand; K3-Apply;
K4-Analyze; K5-Evaluate; K6-Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	3
CO2	9	9	9	9	3	9	3
CO3	9	9	9	9	3	9	1
CO4	9	9	9	9	3	9	1
CO5	9	9	9	9	3	9	1
CO6	9	9	9	9	3	9	1
Total contribution of COs to POs	54	54	54	54	18	54	10
Weighted Percentage COs Contribution to POs	4.2	4.5	4.6	4.7	2.8	5.4	1.7

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Introduction to Database System (8 Hours)

Database Concepts: A Relational approach: Database – Relationships – DBMS – Relational Data Model – Integrity Rules – Theoretical Relational Languages. Database Design: Data Modeling and Normalization: Data Modeling – Dependency – Database Design – Normal forms – Dependency Diagrams - Denormalization – Another Example of Normalization.

UNIT II: Oracle9i and Oracle Tables (10 Hours)

Oracle9i: Overview: Personal Databases – Client/Server Databases – Oracle9i an introduction – SQL *Plus Environment – SQL – Logging into SQL *Plus - SQL *Plus Commands – Errors & Help – Alternate Text Editors - SQL *Plus Worksheet - iSQL *Plus. Oracle Tables: DDL: Naming Rules and conventions – Data Types – Constraints – Creating Oracle Table – Displaying Table Information – Altering an Existing Table – Dropping, Renaming, Truncating Table – Table Types – Spooling – Error codes.

UNIT III: Working with Table (10 Hours)

Working with Table: Data Management and Retrieval: DML – adding a new Row/Record – Customized Prompts – Updating and Deleting an Existing Rows/Records – retrieving Data from Table – Arithmetic Operations – restricting Data with WHERE clause – Sorting – Revisiting Substitution Variables – DEFINE command – CASE structure. Functions and Grouping: Built-in functions –Grouping Data. Multiple Tables: Joins and Set operations: Join – Set operations.

UNIT IV: PL/SQL (10 Hours)

PL/SQL: A Programming Language: History – Fundamentals – Block Structure – Comments – Data Types – Other Data Types – Declaration – Assignment operation – Bind variables – Substitution Variables – Printing – Arithmetic Operators. Control Structures and Embedded SQL: Control Structures – Nested Blocks – SQ L in PL/SQL – Data Manipulation – Transaction Control statements. PL/SQL Cursors and Exceptions: Cursors – Implicit & Explicit Cursors and Attributes – Cursor FOR loops – SELECT…FOR UPDATE – WHERE CURRENT OF clause – Cursor with Parameters – Cursor Variables – Exceptions – Types of Exceptions.

UNIT V: PL/SQL Composite Data Types (10 Hours)

PL/SQL Composite Data Types: Records – Tables – Varrays. Named Blocks: Procedures – Functions – Packages –Triggers – Data Dictionary Views.

TEXT BOOK:

1.Nilesh Shah, Database Systems Using Oracle, 2nd edition, PHI. (UNIT-I: Chapters 1 & 2, UNIT-II: Chapters 3 & 4, UNIT-III: Chapters 5 & 6, UNIT-IV: Chapters 10 & 11, UNIT-V: Chapters 12, 13 & 14).

REFERENCE BOOKS:

1.Abraham Silberschatz, Henry F.Korth, S.Sudarshan, Database System Concepts, 5th Edition, TMH.
2.Alexis Leon, Mathews Leon, Fundamentals of Database Management Systems, Vijay Nicole Imprints Private Limited.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: III	21CAP03	COMPUTER NETWORKS	48	4

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	I	50	50	100

Preamble:

To understand the concepts of data communication over Computer Networks

Course Outcomes:

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Describe the concepts, reference models and various layers of computer networks	K1
CO2	Explain the v principles, protocols and algorithms of different layers of OSI reference models	K2
CO3	Apply the error detection and correction techniques and routing algorithms for efficient and error free transmission in networks	K3
CO4	Analyze the various routing algorithms for handling internal traffic efficiently	K4
CO5	Illustrate the data transmission services and connection establishment on network	K5
CO6	Create innovative error detection and correction algorithms and routing algorithms for effective data transmission over network.	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	3	9
CO3	9	9	9	3	3	3	3
CO4	9	9	3	3	3	1	1
CO5	9	9	3	3	1	1	1
CO6	9	9	3	3	1	1	1
Total contribution of COs to POs	54	54	36	30	26	18	24
Weighted Percentage COs Contribution to POs	**4.2**	**4.5**	**3.0**	**2.6**	**4.1**	**1.8**	**4.1**

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Introduction to Communication on Networks (8 Hours)

Data Communications – Networks – Internet – Protocols and Standard. Network Models: Layers in the OSI Model – TCP/IP Protocol Suite – Addressing.

UNIT II: Physical Layer (10 Hours)

Analog and Digital – Transmission Impairment -Digital to Digital Conversion - Analog to Digital Conversion – Transmission Modes – Digital to Analog Conversion – Multiplexing - Transmission Medium.

UNIT III: Data Link Layer (10 Hours)

Error Detection and Correction : Introduction – Block Coding – Cyclic Codes. Data link Control: Framing –Flow and Error Control – Protocols –Noiseless and Noisy Channels. Multiple Access: Random Access – Channelization. Wired Lans: Standard Ethernet. Wireless Lans.

UNIT IV: Network Layer (10 Hours)

IntroductionConnecting Lans, Backbone Networks and Virtual Lans: Connecting devices - Backbone Networks – Virtual Lans. Network Layer: IPV4 Addresses – IPV6 Addresses – Internetworking – Transition from IPV4 to IPV6.

UNIT V: Transport Layer and Application Layer (10 Hours)

Transport Layer: Process – to –Process Delivery - UDP –TCP – Congestion – Congestion Control – Quality of Services. Application Layer: Namespace – DNS –Remote Logging – E-Mail –FTP – WWW and HTTP: Architecture.

REFERENCE BOOKS:

1. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4thEdition, 2007.
2. F. Halsall, “Data Communications, Computer Networks and Open Systems”, Pearson Education, 2008
3. D. Bertsekas and R. Gallagher, “Data Networks”, 2ndEdition, PHI, 2008.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: IV	21CAP04	OPERATIONS RESEARCH	48	4

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	I	50	50	100

Preamble

To enable the students to gain the knowledge about Linear Programming Problem and Methods to solve an L.P.P.

Course Outcomes

On the successful completion of the course, students will be able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	outline the meaning, purpose and tools of LPP, assignment, replacement, sequencing and pert model	K1
CO2	express the procedures and steps for LPP, assignment, replacement, sequencing and pert model	K2
CO3	illustrate the methodologies to get the optimal solution and the period of replacement	K3
CO4	analyze the concepts of LPP, assignment, replacement, sequencing and pert model	K4
CO5	evaluate different situations after the solution of LPP, assignment, replacement, sequencing and pert problems	K5
CO6	construct LP and Replacement models for various type of problems	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	3	9	9
CO3	9	9	9	9	3	3	1
CO4	9	9	9	9	1	3	1
CO5	9	9	9	9	1	3	1
CO6	9	9	9	9	0	3	0
Total contribution of COs to POs	54	54	54	54	15	30	21
Weighted Percentage COs Contribution to POs	4.2	4.5	4.6	4.7	1.7	3.0	3.6

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I : Linear Programming (10 Hours)

Formulation of LPP - Simplex Method - Big M method - Two Phase Simplex Method.

UNIT II : The Assignment Problem (10 Hours)

Introduction – Mathematical formulation - Hungarian Assignment Method – Maximization in Assignment Problem – Unbalanced Assignment Problem.

UNIT III: Replacement Model (10 Hours)

Introduction – Replacement of items that deteriorates gradually : value of money does not change with time – Value of money changes with time – Replacement of items that fails suddenly - Individual Replacement –Group Replacement.

UNIT IV: Sequencing Problems (10 Hours)

Introduction-Problem of sequencing - Basic terms used in sequencing- Processing n-jobs through 2 machines - Processing n –jobs through k machines - Processing 2 jobs through k machines(Problems only).

UNIT V: **PERT (8 Hours)**

Introduction – Construction of Network - PERT Calculations.

NOTE : *No Derivations and Proof, Simple Problems Only.*

TEXT BOOK:

1. KantiSwarup, P.K.Gupta, ManMohan(2012), "Operations Research", 16th Edition, Publishing Sultan chand& Sons, New Delhi.

UNIT	CHAPTER	SECTION
I	2 4	2.3 – 2.4, 4.3 – 4.4
II	11	11.1 – 11.4
III	18	18.1 –18.3
IV	12	12.1 – 12.6
V	25	25.1 –25.5, 25.7

REFERENCE BOOKS

1. Frederick S. Hillier, Gerald J. Lieberman - "Introduction to Operations Research", Tata McGraw Hill Pub Company Ltd., Seventh Edition.

2. Gupta.P.K., Hira.D.S. - "Problems in Operations Research", S.Chand& Company Ltd.

3. Sharma.J.K. - "Operations Research Theory and Applications", Macmillan India Ltd., Second Edition.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: V ELECTIVE: I	21CAP05A	MOBILE COMPUTING	48	3

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	I	50	50	100

Preamble:

To understand mobile computing applications, techniques and environment

Course Outcomes:

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Explain the features of mobile communication and its services	K1
CO2	Identify the features of various technologies	K2
CO3	Classification of Mobile data networks in Mobile Communication	K3
CO4	Analyze network security in communication	K4
CO5	Evaluate the intent based frameworks in an application	K5
CO6	Generate adhoc networks with security	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	3	9	9
CO3	9	9	9	9	3	9	9
CO4	9	3	9	3	3	9	3
CO5	9	3	3	3	3	3	3
CO6	9	3	3	3	3	3	3
Total contribution of COs to POs	54	36	42	36	18	42	36
Weighted Percentage COs Contribution to POs	4.2	3.0	3.6	3.1	2.8	4.2	6.2

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Introduction (10 Hours)

Introduction: Advantages of Digital Information - Introduction to Telephone Systems :Telephones-Control Functions-Telephone Traffic-Switching-Wireless Information Networks– Information Transmission-Cross Talk-Transmission Links-State Diagram for Telephone Network- Modems. Mobile communication: Need for Mobile Communication – Requirements of Mobile Communication – History of Mobile Communication.

UNIT II: Mobile Communication (10 Hours)

Introduction to Cellular Mobile Communication: Cellular Structure-Frequency Reuse-System Architecture-Traffic and Switching Techniques. Mobility Management: Handoff Techniques-Handoff Detection and Assignment-Types of Handoff-Radio Link Transfer-Roaming Management. Cordless Mobile Communication Systems: Cordless Telephone at Home-Multichannel Cordless Telephone System-Wireless Private Box Exchange.

UNIT III: Mobile Computing (10 Hours)

Mobile Computing: History of data networks – Classification of Mobile data networks - CDPD System – Satellites in Mobile Communication: Satellite classification – Global Satellite Communication – Changeover from one satellite to other.

UNIT IV: Mobile Internet (8 Hours)

Mobile Internet: Working of Mobile IP – Wireless Network Security: Wireless Threats-Authentication and Access Control- Secrecy in Communication -Security Arrangement in CDMA-Security of Wireless Data Networks. Wireless Application Protocol: Properties of WAP- Bearer Services-WAP Components Integration-WAP Client Supporting Networks.

UNIT V: Communication System (10 Hours)

Ad hoc Network and Bluetooth technology: Need for Ad hoc Networks-MANET and Technical Factors Affecting Ad hoc Network-Bluetooth Technology. Intelligent Mobile Communication system: Types of Intelligent Cells-Power Delivery Intelligent Cells-Processing Gain Intelligent Cells. Fourth Generation Mobile Communication systems: User Controlled Services-Reconfigurable Technology-Vision 4G-4G Mobile System Convergence.

REFERENCE BOOKS:

1. T.G. Palanivelu, R. Nakkeeran, “Wireless and Mobile Communication”, PHI Limited,2009
2. Jochen Schiller, “Mobile Communications”, Pearson Education , Second Edition, 2007.
3. Asoke K Talukder,Hasan Ahmed,Roopa Yavagal, “Mobile Computing” , TMH, 2009.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: V ELECTIVE: I	21CAP05B	BUSINESS INTELLIGENCE	48	3

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	I	50	50	100

Preamble:

To understand the principles of Business Intelligence.

Course Outcomes:

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Recall to understand the basics of Business Intelligence	K1
CO2	Interpret the concept of Decision Support Systems and Business Intelligence	K2
CO3	Build knowledge on Decision making, systems, modeling and support	K3
CO4	Analyze an insight on Knowledge Management	K4
CO5	Assess Business Intelligence implementation	K5
CO6	Imagine Integration and Emerging Trends	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	3	9	9
CO3	9	9	9	9	3	9	3
CO4	9	3	9	3	3	3	3
CO5	9	3	3	3	3	9	9
CO6	9	3	3	3	3	3	3
Total contribution of COs to POs	54	36	42	36	18	42	36
Weighted Percentage COs Contribution to POs	4.2	3.0	3.6	3.1	2.8	4.2	6.2

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Introduction to Business Intelligence (BI) (8 Hours)

Introduction – Changing Business Environments and Computerized Decision Support – A Framework of BI – Imtelligent Creation and use and BI Governance – Transaction Processing versus Analytic Processing – Successful BI Implementation – Major Tools & Techniques of BI

UNITII: Decision Support Systems and BI (10 Hours)

Managerial Decision making – Computerized support for Decision making – An early framework for computerized decision support -. The concept of Decision support system – A framework for BI -A work system view of decision support

UNIT III: Decision making, systems, modeling and support (10 Hours)

Decision making : Introduction and Definitions – Models – Phases of the Decision-making process – Decision making: The Intelligent Phase – Decision making :The Design Phase – Decision Making : The Choice Phasr - Decision making : The Implementation Phase How Decisions are supported.

UNIT IV: Knowledge Management (10 Hours)

Introduction to Knowledge Management – Organizational Learning and Transformation – Knowledge Management Activities – Approaches to Knowledge Management – Information Technology in Knowledge Management – Knowledge Management system implementation – Roles of people in Knowledge Management

UNIT V: Business Intelligence implementation: Integration and Emerging Trends (10 Hours)

Implementing BI: An Overview –BI and Integration Implementation – Connecting BI systems to databases and other enterprise systems – On-Demand BI. Issues of Legality, privacy and ethics – Emerging topics in BI: An Overview – Online Social Networking: Basics and examples – Social Networks and BI" Collaborative Decision Making.

.

REFERENCE BOOKS

1. Efraim Turban, Ramesh Sharda, Dursun Delen, David King, "Business Intelligence : A Managerial Approach" Pearson, Second Edition (Units I & V)
2. Efriam Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems",Pearson, Ninth Edition (Units II, III, IV)
3.Ramesh Shrada, Dursun Delen, Efraim Turban,"Business Intelligence : A Managerial Perspective on Analytics", Pearson, Third Edition
4. Galit Shmueli, Nitin R. Patel, Peter C. Bruce,"Data ming for Business Intelligence", Wiley.

WEB REFERENCES:

https://www.selecthub.com/business-intelligence/key-types-business-intelligence-tools/
https://www.youtube.com/watch?v=5ssrUx-jivc
https://www.youtube.com/watch?v=KJHBIIgRyeo
https://www.slideshare.net/BodiBeatBox/ethical-issues-of-business-intelligence-bi

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: V ELECTIVE: I	21CAP05C	CLOUD COMPUTING	48	3

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	I	50	50	100

Preamble:

To understand the Cloud computing architectures, applications, services and security

Course Outcomes:

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the basics of Cloud Computing ,Working, Benefits	K1
CO2	Explain the knowledge of cloud architecture and tools	K2
CO3	Analyze the concepts of cloud computing Services and Security	K3
CO4	Determine the virtualization and data storage in cloud	K4
CO5	Apply the Future Cloud in applications	K5
CO6	Discuss the applications of Cloud computing	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	3	9	9
CO3	9	9	9	9	3	9	9
CO4	9	3	9	3	3	9	3
CO5	9	3	3	3	3	3	3
CO6	9	3	3	3	3	3	3
Total contribution of COs to POs	54	36	42	36	18	42	36
Weighted Percentage COs Contribution to POs	4.2	3.0	3.6	3.1	2.8	4.2	6.2

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Cloud Computing Basics (8 Hours)

Cloud Computing Overview - Applications - Intranets and the cloud – First movers in the cloud - Benefits - limitations of cloud computing – Security Concerns.

UNIT II: Cloud Computing Architecture & Tools (10 Hours)

Cloud Computing Architecture : Cloud Computing Technology – Cloud Architecture – Cloud Modeling and Design – Cloud Computing Tools : Tools and Technologies for Cloud – Cloud Mashups – Apache Hadoop – Cloud Tools

UNIT III: Cloud Computing Services and Security (10 Hours)

Cloud Computing Services : Cloud Computing Elements – Understanding Services and Applications by Type – Cloud Services – Cloud Computing at Work – Cloud Computing and Security : Risks in Cloud Computing – Data Security in Cloud – Cloud Security Services

UNIT IV: Virtualization and Data Storage (10 Hours)

Virtualization: Foundations – Grid, Cloud and Virtualization – Virtualization and Cloud Computing – Data Storage and Cloud Computing : Data Storage – Cloud Storage –Cloud Storage from LANs to WANs

UNIT V: Future Cloud and It's Applications (10 Hours)

Future Cloud: Future Trends – Mobile Cloud – Autonomic Cloud Engine – Multimedia Cloud – Energy Aware Cloud Computing – Jungle Computing – Case Studies.

REFERENCES:

1. A. Srinivasan, J.Suresh, "Cloud Computing – A Practical approach for learning and implementation", Pearson
2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, " Cloud Computing: A Practical Approach", McGraw Hill.
3. Michael Miller, "Cloud Computing", Pearson Education, New Delhi, 2009.
4. Rajkumar Byya, James Broberg, Andrzej Goscinski, " Cloud Computing Principles and Paradigms", Wiley & sons

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: V ELECTIVE: I	21CAP05 D	SERVICE ORIENTED ARCHITECTURE	48	3

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	I	50	50	100

Preamble:

To educate students in implementing SOA in industries. It gives the overview of pros and cons of SOA and explains when, why and which part of SOA you should use in live environment or project designing.

Course Outcomes:

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Describe about evolution, characteristics and services in SOA with SOA architecture, WSDL, SOAP and UDDI.	K1
CO2	Explain basic principles of SOA in project solutions that require problem solving, inference, perception, knowledge representation, and learning.	K2
CO3	Illustrate awareness and a fundamental understanding of various applications of SOA & WS techniques in knowledge representation methods and expert systems.	K3
CO4	Analyze the SOA Architectural style, SOA strategies, modeling web services.	K4
CO5	Design, implementing process of SOA in web service.	K5
CO6	Apply the SOA operational style for the web services.	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	3	9	9
CO3	9	9	9	9	3	9	3
CO4	9	3	9	3	3	3	3
CO5	9	3	3	3	3	9	9
CO6	9	3	3	3	3	3	3
Total contribution of COs to POs	54	36	42	36	18	42	36
Weighted Percentage COs Contribution to POs	4.2	3.0	3.6	3.1	2.8	4.2	6.2

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Roots and Anatomy of SOA (8 Hours)

Roots of SOA: Characteristics of SOA - Comparing SOA to client-server and distributed internet architectures.

Anatomy of SOA: How components in an SOA interrelate - Principles of service orientation.

UNIT II: Web Services (10 Hours)

Web services: Service descriptions – Messaging with SOAP –Message exchange Patterns – Coordination –Atomic Transactions – Business activities – Orchestration – Choreography.

UNIT III: Service Layer (10 Hours)

Service layer: Abstraction – Application Service Layer – Business Service Layer – Orchestration Service Layer.

UNIT IV: Service oriented analysis & Entity-centric business (10 Hours)

Service oriented analysis: Business-centric SOA – Deriving business services- service modeling - Service Oriented Design – WSDL basics – SOAP basics – SOA composition guidelines.

Entity-centric business: service design – Application service design – Taskcentric business service design.

UNIT V: SOA platform basics & WS-BPEL basics (10 Hours)

SOA platform basics: SOA support in J2EE – Java API for XML-based web services (JAX-WS) - Java architecture for XML binding (JAXB) – Java API for XML Registries (JAXR) - Java API for XML based RPC (JAX-RPC)- Web Services Interoperability Technologies (WSIT) - SOA support in .NET – Common Language Runtime - ASP.NET web forms – ASP.NET web services – Web Services Enhancements (WSE).

WS-BPEL basics: WS-Coordination overview - WS-Choreography, WSPolicy, WSSecurity. Learning Resources

REFERENCE BOOKS:

1. Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 1/e, 2005.

2. Thomas Erl, "SOA Principles of Service Design "(The Prentice Hall Service-Oriented Computing Series from Thomas Erl), 2005.

3. Newcomer, Lomow, "Understanding SOA with Web Services", Pearson Education, 2005.

4. Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services, An Architect's Guide", Pearson Education, 2005.

5. Dan Woods and Thomas Mattern, " Enterprise SOA Designing IT for Business Innovation" O'REILLY, 1/e, 2006.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: VI PRACTICAL: I	21CAP06	ADVANCED JAVA PROGRAMMING-PRACTICAL	60	3

Contact hours per semester: 60
Contact hours per week: 5

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	I	50	50	100

Preamble:

The Course provides hands on experience on implementing the concepts of object oriented programming, event driven programming, packages, JDBC and JSP.

Course Outcomes:

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Recall the concepts of Java Programming Language	K1
CO2	Understand the concepts of packages and multithreads	K2
CO3	Apply JDBC concept for database connectivity	K3
CO4	Analyze the networking concepts in java programming	K4
CO5	Illustrate event handling concepts and servlet	K5
CO6	Develop simple projects for the real time applications	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	9	9	3
CO2	9	9	9	9	9	9	3
CO3	9	9	9	9	3	9	3
CO4	9	9	9	9	3	9	3
CO5	9	9	9	9	3	9	3
CO6	9	9	9	9	3	9	3
Total contribution of COs to POs	54	54	54	54	30	54	18
Weighted Percentage COs Contribution to POs	4.2	4.5	4.6	4.7	4.7	5.4	3.1

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

1. Program to demonstrate the multilevel inheritance.
2. Program to prepare students mark sheet using package concept.
3. Program to create a thread using Thread class.
4. Program to find the machine and host IP address.
5. Program to send a file from one system to another using TCP/IP model.
6. Program to prepare Student attendance report using JDBC.
7. Program to prepare EB-Bill using JDBC.
8. Program to implement event driven programming.
9. Program to implement swing components.
10. Program to implement Servlet concepts.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: VII PRACTICAL: II	21CAP07	RELATIONAL DATABASE MANAGEMENT SYSTEM– PRACTICAL	60	3

Contact hours per semester: 60

Contact hours per week: 5

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	I	50	50	100

Preamble:

This course covers the basics on creating database tables using SQL, develop efficient PL/SQL programs to access Oracle databases and manage data retrieval with cursors and cursor variables, Stored Procedures, Functions, Packages and Triggers (PL/SQL Programming).It is designed to provide hands-on experience to create database-level applications using Oracle SQL and PL/SQL.

Course Outcomes

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Relate the basic concepts of relational database system.	K1
CO2	Illustrate the features available in a RDBMS package	K2
CO3	Construct appropriate SQL queries and PL/SQL Programs for database application.	K3
CO4	Analyze different database requirements and design effective database.	K4
CO5	Assess data in tables against appropriate constraints.	K5
CO6	Propose solutions to a broad range of real time applications using PL/SQL	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	3
CO2	9	9	9	9	3	9	3
CO3	9	9	9	9	3	9	3
CO4	9	9	9	9	3	9	1
CO5	9	9	9	9	3	9	1
CO6	9	9	9	9	3	9	1
Total contribution of COs to POs	54	54	54	54	18	54	12
Weighted Percentage COs Contribution to POs	4.2	4.5	4.6	4.7	2.8	5.4	2.1

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

1. Write SQL queries for Data Definition and Data Manipulation Language.
2. Write SQL queries using logical operations and operators.
3. Write SQL queries for group functions.
4. Write SQL queries for sub queries.
5. Write SQL queries to implement JOINS.
6. Write queries to understand the concepts for ROLL BACK, COMMIT & CHECK POINTS.
7. Write PL/SQL Function to find Armstrong numbers from 1 to n.
8. Write PL/SQL code to update values in created tables by using Explicit Cursors.
9. Write a PL/SQL Procedure to check the given number is prime or not by using call procedure
10. Write PL/SQL Program to handle the Exceptions.
11. Write PL/SQL code to implement Trigger.
12. Write PL/SQL Program to create and execute a package.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: VIII	21CAP08	DATA STRUCTURES AND ALGORITHMS	48	4

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	II	50	50	100

Preamble

The Paper offers the depth understanding and knowledge of different data structures, algorithms and their applications.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Recognize various data structures, algorithms and sorting methods	K1
CO2	Visualize the range of data structure and algorithm concepts	K2
CO3	Apply appropriate data structures and algorithm to solve real time applications	K3
CO4	Investigate various data structures and algorithm to uncover optimal solutions for the computational problems	K4
CO5	Justify the relevance of an algorithm for a specific application with respect to space and time complexity	K5
CO6	Devise innovative and efficient data structure and algorithm for solving the complex real time problems	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	3
CO2	9	9	9	9	3	9	3
CO3	9	9	9	9	3	9	3
CO4	9	9	9	9	3	9	3
CO5	9	9	9	9	3	9	1
CO6	9	9	9	9	3	9	1
Total contribution of COs to POs	54	54	54	54	18	54	14
Weighted Percentage COs Contribution to POs	4.2	4.5	4.6	4.7	2.8	5.4	2.4

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Data Structure: Introduction and Linear Data Structures (10 Hours)

Introduction-Data structure- Definition-– Arrays - Order List – Sparse Matrices - Representation of Arrays - Stacks and Queues – Fundamentals - Evaluation of Expression - Multiple Stacks and Queues.

UNIT II: Linked Lists and Non Linear Data Structures (9 Hours)

Linked Lists: Singly Linked List - Linked Stacks and Queues - Polynomial Addition - Doubly Linked Lists - Tress: Basic Terminology-Binary Trees-binary Tree Representation - Binary Tree Traversal. Graphs: Terminology and representation - Introduction –Definition and Terminology-Graph Representation – Traversals.

UNIT III: Algorithm: Introduction and Divide and Conquer Method (11 Hours)

What is algorithm **–** Algorithm Specification – Performance Analysis: Space Complexity - Time Complexity – Asymptotic Notation. Divide and Conquer: General Method - Binary Search - Finding the maximum and minimum - Merge sort - Quick sort – Selection.

UNIT IV: Greedy Method (9 Hours)

Greedy Method: General Method - Knapsack problem - Job sequencing with deadlines - Optimal merge patterns - minimum spanning trees - Single source shortest paths.

UNIT V: Dynamic Programming (9 Hours)

Dynamic Programming: General Method - Multistage Graphs- All pair shortest path - Optimal binary search trees - 0/1 Knapsack - Traveling Salesperson problem.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Shani, Fundamentals of Data Structures, First Edition, Galgotia Publication.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, (2008) , Fundamentals of Computer Algorithms, Second Edition, Hyderabad Universities Press (India) Private Limited Publication.
3. Seymour Lipschutz , G.A. Vijayalakshmi Pai, Data Structures , Tata McGrawhill, Year 2006.
4. D. Samanta, "Classical Data Structure", Prentice Hall India, ISBN: 8120318749.
5. Coremen T H, Leiserson C E, Rivest R L and Stein, Clifford, Introduction to algorithms, PHI, 2nd Edition, 2009.
6. Anany Levitin, Introduction to the Design and Analysis of Algorithm, Pearson Education.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: IX	21CAP09	WEB PROGRAMMING	48	4

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	II	50	50	100

Preamble

To enable the students to learn the concepts of web Programming techniques

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define the basic of Dynamic HTML, Java Script, Perl and PHP	K1
CO2	Explain Exception Handling Array, Hashes in Perls	K2
CO3	Choose the best suitable web programming techniques for developing a Personal Blog.	K3
CO4	Make use of Dynamic web pages using Events.	K4
CO5	Discuss on Dynamic content Modifying	K5
CO6	Design and Implement Object Class in Java Script	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	3	1
CO2	9	9	9	9	1	1	1
CO3	9	9	9	9	9	9	1
CO4	9	9	9	9	9	3	3
CO5	9	9	9	9	9	3	1
CO6	9	9	9	9	3	3	1
Total contribution of COs to POs	54	54	54	54	34	22	8
Weighted Percentage COs Contribution to POs	4.2	4.5	4.6	4.7	5.4	2.2	1.4

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: An Introduction to JavaScript (8 Hours)

What is Dynamic HTML? - Java Script-Java Script Basics - Variables-String Manipulation - Mathematical Functions – Statements - Operators – Arrays - Functions.

UNIT II: Objects in JavaScript (10 Hours)

Data and Objects in JavaScript - Regular Expressions - Exception Handling - Built in Objects – Events - Dynamic HTML with Java Script - Data Validation - Opening a New Window – Messages and Confirmations - The Status Bar - Writing to a Different Frame - Rollover Buttons-Moving Images - Multiple Pages in a single Download.

UNIT III: Programming in Perl5 (10 Hours)

Why Perl? - Online Documentation - The Basic Perl Program – Scalars – Arrays - Hashes – Control Structures - Processing Text - Regular Expressions – Using Files.

UNIT IV: An Introduction to PHP (10 Hours)

PHP – Using PHP – Variables - Program Control - Built Functions - Exercises.

UNIT V: Introducing JQuery (10 Hours)

Making jQuery Work-Working With DOM-Working with Events – Using the Photographer's Exchange Web Site-Making Navigation Graceful-Creating and Calling Modal Windows-Binding Events to Other Elements.

REFERENCE BOOKS:

1. Chris Bates , "Web Programming Building Internet Applications",Wiley – Dreatech India PVT.Ltd,Second Edition,2006

2. Jay Blanchard "Applied jQuery Develop and Design",Pearson Publications,2013.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: X	21CAP10	SOFTWARE PROJECT MANAGEMENT	48	4

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	II	50	50	100

Preamble

To understand the fundamental principles of software project management and different methods and techniques used for project management

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Choose the Product Life Cycle model and metrics	K1
CO2	Outline the aspects in software project management and software quality assurance	K2
CO3	Model various phases in software and challenges faced during design , development and testing	K3
CO4	Examine the functions of software requirement gathering and cost estimation process	K4
CO5	Evaluate various development techniques and implementation methods	K5
CO6	Build and design real time software projects	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	9
CO3	9	9	9	9	3	1	3
CO4	9	9	9	9	3	1	3
CO5	9	9	9	9	1	3	1
CO6	9	9	9	9	1	1	3
Total contribution of COs to POs	54	54	54	54	26	24	28
Weighted Percentage COs Contribution to POs	4.2	4.5	4.6	4.7	4.1	2.4	4.8

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Product Life Cycle (10 Hours)

Product Life Cycle: Introduction – Idea Generation- Prototype Development Phase- Alpha phase –Beta phase- Protection phase- Maintenance and obsolescence phase. Project Life Cycle Models: What is project life cycle model-A frame work for studying different life cycle models- The waterfall model- The prototype model- The Rapid Application Development Model- The spiral model and its variants. Metrices: Introduction- The metrices roadmap- A typical metrices strategy – What should you measure – Set Targets and Track them- Understanding and Trying to minimize variability- Act on data-People and Organisational Issues in metrices programmes- Common Pitfalls to watch out for in metrices programmes- Metrices implementation checklists and tools.

UNIT II: Software configuration management (10 Hours)

Introduction-Basic definitions and terminology-The Process and Activities of software Configuration Audit –Software configuration management in geographically distributed teams- Metrices in software configuration management –Software configuration management tools and automation. Software quality assurance: How do you define quality- Why is quality important in software- Quality Control and quality assurance –Cost and benefits of quality – Software quality analyst's functions- Some popular misconceptions about the SQA's role –Software quality assurance tools –Organizational structures –Profile of a successful SQA-measures of SQA success –Pitfalls to watch out for in the SQA's role. Risk management: Introduction-What is Risk management and why is it important- Risk management cycle- Risk identification: Common tools and techniques- Risk quantification –Risk monitoring-Risk mitigation- Risks and mitigation in the context of global project- Teams –Some practical techniques in risk management –Metrices in risk management.

UNIT III: Software Requirements Gathering (10 Hours)

Inputs and start criteria for requirements gathering- Dimensions of requirements gathering Steps to be followed during requirements gathering outputs and quality records from the requirements phase- Skills sets required during the requirements phase- Differences for a Shrink-wrapped software- Challenges during the requirements management phase- Metrices for the requirement phase. Estimation: what is estimation-when & why is estimation done The Three phases of estimation-Estimation methodology- Formal models for size estimation – Translation effort estimated into schedule estimates –Common challenges during estimation Metrices for the estimation processes.

UNIT IV: Design and Development Phases (10 Hours)

Some difference in our chosen approach-Salient features of design- Evolving an architecture /Blueprint –Design for reusability- Technology choices /constraints –Design to standards – Design for portability- User interface issues- Design for testability-Design for diagnosability-Design for maintainability- Design for Installability- Inter –Operability design-Challenges during design and development phases-Skill sets for design and development metrices for design and development phases. Project management in the testing phase: Introduction- What is testing-

What are the activities that make up testing- Test scheduling and types of tests-People issues in testing management structures for testing in global teams –Metrics for testing phase.

UNIT V: Project Management in the Maintenance Phase (8 Hours)

Introduction- Activities during the maintenance phase-management issues during the maintenance phase- Configuration management during the maintenance phase –Skill sets for people in the maintenance phase estimating size, effort and people resources for the maintenance phase- Advantages of using geographically distributed teams for the maintenance phase-Metrics for the maintenance phase. Globalization issues in project management: Evolution of globalization- Challenges in building global teams-Models for the execution of some effective management techniques for managing global teams. Impact of the internet on project management: Introduction – The effect of internet on project management –Managing projects for the internet- Effect on project management activities.

REFERENCE BOOKS :

1. Gobalswamy Ramesh, "Managing Global Software Projects", Tata McGraw Hill Publishing Company, 2003.
2. S.A. Kelkar, "Software Project Management –A concise study", PHI, 2003
   Mike Cotterel, Bob Hughes, "Software Project Management", Inclination / Thomas computer press, 1955.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XI	21CAP11	OPERATING SYSTEM	48	4

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	II	50	50	100

Preamble

To understand the fundamental of operating system and different methods and techniques used.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Outline the Memory Management, Processor Management, Device Management and Information Management	K1
CO2	Explain the basic principles of Multiprogramming and Job Scheduling	K2
CO3	Illustrate awareness and a fundamental understanding of various applications used in operating system	K3
CO4	Analyze DOS, Windows 98, Windows NT & Linux	K4
CO5	Apply scientific methods to model Job scheduling	K5
CO6	Demonstrate Memory Management, Processor Management, Device Management and Information Management using various methods	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	3
CO2	9	9	9	9	3	9	3
CO3	9	9	9	9	3	3	3
CO4	9	9	9	9	3	3	1
CO5	9	9	9	9	1	3	1
CO6	9	9	9	9	1	3	1
Total contribution of COs to POs	54	54	54	54	14	30	12
Weighted Percentage COs Contribution to POs	4.2	4.5	4.6	4.7	2.2	3.0	2.1

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Overview of Operating System (8 Hours)

Overview of Operating System: Importance of Operating Systems; Basic Concepts and Terminology; An Operating System Resource Manager: Memory Management Functions, Processor Management Functions, Device Management Functions, and Information Management Functions.

UNIT II: Memory Management (10 Hours)

Memory Management: Single Contiguous Allocation: H/W Support, S/W Support, Advantages, Disadvantages; Introduction to Multiprogramming: Concept of Multiprogramming, Measure of System I/O Wait Percentage, Relevance of Multiprogramming to Memory Management ; Partitioned Allocation, Relocatable Partitioned Memory Management, Paged Memory Management, Demand-Paged Memory Management, Segmented Memory Management, Segmented and Demand –Paged Memory Management, Other Memory Management Schemes (Swapping, Overlays).

UNIT III: Processor Management (10 Hours)

Processor Management: State Model : Job Scheduler, Process Scheduling , Job and Process Synchronization, Structure of Processor Management ; Job Scheduling : Functions, Policies, Job Scheduling in Non multi programmed Environment, Job Scheduling in Non multi programmed environment, Job Scheduling in multi programmed environment ; Process Scheduling, Multiprocessor Systems : Separate Systems, Coordinated Job Scheduling, Master/Slave Scheduling, Homogeneous Processor scheduling ; Process Synchronization : Race Condition, Synchronization Mechanism, Deadly Embrace, Synchronization Performance Considerations.

UNIT IV: Device Management (10 Hours)

Device Management: Techniques for Device Management: Dedicated Devices, Shared Devices, Virtual Devices; Device Characteristics- Hardware Considerations : Input or Output Devices, Storage Devices; Channels and Control Units : Independent Device Operation, Buffering, Multiple Paths, Block Multiplexing ; Device Allocation Considerations; Virtual Devices.

UNIT IV: Information Management (10 Hours)

Information Management: Introduction; A Simple File System; General Model of a File System; Symbolic File System; Basic File System, Access Control Verification; Logical File System; Physical File System; Case study on DOS, Windows 98, Windows NT & Linux.

REFERENCE BOOKS:

1. Madnick E., Donovan J., “Operating Systems”, Tata McGraw Hill.
2. Silbershatz and Galvin, “ Operating System Concepts”, Addison Wesley.
3. Tannenbaum, “Operating systems”, PHI.4. Peterson, “Operating System”.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XII ELECTIVE: II	21CAP12A	ARTIFICIAL INTELLIGENCE	48	3

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	II	50	50	100

Preamble:

To learn about the concepts of Artificial Intelligence and Expert System

Course Outcomes:

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Outline the fundamental understanding of the history of Artificial Intelligence(AI) and its foundations.	K1
CO2	Explain basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	K2
CO3	Illustrate awareness and a fundamental understanding of various applications of AI techniques in knowledge representation methods and expert systems.	K3
CO4	Analyze AI problems using various search techniques and develop applications in an AI language and expert system shell	K4
CO5	Apply scientific methods to model AI techniques	K5
CO6	Demonstrate AI and its current scope and limitations, and social implications.	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	3	9	9
CO3	9	9	9	9	3	9	9
CO4	9	3	9	3	3	9	3
CO5	9	3	3	3	3	3	3
CO6	9	3	3	3	3	3	3
Total contribution of COs to POs	54	36	42	36	18	42	36
Weighted Percentage COs Contribution to POs	4.2	3.0	3.6	3.1	2.8	4.2	6.2

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Introduction – Problems and Search (8 Hours)

What is an AI Technique? - Problems, Problems Space and Search – Defining the Problem as a State Search – Production Systems – Problem Characteristics – Production System Characteristics – Issues in the Design of Search Programs - Heuristic Search Techniques: Generate and Test – Hill Climbing – Best First Search. Problem Reduction – Constraint Satisfaction – Means – Ends Analysis.

UNIT II: Knowledge Representation (10 Hours)

Knowledge Representation Issues: Representations and Mappings – Approaches to Knowledge Representation – Issues in Knowledge Representation – The Frame Problem. Using Predicate Logic: Representing Simple Facts in Logic – Representing Instance and Isa Relationships – Computable Functions and Predicates – Resolution. Representing Knowledge Using Rules: Procedural versus Declarative Knowledge - Logic Programming – Forward versus Backward Reasoning – Matching – Control Knowledge.

UNIT III: Game Playing and Planning (10 Hours)

Game Playing: The Minimax Search Procedure - Adding Alpha-Beta Cutoffs - Additional Refinements - Iterative Deepening - Planning: The Blocks World - Componenets of a Planning System - Goal Stack Planning - Nonlinear Planning Using Constraint Posting - Hierrarcical Planning

UNIT IV: Natural Lanaguage Processing and Learning (10 Hours)

Natural Language Processing: Introduction - Syntactic Processing - Semantic Analysis - Discourse and Pragmatic Processing - Learning: What is Learning? - Rote Learning - Learning by Taking Advice - Learning in Problem Solving - Learning from Examples - Explanation Based Learning - Discovery - Analogy - Foemal Learning Theory - Neural Net Learning and Genetic Learning

UNIT V: Expert Systems, Perception and Action (10 Hours)

Expert Systems: Representing and Using Domain Knowledge - Expert System Shells - Explanation - Knowledge Acquisition - Perception and Action: Real-Time Search - Perception - Action - Robot Architectures.

REFERENCE BOOK:

1. Elain Rich & Kevin Knight, Artificial Intelligence - Tata McGraw Hill – Second Edition, 1991.
2. Stuart Russel, Peter Norvig, Artificial Intelligence: A Modern Approach,3rd Edition
3. David W. Rolston, Principles of Artificial Intelligence & Expert Systems Development – McGraw Hill.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XII ELECTIVE: II	21CAP12B	ADHOC AND SENSOR NETWORKS	48	3

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	II	50	50	100

Preamble:

To educate students in implementing mobile adhoc and sensor networks in industries. It gives the research and application of advanced wireless technologies for day today life.

Course Outcomes:

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Describtion ofMobile Adhoc and sensor networks	K1
CO2	Explain working principles of WSN and Adhoc networks	K2
CO3	Illustrate the sensors and adhoc principles in wireless latest technologies	K3
CO4	Analyze the Adhoc& WSN Architectural style	K4
CO5	Design, implementing process of MANET & WSN	K5
CO6	Apply the MANET & WSN with different algorithms	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	3	9	9
CO3	9	9	9	9	3	9	9
CO4	9	3	9	3	3	9	3
CO5	9	3	3	3	3	3	3
CO6	9	3	3	3	3	3	3
Total contribution of COs to POs	54	36	42	36	18	42	36
Weighted Percentage COs Contribution to POs	4.2	3.0	3.6	3.1	2.8	4.2	6.2

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Mobile Communications and Computing (8 Hours)

Introduction Mobile Communications and computing: Mobile Computing (MC)-Introduction to MC, novel applications, limitations, and architecture GSM – Mobile services, System Architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and new data services.

UNIT II: Wireless Medium Access Control (10 Hours)

Wireless Medium Access Control: Motivation for a specialized MAC, SDMA, FDMA, TDMA, CDMA. Mobile Network layer – Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host configuration Protocol (DHCP). Mobile transport layer – traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/ fast recovery, Transmission / timeout freezing, Selective retransmission, Transaction oriented TCP.

UNIT III: Mobile Ad Hoc Networks(MANET) (10 Hours)

Mobile Ad Hoc Networks(MANET): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, Security in MANET protocols, and Tools: Wireless Application Protocol – WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.

UNIT VI: Wireless Sensor Network (10 Hours)

Wireless Sensor Network: Wireless Sensor Network Applications, Collaborative processing, Key Definitions of sensor networks. Canonical problem- localization and Tracking, Bayesian state estimation, Distributed representation and interface of states, impact of choice of representation, design consideration in distributed tracking, tracking multiple objects, state space decomposition, data association, sensor models, performance comparison and metrics.

UNIT V: Protocols (10 Hours)

Protocols: IIIE 802.15.4 standard and zigbee, general issues, geographic, energy –aware routing, unicast geographic routing, routing on a curve, energy – minimizing broadcast, attribute- based routing, directed diffusion, rumor routing, geographic hash tables; infrastructure establishment, topology control, clustering, time synchronization, clocks and communication delays, interval methods, broadcasts, localization and localization services, ranging techniques, range based localization algorithms, information- based sensor tasking. IDSQ: information driven sensor querying, cluster leader based protocol, sensor tasking in tracking relations, joint routing and information aggregation, multi step information – directed routing, sensor group management.

REFERENCE BOOK:

1. Jochen Schiller,Mobile Communications,Addison-Wesley,Second edition.
2. Feng Zhao,LeonidusGuibas,Wireless Sensor Networks-An information Processing approach, Elsevier publication.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XII ELECTIVE: II	21CAP12C	DIGITAL IMAGE PROCESSING	48	3

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	II	50	50	100

Preamble:

To attain the knowledge of digital image processing

Course Outcomes:

On successful completion of the course the students should have:

CO Number	CO Statement	Knowledge Level
CO1	Define the concepts of digital image processing	K1
CO2	Discuss the various image processing methods and image transform formats	K2
CO3	Illustrate sampling, filtering and detection methods	K3
CO4	Analyze the enhancement, segmentation , restoration and compression techniques with denoising	K4
CO5	Summarize the different image processing techniques	K5
CO6	Generalize the overview of image processing techniques with different methods	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	3	9	9
CO3	9	9	9	9	3	9	3
CO4	9	3	9	3	3	3	3
CO5	9	3	3	3	3	9	9
CO6	9	3	3	3	3	3	3
Total contribution of COs to POs	54	36	42	36	18	42	36
Weighted Percentage COs Contribution to POs	4.2	3.0	3.6	3.1	2.8	4.2	6.2

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

Unit I: Introduction to Image – Processing (8 Hours)

Introduction to Image – Processing: Introduction – Resolution – Human Visual System – Classification of Digital Images- Image types- Elements of an Image – processing system- Image file formats – Applications of Digital Image Processing- **Image Transform**: Introduction – Need for Transform – Image Transform – Fourier Transform – 2D Discrete Fourier Transform.

Unit II: Image Enhancement (10 Hours)

Image Enhancement: Introduction – Image Enhancement in Spatial Domain –Enhancement through Point operation – Types of Point Operation – Histogram Manipulation – Linear Gray-Level Transformation – Nonlinear Gray-Level Transform – Local or Neighbourhood Operation – Median Filter – Spatial Domain High-pass Filtering or Image Sharpening – Bit-plane Slicing – Image Enhancement in Frequency Domain – Homomorphic Filter – Zooming Operation – Image Arithmetic

Unit III: Image Restoration and Denoising (10 Hours)

Introduction – Image Degradation – Types of Image Blur – Classification of Image – restoration Techniques – Image-restoration Model – Linear Image – restoration Techniques –Image Denoising – Classification of Noise in Image – Median Filtering – Trimmed Average Filter – Performance Metrics in Image Restoration – Applications of Digital Image Restoration.

Unit IV: Image Segmentation (10 Hours)

Introduction – Classification of Image – segmentation Techniques – Region Approach to Image Segmentation – Clustering Techniques – Image Segmentation Based on Thresholding – Edge-based Segmentation – Classification of Edges – Edge Detection – Edge Linking.

Unit V: Image Compression (10 Hours)

Introduction – Need for Image Compression – Redundancy in Images – Classification of Redundancy in Images – Image-compression Scheme – Classification of Image-compression Schemes – Fundamentals of Information theory – Wavelet – based Image Compression – Fractal Image Compression

REFERENCE BOOKS

1. S.Jeyaraman, S.Esakkirajan, T.Veerakumar, “Digital Image Processing”, McGraw Hill Education (India) Private Limited, New Delhi, 2014
2. Rafael G. Gonzalez , Richard E. Woods, “Digital Image Processing”, Pearson Education. 3rd Edition.
3. A.K. Jain, “Fundamental of Digital Image Processing”, PHI Publications, 4th Edition 2011.
4. Chanda &Majumdar,”Digital Image Processing and analysis”, PHI Publications, 2nd Edition 2007.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XII ELECTIVE: II	21CAP12D	VIRTUAL REALITY SYSTEMS	48	3

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	II	50	50	100

Preamble:

The Proposed Paper offers to explore materials and processes used in immersive virtual reality; show a basic awareness and understanding of historical and theoretical contexts relevant to immersive virtual reality and Demonstrate an understanding of the importance of critical and self-reflective practice.

Course Outcomes:

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define the Basics and Introduction of Virtual Reality and how VR systems work.	K1
CO2	Illustrate the Impressive Virtual Reality Tools	K2
CO3	Choose, develop, experiment, the use of particular designs for VR experiences.	K3
CO4	Summarize, distill, and design a research contribution within academic VR.(Virtual Reality take Part in Classroom , Campus and Industrial Training)	K4
CO5	Evaluate the drawbacks of specific VR techniques on the human body.	K5
CO6	Develop the Running Experiments in Virtual Labs	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	3	9	9
CO3	9	9	9	9	3	9	3
CO4	9	3	9	3	3	3	3
CO5	9	3	3	3	3	9	9
CO6	9	3	3	3	3	3	3
Total contribution of COs to POs	54	36	42	36	18	42	36
Weighted Percentage COs Contribution to POs	4.2	3.0	3.6	3.1	2.8	4.2	6.2

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Introduction to Virtual Reality (8 Hours)

Immersion in Alternate Worlds: What is Virtual Reality? - How does Virtual Reality Work? - A Quick Tour of VR - Immersing the Audience - Entertaining the Senses.

UNIT II: The Tools of Virtual Reality (10 Hours)

Reality in a Box - Trackers: Where in the (Virtual) World Are You? - Virtual Visualization - Three - Dimensional Sound- Touching Objects in Thin Air: Manipulation Devices - Working in Wide - Open Spaces: Projection - Based VR.

UNIT III: Science with VR (10 Hours)

Getting a Feel for Microsoft World - Exploring Other Planets via VR - VR and Scientific Visualization - Running Experiments in Virtual Labs - Blowing in the Virtual Wind.

UNIT IV: Learning, Training, and Playing in VR (10 Hours)

VR in the Classroom - VR on Campus - High- Tech Training in Virtual Environments - Virtual Industrial Training - VR and Entertainment - Virtual Worlds within a Virtual World - VR Gaming at Home .

UNIT V: Real Drawbacks to Virtual Reality (10 Hours)

Cyberhype: Mistaking Pipe Dreams for Predictions - The Physical drawbacks of Virtual Reality - Cyberspace Sickness - Decompressing from VR - Blurring the Definition of Reality.

REFERENCE BOOKS:

1. Sean M.Grady, "Virtual Reality Computers Mimic The Physical World", University Press (India) Limited Publications.2000
2. John Vince, "Virtual Reality Systems", Pearson Publications.
3. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2009.
4. Gerard Jounghyun Kim, "Designing Virtual Reality Systems", the Structured Approach, Springer London, 2005.

WEB REFERENCES:

https://www.researchgate.net/publication/359254589_Visualization_in_virtual_reality_a_systematic_review
https://www.youtube.com/watch?v=Nq3mPFgpREE
https://www.sciencedirect.com/science/article/pii/S2212827120305539
https://www.youtube.com/watch?v=bN3JSk9xrhE

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XIII PRACTICAL: III	21CAP13	DATA STRUCTURES AND ALGORITHMS USING JAVA - PRACTICAL	48	2

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	II	50	50	100

Preamble

The course presents various data structures and algorithms with its implementation in JAVA to obtain practical understanding of their concepts and applications.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Recall various data structures, algorithms and sorting methods while writing programs	K1
CO2	Demonstrate the concepts of data structures and algorithms using Java	K2
CO3	Select appropriate data structure and algorithm to solve a specific problem	K3
CO4	Analyze various algorithms with respect to their computational efficiency	K4
CO5	Justify the application of a specific algorithm to solve the given problem with respect to its space and time complexity	K5
CO6	Develop software in Java using various data structures and algorithms for real time applications	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	9	9	3
CO2	9	9	9	9	9	9	3

CO3	**9**	**9**	**9**	**9**	**9**	**9**	**3**
CO4	**9**	**9**	**9**	**9**	**9**	**9**	**3**
CO5	**9**	**9**	**9**	**9**	**3**	**9**	**3**
CO6	**9**	**9**	**9**	**9**	**9**	**9**	**3**
Total contribution of COs to POs	**54**	**54**	**54**	**54**	**48**	**54**	**18**
Weighted Percentage COs Contribution to POs	**4.2**	**4.5**	**4.6**	**4.7**	**7.6**	**5.4**	**3.1**

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

1. Program to implement push and pop operations in a stack.
2. Program to implement insert and delete operations in a queue.
3. Program to implement insertion and deletion operations in a singly linked list.
4. Program to convert an infix expression to postfix expression and evaluate it.
5. Program to implement in order, pre order and post order traversal of a binary tree.
6. Program to implement breadth first and depth first search algorithm in a graph.
7. Program to implement binary search using divide and conquer method
8. Program to implement quick sort using divide and conquer method
9. Program to construct minimum cost spanning tree using Kruskal algorithm
10. Program to perform Job sequencing with deadlines using Greedy algorithm
11. Program to solve knapsack problem using dynamic programming
12. Program to solve Traveling Salesman problem using dynamic programming

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XIV PRACTICAL: IV	21CAP14	WEB PROGRAMMING - PRACTICAL	48	2

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	II	50	50	100

Preamble

This course provides programming skills in HTML,PERL and PHP. To enable the students to develop web based application

Course Outcomes

On successful completion of the course the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define the basic of HTML Forms and Controls and validation	K1
CO2	Tagging the arithmetic operations, Email Processing in Java Script	K2
CO3	Execute the Data Base Concepts	K3
CO4	Calculate the web page view count using session	K4
CO5	Display the digital clock which displays date and time using Perl Program	K5
CO6	Design and build the server information's	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	3	9	9	3
CO2	9	9	9	3	9	9	3
CO3	9	9	9	9	9	9	9

CO4	**9**	**9**	**9**	**9**	**9**	**9**	**9**
CO5	**9**	**9**	**9**	**9**	**9**	**9**	**9**
CO6	**9**	**9**	**9**	**9**	**9**	**9**	**9**
Total contribution of COs to POs	**54**	**54**	**54**	**42**	**54**	**54**	**42**
Weighted Percentage COs Contribution to POs	**4.2**	**4.5**	**4.6**	**3.7**	**8.5**	**5.4**	**7.2**

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

1. Create a HTML form with Name, Address and E-mail text fields. On submitting, store the values in MySQL table.
2. Write JavaScript to validate the following fields of the above registration page.
    a. Name (Name should contains alphabets and the length should not be less than 6 characters).
    b. Password (Password should not be less than 6 characters length).
    c. E-mailid (should not contain any invalid and must follow the standard pattern name@domain.com)
    d. Phone number (Phone number should contain 10 digits only)
3. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient
4. Write a program in PHP for a simple email processing.
5. Write a program for PHP for a login script; create a login database and store username and password.
6. Write PHP program to upload image to the server using html and PHP
7. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page
8. Write a Perl program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
9. Write a Perl program to display a digital clock which displays the current time of the server.
10. Write a Perl program to display Server Information's.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – IV	ABILITY ENHANCEMENT	21AEP01	CYBER SECURITY	24	2

Contact hours per semester: 24
Contact hours per week: 2

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	II	100	-	100

Preamble:

To understand the basics of cyber security and the security threats in day-to-day activities.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Recall the basic concepts of information security and its types	K1
CO2	Gain knowledge on cyber space issues and cyber security measures	K2
CO3	Identify various risks and threats in cyber space	K3
CO4	Apply security measures to prevent ourselves from threats in social media	K4
CO5	Compare various social media, security issues and measures	K5
CO6	Propose a secured cyber platform for people to connect each other for their social and professional concerns	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	9

CO3	**9**	**9**	**9**	**9**	**9**	**9**	**9**
CO4	**9**	**9**	**9**	**9**	**3**	**9**	**9**
CO5	**9**	**9**	**3**	**3**	**3**	**9**	**3**
CO6	**9**	**9**	**3**	**3**	**3**	**3**	**3**
Total contribution of COs to POs	**54**	**54**	**42**	**42**	**36**	**48**	**42**
Weighted Percentage COs Contribution to POs	**4.2**	**4.5**	**3.6**	**3.7**	**5.7**	**4.8**	**7.2**

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Information Security (5 Hours)

History of Information Security - Need for Security-**Types of Security:** Physical Security – Network Security –Personal Security –Operation Security –Communication Security - Information Security Threats.

UNIT II: Introduction to Cyber Security (5 Hours)

Cyber Security: Objectives- Roles- Differences between Information Security and Cyber Security. **Cyber Security Principles:** Confidentiality- Integrity – Availability.

UNIT III: Risks & Vulnerabilities (5 Hours)

Risk Meaning: Risk Management –Problems of Measuring Risk -Risk Levels-Risk Analyzes-Risk Assessment –Response to Risk Terminology- **Threats:** Components of Threats-Types of Threats- **Vulnerabilities:** Computing System Vulnerabilities –Hardware Vulnerabilities-Software Vulnerabilities-Data Vulnerabilities-Human Vulnerabilities.

UNIT IV: Social media (5 Hours)

Introduction to social media: What, Why –Pros and cons- Security issues in social media: Mail-Facebook-Whatsapp-Twitter-Preventive and control measures.

UNIT V: Case study (4 Hours)

Impact of social media: Education -Business- Banking-Mobile –Human Life- Present generation-Indian scenario.

WEB REFERENCES:

1. https://m.youtube.com/watch?v=o6pgd8gLFHg
2. https://m.youtube.com/watch?v=3rl4ZjZpcHU
3. https://blog.barkly.com/10-fundamental-cybersecurity-lessons-for-beginners
4. https://5social media security risk and how to avoid them.html
5. https://10 cyber security twitter profiles to watch.html
6. https://cyber security in banking 4 trends to watch in 2017.html
7. https://gmail hacking security tips-indian cyber security solutions.html

8. https://why social media sites are the new cyber weapons of.html
9. EBook:A complete guide to Staying Ahead in the Cyber Security Game

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CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XV	21CAP15	DATA MINING AND BIG DATA ANALYTICS	60	4

Contact hours per semester: 60
Contact hours per week: 5

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
II	III	50	50	100

Preamble:

To attain the knowledge in basic of Data Mining and the students can learn, Understand and Practice Big Data Analytics.

Course Outcomes:

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define Data Mining concepts with Hadoop architecture	K1
CO2	Explain Data Mining Techniques and Algorithms	K2
CO3	Interpret R Language and Hadoop architecture with algorithms	K3
CO4	Categorize classification, clustering and association rules in data mining	K4
CO5	Estimate Data Mining Algorithms with R language	K5
CO6	Integrate different measures using data mining techniques	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	3
CO2	9	9	9	9	3	9	3

CO3	**9**	**9**	**9**	**9**	**3**	**9**	**3**
CO4	**9**	**9**	**9**	**9**	**3**	**9**	**3**
CO5	**9**	**9**	**9**	**9**	**3**	**3**	**1**
CO6	**3**	**3**	**3**	**9**	**3**	**3**	**1**
Total contribution of COs to POs	**48**	**48**	**48**	**54**	**18**	**42**	**14**
Weighted Percentage COs Contribution to POs	**3.8**	**4.0**	**4.1**	**4.7**	**2.8**	**4.2**	**2.4**

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

Unit I: Introduction to Data Mining Techniques (12 Hours)

Introduction: Basic Data Mining Tasks- Data Mining Versus Knowledge Discovery in Databases- Data Mining Issues- Data Mining Metrics-Social Implication of Data Mining- Data Mining from a Database Perspective- Database /OLTP Systems-Fuzzy sets and Fuzzy Logic.

Data Mining Techniques: Introduction- A statistical Perspective on Data Mining- Similarity Measures – Decision Tress-Neural Networks-Genetic Algorithms.

Unit II: Classification (12 Hours)

Classification: Introduction- Statistical- Based Algorithm- Distance-Based Algorithms – Decision Tree-Based Algorithms- Neural Network-Based Algorithm-Rule Based Algorithm-Combining Techniques.

Unit III: Clustering and Association Rules (12 Hours)

Clustering: Introduction- Similarity and Distance Measures- Outliers- Hierarchical Algorithms-Partitional Algorithms.

Association Rules: Introduction- Large Item sets- Basic Algorithms- Parallel and Distributed Algorithms- Comparing Rules-Advanced Association Rule Techniques.

Unit IV: Using R and Hadoop (12 Hours)

Getting Ready to Use R and Hadoop: Installing R- Installing RStudio- Understanding the Features of R language- Installing Hadoop- Understanding Hadoop features- Learning the HDFS and MapReduce architecture.

Writing Hadoop MapReduce Programs: Understanding the basics of MapReduce- Introducing Hadoop MapReduce –Understanding the Hadoop MapReduce Fundmentals.

Unit V: Integration R and Hadoop (12 Hours)

Integration R and Hadoop: Introducing RHIPE- Understanding the architecture of RHIPE-Understanding RHIPE Samples- Introducing RHadoop.

Using Hadoop Streaming with R: Basics of Hadoop streaming- How to run Hadoop streaming with R?- Exploring the HadoopStreaming R Package.

REFERENCE BOOKS:

1. Margaret H.Dunham, "Data Mining- Introductory and Advanced Topics", Pearson Education, 2009. **(Unit:1,2,3)**

2. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", PACKT Publishing, 2013. **(Unit:4 & 5)**
3. Radha Shankarmani and M.Vijayalakshmi, "Big Data Analytics", 2nd Edition, Wiley.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	**CORE : XVI**	**21CAP16**	**MACHINE LEARNING USING PYTHON**	**48**	**4**

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
II	**III**	**50**	**50**	**100**

Preamble:

This course covers the basic concepts and techniques of Machine Learning and implementation of algorithms using python programming.

Course Outcomes:

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Gain knowledge about basic concepts of Machine Learning.	K1
CO2	Identify machine learning techniques suitable for a given problem	K2
CO3	Apply suitable machine learning techniques for various applications.	K3
CO4	Compare various supervised and unsupervised learning algorithms	K4
CO5	Assess strengths and weaknesses of popular machine learning approaches.	K5
CO6	Design and implement various machine learning algorithms in a range of real-world applications.	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	**9**	**9**	**9**	**9**	**3**	**9**	**3**
CO2	**9**	**9**	**9**	**9**	**3**	**9**	**3**

CO3	**9**	**9**	**9**	**9**	**3**	**9**	**3**
CO4	**9**	**9**	**9**	**9**	**3**	**9**	**3**
CO5	**9**	**9**	**9**	**3**	**3**	**9**	**3**
CO6	**9**	**9**	**3**	**3**	**3**	**3**	**3**
Total contribution of COs to POs	**54**	**54**	**48**	**42**	**18**	**48**	**18**
Weighted Percentage COs Contribution to POs	**4.2**	**4.5**	**4.1**	**3.7**	**2.8**	**4.8**	**3.1**

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Introduction (8 Hours)

Introduction- Why Machine Learning?- Why Python? - Essential Libraries and Tools- A First Application: Classifying Iris Species

UNIT II: Supervised Learning (10 Hours)

Classification and Regression- Generalization, Overfitting, and Underfitting -Supervised Machine Learning Algorithms: Some Sample Datasets - k-Nearest Neighbors : k-Neighbors classification- k-neighbors regression - Linear Models : Linear models for regression - Linear regression- Linear models for classification-Linear models for multiclass classification - Naive Bayes Classifiers - Decision Trees.

UNIT III: Unsupervised Learning and Preprocessing (10 Hours)

Types of Unsupervised Learning -Challenges in Unsupervised Learning -Preprocessing and Scaling -Dimensionality Reduction, Feature Extraction, and Manifold Learning : Principal Component Analysis (PCA)- Clustering : k-Means Clustering - Agglomerative Clustering: Hierarchical clustering and dendrograms –DBSCAN.

UNIT IV: Representing Data and Engineering Features (10 Hours)

Categorical Variables - OneHotEncoder and ColumnTransformer: Categorical Variables with Scikit-learn - Convenient ColumnTransformer creation with make_columntransformer - Automatic Feature Selection

UNIT V: Working with Text Data (10 Hours)

Types of Data Represented as Strings -Representing Text Data as a Bag of Words: Applying Bag-of-Words to a Toy Dataset - Stopwords - Bag-of-Words with More Than One Word (n-Grams) - Topic Modeling and Document Clustering

REFERENCE BOOKS:

1. Andreas C. Müller, Sarah Guido, Introduction to Machine Learning with Python, October 2016. Publisher(s): O'Reilly Media, Inc.
2. Sebastian Raschka, Python Machine Learning, 2015, Packet Publishing Giuseppe Bonaccorso, Machine Learning Algorithms, 2017.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XVII	21CAP17	NETWORK SECURITY AND CRYPTOGRAPHY	60	4

Contact hours per semester: 60
Contact hours per week: 5

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
II	III	50	50	100

Preamble:

To attain the knowledge in basic of network security and various methods in cryptography

Course Outcomes:

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define the basics of network security	K1
CO2	Summarize the intrusion detection and its solutions to overcome the attacks	K2
CO3	Organize the Asymmetric Key Algorithms and Digital Signatures	K3
CO4	Analyze the knowledge on symmetric key algorithms	K4
CO5	Inspect the concept of digital signature	K5
CO6	Design the Network Security, Firewalls and Virtual Private Networks	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	3	3
CO2	9	9	9	9	3	3	3
CO3	9	9	9	9	9	3	3

CO4	**9**	**9**	**9**	**9**	**9**	**3**	**1**
CO5	**9**	**9**	**9**	**9**	**9**	**3**	**1**
CO6	**9**	**9**	**9**	**9**	**9**	**3**	**1**
Total contribution of COs to POs	**54**	**54**	**54**	**54**	**42**	**18**	**12**
Weighted Percentage COs Contribution to POs	**4.2**	**4.5**	**4.6**	**4.7**	**6.6**	**1.8**	**2.1**

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Introduction to Network Security (12 Hours)

Attacks on Computers and Computer Security: Introduction-The Need for security- Security Approaches-Principles of Security-Types of Attacks. Cryptography: Concepts and Techniques: Introduction-Plain Text and Cipher Text-Substitution techniques- Transposition techniques- Encryption and Decryption- Symmetric and Asymmetric Key Cryptography- Steganography

UNIT II: Symmetric Key Algorithms (12 Hours)

Symmetric Key Algorithms: Algorithms Types and Modes-An Overview of Symmetric key Cryptography- Data Encryption Standard (DES)- International Data Encryption Algorithm (IDEA)- RC4- RC5- Blowfish.

UNIT III: Asymmetric Key Algorithms and Digital Signatures (12Hours)

Asymmetric Key Algorithms, Digital Signatures and RSA: Brief history of Asymmetric Key Cryptography- Overview of Asymmetric Key Cryptography- RSA Algorithm- Symmetric and Asymmetric key Cryptography together- Digital Signatures- Knapsack Algorithm.

UNIT IV: Digital Certificates and Internet Security Protocol (12 Hours)

Digital Certificates- Private Key Management. Internet Security Protocols: Basic concepts- Secure Socket Layer (SSL)- Transport Layer Security (TLS)- Secure Hyper Text Transfer Protocol (SHTTP)- Time Stamping Protocol (TSP)- Secure Electronic Transaction (SET)

UNIT V: Network Security, Firewalls and Virtual Private Networks (12 Hours)

Introduction-Brief Introduction to TCP/IP- Firewalls- IP Security- Virtual Private Networks (VPN)- Intrusion.

REFERENCE BOOKS:

1. Atul Kahate, Cryptography and Network Security, 2nd Edition, Tata McGrawHill. **(Unit I: Chapter 1,2, Unit II: Chapter 3, Unit III: Chapter 4, Unit IV: Chapter 5,6 Unit V: Chapter 7)**
2. William Stallings, Cryptography and Network Security, Fifth Edition, Pearson Education.
Douglas Stinson, Cryptography: Theory and Practice, CRC Press, CRC Press LLC

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XVIII ELECTIVE: III	21CAP18A	INTERNET OF THINGS	48	3

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
II	III	50	50	100

Preamble:

To enable the students to understand the concepts of IOT AND technologies used to build IoT applications.

Course Outcomes:

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	To identify the vision of IoT and its future roadmap	K1
CO2	Understanding the technologies used for IoT applications	K2
CO3	Use IoT to solve real world problems	K3
CO4	Examine the constraints and opportunities of wireless networks for IoT.	K4
CO5	Assess potential security issues and solutions in IoT	K5
CO6	To design new IoT based prototypes for real life situations	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	3	9	9

CO3	**9**	**9**	**9**	**9**	**3**	**9**	**9**
CO4	**9**	**3**	**9**	**3**	**3**	**9**	**3**
CO5	**9**	**3**	**3**	**3**	**3**	**3**	**3**
CO6	**9**	**3**	**3**	**3**	**3**	**3**	**3**
Total contribution of COs to POs	**54**	**36**	**42**	**36**	**18**	**42**	**36**
Weighted Percentage COs Contribution to POs	**4.2**	**3.0**	**3.6**	**3.1**	**2.8**	**4.2**	**6.2**

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Introduction and Design Principles for Connected Devices (8 Hours)
Internet of Things- Conceptual framework –Architectural view, Technology behind IoT–Sources of IoT - M2M communication –Examples- IoT/M2M sytems -Layers –Communication Technologies –Gateway

UNIT II: Design Principles for Web Connectivity and Internet connectivity (10 Hours)
Web communication Protocols –Message Communication Protocols – Web connectivity using gateway, SOAP, REST, HTTP RESTful and Websockets- Internet connectivity – Internet based Communication – IP Addressing in the IoT- Media Access Control –Application Layer Protocols.

UNIT III: Sensor Participatory Sensing and wireless sensor networks (10 Hours)
Sensor technology – Participatory sensing, Industrial IoT and Automotive IoT – Actuators – Sensor data communication Protocols –Radio Frequency Identification Technology –Wireless Sensors networks Technology.

UNIT IV: Embedded devices Prototyping and Software Designing for IoT (10 Hours)
Embedded computing Basics –Embedded platforms for Prototyping – Things always connected to Internet/Cloud - Prototyping embedded device Software

UNIT V: IoT Security and Case studies (10 Hours)
Vulnerabilities - Security requirements - threat analysis – Identity management and Establishment ,access control and secure message communication –Design Layers , Design Complexity and designing using cloud PaaS – IoT Applications for Smart homes, cities Environment monitoring and Agriculture.

Reference Books:

1. Raj Kamal, Internet of Things Architecture and Design Principles, McGrawHill Education(India) Pvt Ltd., 2017. ISBN-13:978-93-5260-523-1

2. Arshdeep Bahga, Vijay Madisetti, Internet of Things – A hands-on approach, Universities Press, 2015.
3. Marco Schwartz, Internet of Things with the Arduino Yun,, Packt Publishing, 2014.
4. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, ISBN: 978-1-118-43062-0,Wiley, November 2013

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XVIII ELECTIVE: III	21CAP18B	SOFT COMPUTING	48	3

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
II	III	50	50	100

Preamble

To understand the Soft computing architectures, applications and challenges

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the basics of neural networks	K1
CO2	Explain the knowledge on supervised and unsupervised learning	K2
CO3	Apply the concepts of fuzzy logic and fuzzy sets	K3
CO4	Analyze the membership functions and defuzzification	K4
CO5	Illustrate Genetic Algorithm	K5
CO6	Evaluate genetic algorithm	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	3	9	9
CO3	9	9	9	9	3	9	9
CO4	9	3	9	3	3	9	3

CO5	**9**	**3**	**3**	**3**	**3**	**3**	**3**
CO6	**9**	**3**	**3**	**3**	**3**	**3**	**3**
Total contribution of COs to POs	**54**	**36**	**42**	**36**	**18**	**42**	**36**
Weighted Percentage COs Contribution to POs	**4.2**	**3.0**	**3.6**	**3.1**	**2.8**	**4.2**	**6.2**

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Introduction (8 Hours)

Neural Networks – Artificial Neural Network: Fundamental Concepts – Important Terminologies of ANNs - McCulloch-pitts Neuron Model – Linear Separability – Hebb Network.

UNIT II: Supervised and Unsupervised Learning (10 Hours)

Supervised Learning Network: Perceptron Networks – Back-Propagation Network – Radial Basis Function Network, Associative Memory Networks: Autoassociative Memory Network – Heteroassociative Memory Network – Bidirectional Associative Memory. Unsupervised Learning Networks: Kohonen Self-Organizing Feature Maps – Learning Vector Quantization.

UNIT III: Fuzzy Logic and Fuzzy Sets (10 Hours)

Classical Sets, Fuzzy Sets- Fuzzy relations, cardinality, operations and properties of fuzzy relations, fuzzy composition.

UNIT IV: Membership Functions and Defuzzification (10 Hours)

Introduction - Feature of the membership functions – Fuzzification - Methods of Membership Value Assignments. Defuzzification.

UNIT V: Genetic Algorithm (10 Hours)

Introduction - Biological Backgroud – Traditional Optimization and Search Techniques – Genetic Algorithm and Search Space, Operators in Genetic Algorithm – Encoding – Selection – Crossover – Mutation.

REFERENCE BOOKS:

1. S. N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Wiley-India, 2008.
2. S. N. Sivanandam, S. Sumathi, S.N. Deepa, Introduction to Neural Networks using MATLAB 6.0 , Tata McGraw-Hill, New Delhi, 2006
3. D.E. Goldberg, Genetic algorithms, optimization and machine learning, Addison Wesley 2000.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XVIII ELECTIVE: III	21CAP18C	THEORY OF COMPUTATION	48	3

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
II	III	50	50	100

Preamble:

This course presents the basic theory of computation, techniques, regular languages, context free languages, pushdown automation and turing machine which could be used in design of a compiler.

Course Outcomes:

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Relate Regular Languages and Finite Automata	K1
CO2	Illustrate Context Free Languages.	K2
CO3	Construct Grammar.	K3
CO4	Classify the Chomsky Classification	K4
CO5	Evaluate Pushdown Automation	K5
CO6	Build adequate knowledge in Turing Machine	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	3	9	9

CO3	**9**	**9**	**9**	**9**	**3**	**9**	**3**
CO4	**9**	**3**	**9**	**3**	**3**	**3**	**3**
CO5	**9**	**3**	**3**	**3**	**3**	**9**	**9**
CO6	**9**	**3**	**3**	**3**	**3**	**3**	**3**
Total contribution of COs to POs	**54**	**36**	**42**	**36**	**18**	**42**	**36**
Weighted Percentage COs Contribution to POs	**4.2**	**3.0**	**3.6**	**3.1**	**2.8**	**4.2**	**6.2**

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Regular Languages and Finite Automata (8 Hours)

Finite State Systems – Non Deterministic Finite Automata – Equivalence of DFA and NFA – Finite Automation with Ɛ Moves – Equivalence of NFA's with and without Ɛ Moves – Regular expression and its manipulations-.Minimisation of FSA- Moore and Mealy Machines.

UNIT II: Context Free Languages (10 Hours)

Context Free Grammars – Derivations and Languages – Relation between Derivation and Derivation Trees – Simplification of Context Free Grammars – Normal Forms for Context Free Grammars.

UNIT III: Grammar and Chomsky Classification (10 Hours)

Introduction – Grammar -Chomsky Classification – Formal Grammar – The Hierarchy Languages and their relations- Operations on Languages – Tabular presentation of closure properties of Languages – Recursive and recursively enumerable sets.
Introduction –LR(k) Grammar - LR items – LR(0) Grammar – Computing sets of valid items - Properties of LR(k) Grammar.

UNIT IV: Pushdown Automation (10 Hours)

Introduction – Acceptance by PDA –sPushsown Automata and Context Free Languages – Deterministic Context Free Languages and Deterministic Pushdown Automata – LR(0) Grammar – Parsing.

UNIT V: Turing Machine (10 Hours)

Definition and examples – Computable languages and functions -. Turing Machine construction – Turing Reducibility – P and NP problems – NP Complete and NP hard problems.

REFERENCE BOOKS:

1. Dr.A/M. Natarajan, A. Tamilarasi, P. Balasubramani, "Theory of Computation", A New Age International Publishers, 2003.
2. D.P. Acharjya, "Theory of Computation", MJP Publishers, Second Ediont2010.
3. Harry R. Lewis, Christos H. Papadimitrioui, "Elements of the Theory of Computation", PHI Learning Private Ltd., Second Edition.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XVIII ELECTIVE: III	21CAP18D	RESEARCH METHODOLOGY	48	3

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	III	50	50	100

Preamble

To expose the students with the principles, procedures and techniques of research methodology and assist in planning, carrying and implementing a research project.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Recall the concepts of research, limitations of research, purpose of literature review, sources of literature, research problem definition and research design.	K1
CO2	Infer research types, need for research design, importance of research design, classifications of research design, report writing.	K2
CO3	Develop research approaches, basic principles of research design, research report, oral presentation.	K3
CO4	Classify research process, literature search procedure, qualitative and quantitative data, data analysis and interpretation.	K4
CO5	Justify data collection, dependent and independent variables, criteria for good research, guidelines for oral and written presentation of research findings.	K5
CO6	Propose a research paper for a scientific journal and develop a testing hypothesis for research.	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	9

CO2	**9**	**9**	**9**	**9**	**3**	**9**	**9**
CO3	**9**	**9**	**9**	**9**	**3**	**9**	**3**
CO4	**9**	**3**	**9**	**3**	**3**	**3**	**3**
CO5	**9**	**3**	**3**	**3**	**3**	**9**	**9**
CO6	**9**	**3**	**3**	**3**	**3**	**3**	**3**
Total contribution of COs to POs	**54**	**36**	**42**	**36**	**18**	**42**	**36**
Weighted Percentage COs Contribution to POs	**4.2**	**3.0**	**3.6**	**3.1**	**2.8**	**4.2**	**6.2**

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Introduction to Research Methodology (8 Hours)

Introduction to Research: Meaning, Objectives, Types of research – Research approaches – Research methods Vs Methodology - Research process – Criteria of good research – Limitations of research.

UNIT II: Literature Survey & Problem Definition (8 Hours)

Literature Survey: Purpose of review of literature – Literature search procedure – Sources of literature – Importance of review of literature. Selecting a research problem – Problem definition: Necessity, Techniques and Illustration.

UNIT III: Research Design (12 Hours)

Essentials of research design: Need, Features of a good design and important concepts - Classifications of research design – Basic principles of experimental design - Measurement and Scaling: Quantitative, Qualitative, Data Collection, Data Preparation.

UNIT IV: Mathematical Modeling (12 Hours)

Descriptive statistics: Measures of central tendency, Measures of dispersion, Measure of skewness, kurtosis. Measure of Relationship: Regression analysis - Dependent and Independent variable - Simple linear regression model – Hypothesis: Fundamentals of Hypothesis testing – Testing the hypothesis.

UNIT V: Report Writing (8 Hours)

Report writing: Significance of report writing – Different steps in writing report – Layout of research paper – Types of report – Oral presentation – Mechanics of writing research report - Precautions of writing research report -Case study: Preparing a research paper for a scientific journal.

REFERENCE BOOKS:

1. C R Kothari, Gaurav Garg "Research methodology Methods and Techniques", Third edition,New Age International publishers.

2. Kumar," Research Methodology: A Step by Step Guide for Beginners", 3rd. ed. Indian: PE, 2010

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XIX PRACTICAL: V	21CAP19	DATA MINING AND BIG DATA ANALYTICS-PRACTICAL	48	2

Contact hours per semester: 48
Contact hours per week: 4

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	III	50	50	100

Preamble

To uncover hidden patterns, unknown correlations and other useful information to make better decisions.

Course Outcomes

On the successful completion of the course, students will be able to

.CO Number	CO Statement	Knowledge Level
CO1	Recall Data Mining techniques and Hadoop concepts	K1
CO2	Clarify Data Mining Techniques and Hadoop framework	K2
CO3	Apply R Language to implement data mining algorithms	K3
CO4	Investigate various classification and clustering algorithm using R language with respect to their computational efficiency	K4
CO5	Determine tools and techniques to analyze Big Data.	K5
CO6	Design software using Data mining algorithms and Big Data Analytics for real time applications using R	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	3

CO2	**9**	**9**	**9**	**9**	**3**	**9**	**3**
CO3	**9**	**9**	**9**	**9**	**3**	**9**	**3**
CO4	**9**	**9**	**9**	**9**	**3**	**9**	**3**
CO5	**9**	**9**	**9**	**9**	**3**	**3**	**3**
CO6	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Total contribution of COs to POs	**48**	**48**	**48**	**48**	**18**	**42**	**18**
Weighted Percentage COs Contribution to POs	**3.8**	**4.0**	**4.1**	**4.2**	**2.8**	**4.2**	**3.1**

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

1. Implement Apriori algorithm to extract association rule of data mining.
2. Implement K-Means Clustering techniques.
3. Implement any one Hierarchal Clustering.
4. Implement Classification Algorithm
5. Implement a decision tree
6. Linear regression
7. Implement any one statistical based algorithm.
8. Implement outliers.
9. Implement logistic Regression.
10. Implement time series analysis.
11. Installation of Hadoop
12. File Management tasks in Hadoop
13. Word count Map Reduce

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XX PROJECT: I	21CAP20	MINI PROJECT AND VIVA VOCE	60	3

Contact hours per semester: 60
Contact hours per week: 5

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	III	50	50	100

Preamble

The Proposed Paper intends students to apply the programming knowledge into a real- world situation/problem and promote the concept of entrepreneurship.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Describe the systematic approach for handling a projects	K1
CO2	Illustrate the methodologies and professional way of documentation and communication.	K2
CO3	Demonstrate the key stages in development of the project.	K3
CO4	Analyze the various requirements of the given project	K4
CO5	Evaluate the relevance and level of achievement of project objectives	K5
CO6	Develop innovative thinking and thereby get prepared for main project	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	9
CO3	9	9	9	9	9	9	9

CO4	**9**	**9**	**9**	**9**	**9**	**9**	**9**
CO5	**9**	**9**	**9**	**9**	**3**	**9**	**3**
CO6	**9**	**9**	**9**	**9**	**3**	**3**	**3**
Total contribution of COs to POs	**54**	**54**	**54**	**54**	**42**	**48**	**42**
Weighted Percentage COs Contribution to POs	**4.2**	**4.5**	**4.6**	**4.7**	**6.6**	**4.8**	**7.2**

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

MINI PROJECT (GUIDELINES FOR MINI PROJECT):

a. The aim of the Mini Project is to lay a foundation for the Main Project.

b. Each student should carry out individually one Mini Project Work and it may be a case study using the software packages that they have learned or may be an implementation of a concept in a paper prescribed on a journal.

c. It should be compulsorily done in the college only under the supervision of the staff concerned.

Departments encouraging project work may adopt the following structure for evaluation of reports else, they shall define their own rubrics as per need. **The project reports** are evaluated at the end of semester by the **Internal & External Examiners** as appointed By COE. Following weightages shall be used to evaluate the Project report:

SPLIT - UP	**COMPONENTS**		**TOTAL MARKS (100)**
CIA	Review I and Presentation	25	50
	Review II and Presentation	25	
ESE*	Problem Identification	10	50
	Nature of Work / Logic behind the study	20	
	Learning Outcome	10	
	Viva – Voce	10	

*ESE Viva-Voce for Mini-projects will be jointly conducted by internal and external examiners.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART – III	CORE: XXI	21CAP21	GREEN COMPUTING	36	2

**Open Elective offered for students of other PG Programmes /Departments*

Contact hours per semester: 36
Contact hours per week: 3

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	III	50	50	100

Preamble

To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment, skill in energy saving practices in their use of hardware, examine technology tools that can reduce paper waste and carbon footprint by user.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Label the problems concerning with e-waste and its consequences on environment	K1
CO2	Describe the components involved and how effectively we can achieve cost saving without harming environment	K2
CO3	Inspect the procedural aspects towards going green.	K3
CO4	Categorize the means of green compliance	K4
CO5	Specify the certifications necessary for hardware devices	K5
CO6	Assess the green metrics adopt for the entire organization	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	9
CO2	9	9	3	9	3	9	9
CO3	9	9	9	9	3	9	9
CO4	9	6	9	6	3	6	3
CO5	9	6	3	3	3	3	6

CO6	**3**	**3**	**3**	**6**	**3**	**6**	**6**
Total contribution of COs to POs	**48**	**42**	**36**	**42**	**18**	**42**	**42**
Weighted Percentage COs Contribution to POs	**3.8**	**3.5**	**3.0**	**3.7**	**2.8**	**4.2**	**7.2**

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I Green Computing Essentials (6 Hours)

Overview and Issues: Introduction - green Computing - Problems – Your Company's Carbon Footprint – Cost Savings. **Initiatives and Standards**: Global Initiatives.

UNIT II Green Computing Tribulations and Optimizations (8 Hours)

Minimizing Power Usage: Power problems - Monitoring power Usage – Reducing Power Usage – Low power Computers – Components. **Cooling:** Cooling Costs – Reducing Cooling Costs – Adding Cooling – Datacenter Design.

UNIT III Green Enterprise Transforming (7 Hours)

Changing the Way of Work: Old Behaviour – Steps – Teleworkers and Outsourcing. **Going Paperless:** Paper Problems – Paper and Office – Going Paperless – Intranets – Electronic Data Interchange (EDI).

UNIT IV Green Compliance (7 Hours)

Recycling: Problems – Means of Disposal – Life Cycle – Hard Drive Recycling. **Hardware Considerations**: Certification Programs – Energy Star.

UNIT V Green Accomplishment (8 Hours)

Greening Your Information Systems: Initial Improvement Calculations – Change Business Process – Improve Technology Infrastructure. **Staying Green:** Organizational Check-ups – Equipment Check-ups – Certifications – Helpful Organizations.

TEXT BOOKS:

1. Tushar Sambare , Sonali Sambare: Green Computing, Himalaya Publishing House, First Edition 2008.

REFERENCE BOOKS:

1. Carl Speshocky, Empowering Green Initiatives with IT, John Wiley & Sons, 2010.
2. Jason Harris, Green Computing and Green IT- Best Practices on regulations & Industry, Lulu.com, 2008.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART V: PROFICIENCY ENHANCEMENT	**SELF STUDY**	**21PEP01**	**MANAGEMENT INFORMATION SYSTEM (SELF STUDY)**	**-**	**2**

Contact hours per semester: -
Contact hours per week: -

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
II	**III**	**-**	**100**	**100**

Preamble

To expose the students with the structure and classifications of MIS, decision making, system development stages and information system enabler.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define the concepts of MIS,types of information, support systems, system concepts and organizational learning	K1
CO2	Explain organizational functions, decision making systems, system analysis tools, system design and planning	K2
CO3	Develop different classifications and models of MIS, strategies of information systems with concepts of IS	K3
CO4	Classify design methods of decision support systems and its types, structured analysis tools for system development.	K4
CO5	Determine various models of IS, information requirement analysis,testing tools and its working procedures.	K5
CO6	Design and develop MIS model for a company, bank and hotel with real time examples	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	**9**	**9**	**9**	**9**	**3**	**9**	**3**
CO2	**9**	**9**	**9**	**9**	**3**	**9**	**3**
CO3	**9**	**9**	**9**	**9**	**3**	**9**	**3**
CO4	**9**	**3**	**9**	**3**	**3**	**3**	**3**

CO5	**9**	**3**	**3**	**3**	**3**	**3**	**3**
CO6	**9**	**3**	**3**	**3**	**3**	**3**	**3**
Total contribution of COs to POs	**54**	**36**	**42**	**36**	**18**	**36**	**18**
Weighted Percentage COs Contribution to POs	**4.2**	**3.0**	**3.6**	**3.1**	**2.8**	**3.6**	**3.1**

Level of correlation: 0–No correlation; 1–Low correlation; 3–Medium correlation; 9-High correlation between COs and POs.

COURSE CONTENT:

UNIT I: Introduction, Structure and Classification of MIS

Framework of Management Information Systems: Importance's of MIS - Concepts of management - Information – System - Definition of MIS - Information technology and MIS - Nature and scope of MIS - MIS characteristics and functions.Structure and Classification of MIS: Structure of MIS - MIS structure based on physical components - Information system processing functions - Decision support - Levels of management activities - Organizational functions - MIS classification - Transaction processing system - Management information system - Decision support system - Executive support system.

UNIT II: Decision making and Information Systems

Decision making and MIS: Decision making - Simon's model of decision making - Types of decisions - Purpose of decision making - Level of programmability - Knowledge of outcomes - Methods of choosing among alternatives - Decision making and MIS. Information and system concepts: Types of information - strategic information - Tactical information- Operational information. Information quality, dimensions of information, System: Kinds of Systems - System related concepts - Elements of systems - Human as an information processing system.

UNIT III: System Development, Implementation and maintenance

System Development Approaches: System development stages - System investigation - System analysis - System design - Construction and testing – Implementation - Maintenance. System development approaches (a brief introduction): Waterfall model- Prototyping model - Iterative enhancement model - Spiral model. System analysis: Introduction - Requirement definition - Strategies for requirement definition - Structured analysis tools: Data flow diagram - Data dictionary - Decision trees - Structured English - Decision trees.

UNIT IV: System Design and Planning

System Design: Objectives - Conceptual design - Design methods - Detailed system design.Implementation and evaluation of MIS: Implementation process - Hardware and software selection - Evaluation MIS - System maintenance.Information system Planning: Information system planning - Planning terminology - The Nolan stage model - The four state model of IS planning - Strategic planning - Information requirement analysis.

UNIT V: Information System Enabler

Information system as an Enabler: Introduction - Changing concepts of IS - Information for general management - Information for decision making - Information as a strategic resource IS as an Enabler - Competitive advantage - Organisational change - Organisational learning.

REFERENCE BOOKS:

1. D.P. Goyal, " Management information systems", Macmillan India Ltd, First Published 2000.
2. Whitten,Bentley, & Barlow, "System Analysis and Design Methods", TMH
3. J. Kanter, "Structured Analysis & Design of Information System", PHI.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
PART-III	CORE: XXII PROJECT: II	21CAP22	MAJOR PROJECT AND VIVA-VOCE	-	12

Contact hours per semester: -
Contact hours per week: -

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
II	IV	100	100	200

Preamble

The Proposed Paper allows students to apply the programming knowledge into a real- world situation/problem and promote the concept of entrepreneurship.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Recall the principles and methodologies of software engineering	K1
CO2	Demonstrate the ability to locate and use technical information from multiple sources.	K2
CO3	Apply the acquired communication, technical and programming skills in the development of the project.	K3
CO4	Analyze a given problem to apply appropriate problem solving methodology	K4
CO5	Validate the feasibility of the project	K5
CO6	Develop real time projects as per industry needs	K6

K1 – Remember; K2 – Understand; K3 – Apply;
K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	9
CO3	9	9	9	9	9	9	9
CO4	9	9	9	9	9	9	9
CO5	9	9	9	9	9	9	9
CO6	9	9	9	9	9	3	3

Total contribution of COs to POs	**54**	**54**	**54**	**54**	**54**	**48**	**48**
Weighted Percentage COs Contribution to POs	**4.2**	**4.5**	**4.6**	**4.7**	**8.5**	**4.8**	**8.2**

Level of correlation: 0–No correlation; 1–Low correlation;
3–Medium correlation; 9-High correlation between COs and POs.

MAJOR PROJECT (GUIDELINES FOR MAJOR PROJECT):

a. Each student should carry out individually one Major Project Work using the software packages that they have learned or may be an implementation of a concept in a paper prescribed on a journal.

b. It should be compulsorily done in the IT Industry or some other company only under the supervision of the staff concerned.

Departments encouraging project work may adopt the following structure for evaluation of reports. **The project reports** are evaluated at the end of semester by the **Internal & External Examiners** as appointed By COE. Following weightages shall be used to evaluate the Project report:

SPLIT - UP	**COMPONENTS**		**TOTAL MARKS (200)**
CIA	Regularity	25	100
	Review I and Presentation	25	
	Review II and Presentation	25	
	Review III and Presentation	25	
ESE*	Problem Identification	20	100
	Nature of Work / Logic behind the study	20	
	Learning Outcome	10	
	Viva – Voce	50	

ESE Viva-Voce for projects will be jointly conducted by internal and external examiners.

DISTRIBUTION OF MARKS AND QUESTION PAPER PATTERN FOR MCA PROGRAMME

For Scholastic Courses:

CATEGORY	TOTAL MARKS	DISTRIBUTION OF MARKS		PASSING MINIMUM (FOR ESE)	OVERALL PASSING MINIMUM FOR (CIA & ESE)
		CIA*	ESE**		
Theory / Practical / Mini Project (Both CIA and ESE) Core / Elective / Open Elective / Any category	100	50	50	25	50
Major Project (Both CIA and ESE)	200	100	100	50	100
100% INTERNAL (ONLY CIA) Ability Enhancement Course: Cyber Security	100	100	--	--	50
100% EXTERNAL (ONLY ESE) Proficiency Enhancement	100	--	100	50	50

***Bloom's Taxonomy based assessment pattern.**

**** ONLY CIA indicates 100% CIA course, ONLY ESE indicates 100% ESE appearance, BOTH indicates CIA and ESE components WITH MANDATED appearance for CIA to take up the ESE.**

For Co-Scholastic Courses:

Category	Theory	Practical	Total Marks	PASSING MINIMUM @ ANNUAL EXAM	Grade
BOTH Theory and Practical	50	50	100	50	Marks 90 - 100 - A++ Outstanding Marks 80 – 89 - A+ Excellent Marks 70 – 79 - A Very Good Marks 60 - 69 - B+ Good Marks 50 – 59 - B Average Marks 40 – 49 - C Satisfactory Marks 0 - 39 - U Re-appear
ONLY Theory	100	--	100	50	
ONLY Practical	--	100	50	50	

For Courses offered as Scholastic Courses:

A) For Theory Courses (BOTH CIA AND ESE) under PART III / IV:

<table>
<tr><th>SPLIT – UP</th><th>COMPONENTS</th><th>MARKS</th><th>TOTAL MARKS</th></tr>
<tr><td rowspan="5">CIA</td><td>Average of 3 online assignments</td><td>5</td><td rowspan="5">50</td></tr>
<tr><td>Others</td><td>5</td></tr>
<tr><td>Seminar</td><td>10</td></tr>
<tr><td>Average of CIA I and CIA II TESTS</td><td>20</td></tr>
<tr><td>Model Exam</td><td>10</td></tr>
<tr><td rowspan="4">CIA Test QP pattern</td><td>CIA – I and CIA – II 1.5 hrs</td><td rowspan="2">5</td><td rowspan="4">25</td></tr>
<tr><td>Section A: 5 Questions (5 X 1 = 5)
K1: Remember Level, K2: Understand Level
(Either / or Type Questions)</td></tr>
<tr><td>Section B: 5 Questions (5 X 3 = 15)
K3 – 3 questions, K4 – 2 questions
Both options from same level
(Either / or Type Questions)
K3: Apply Level
K4: Analyze Level</td><td>15</td></tr>
<tr><td>Section C : 1 Question (1X 5 = 5)
K4 / K5 /K6 – 1 Question
Both options from same level
(Either / or Type Question)
K4: Analyze Level
K5: Evaluate Level
K6: Create Level</td><td>5</td></tr>
<tr><td>Model Exam
and</td><td>Section A: (10 X 1 = 10)
K1: Remember Level
Two questions from each unit (No Choice)</td><td>10</td><td></td></tr>
</table>

SPLIT – UP	COMPONENTS	MARKS	TOTAL MARKS
ESE	**Section B: (5 X 3 = 15)** K3 – 3 questions, K4 – 2 questions One question from each unit / both options from same level *(Either / or Type Questions)* K3: Apply Level K4: Analyze Level	15	**50**
	Section C : (5 X 5 = 25) K4 – 1 question, K5 – 3 questions, K6 – 1 question One Question from each unit / both options from same level *(Either / or Type Questions)* K4: Apply Level K5: Analyze Level K6: Evaluate Level Q.No. 20 is COMPULSORY	25	

Guidelines for Assignment: (5 marks):

A student is expected to submit three online assignments on any topic relevant to her course as directed by her course instructor based on the assignment schedule provided at the beginning of the semester for every course. Marks will be awarded based on concept clarification and justification on the task. Average marks of the three assignments are considered in this case. K6 –level assignments are appreciable. A student can score a maximum of 5 marks from assignments.

Guidelines for Others: (5 marks)

A student will be evaluated during the semester on her participation in class, case studies presentation, field work, field survey, group discussion, term paper, participation in workshop/conference, presentation of papers in conferences, surprise / informed quizzes from

the respective courses that maybe conducted online / offline with simple multiple choice questions, report / content writing, online courses, etc. Average marks in these activities will fetch her a maximum of 5 marks.

Guidelines for Seminar (10 marks):

A student shall handle a seminar on any topic relevant to her course as directed by her course instructor for which marks shall be awarded based on concept clarification and justification on the task. A student can score a maximum of 10 marks for her seminar.

Guidelines for CIA tests (20 marks):

A student will be evaluated during the semester in Two CIA tests that would be conducted as per the schedule approved by the academic head. Average of the two tests will be considered in this category. Appearance for at least one CIA is mandatory.

Guidelines for MODEL exam (10 marks):

A student has to be appear for the MODEL EXAM that would be conducted as per the schedule approved by the academic head. Appearance for MODEL EXAM is mandatory for ESE appearance.

B) <u>For Practical Courses (With CIA and ESE) under Part III :</u>

<table>
<tr><th>SPLIT – UP</th><th>COMPONENTS</th><th>MARKS</th><th>TOTAL MARKS</th></tr>
<tr><td rowspan="4">CIA</td><td>Conduct of Experiments / Observations
(Minimum 10 experiments to be conducted/practical course/semester)</td><td>10</td><td rowspan="4">50</td></tr>
<tr><td>Periodical Lab Tests (Average of TWO) 15 Marks</td><td rowspan="2">35</td></tr>
<tr><td>Model Test : 20 Marks</td></tr>
<tr><td>Record Work</td><td>5</td></tr>
<tr><td>ESE</td><td>Experiment / Activity: 1
Algorithm/Steps/Procedure/Logic
Input/Execution/Observations/Output/Result</td><td>10
10</td><td>50</td></tr>
</table>

	Experiment / Activity: 2 Algorithm/Steps/Procedure/Logic Input/Execution/Observations/Output/Result	10 10	
	Record Work	10	

*There shall be change in the components measured depending on the nature of the course and is left to the discretion of the department.

*RECORD WORK is MANDATORY for ESE appearance.

C) <u>Components and Breakup of Marks for Institutional Training / Mini Project (CIA) under Part - III :</u>

Institutional Training reports are evaluated at the end of semester - V by the **Internal Examiners** only as appointed by COE. Following weightages shall be used to evaluate the institutional training report / mini-project:

COMPONENTS*	**MARKS**	**TOTAL MARKS**
Understanding and articulation of concepts	30	**100**
Clarity and comprehensiveness of presentation in the report	30	
Structure and neatness of the report	40	

* 100% CIA, NO ESE.

***Different metrics may be evaluated depending on the nature of the work carried out during the training period and is left to the discretion of the department.**

D) <u>Components and Breakup of Marks for evaluation of Project (ESE) under Part III:</u>

Departments encouraging project work may adopt the following structure for evaluation of reports else, they shall define their own rubrics as per need. The **project reports** are evaluated at the end of semester jointly by the **Internal & External Examiners** as appointed by CoE. Following components shall be used for evaluation:

SPLIT - UP	**COMPONENTS**	**TOTAL MARKS**

CIA	Regularity	15	50
	Review / Presentation	15	
	Knowledge about the organisation / theme of study	20	
ESE*	Nature of Work / Logic behind the study	10	50
	Learning Outcome	20	
	Viva – Voce	20	

* **ESE Viva-Voce for projects will be jointly conducted by internal and external examiners.**

- There shall be change in the components measured depending on the nature of the course and is left to the discretion of the department.

E) <u>For COURSES that are 100% ESE under Part –IV and PART V:</u>

SPLIT – UP	COMPONENTS	TOTAL MARKS
21AEP01 21PEP01	**Answer all Questions 5 X 20 = 100** 3 Hours One question from each unit *(*Either / or type*)* *Both options from the same unit / same level* *K1, K2,K3,K4,K5, K6 - ANY LEVEL*	100

Note : 100% ESE ONLY, NO CIA.

For courses offered under Co-Scholastic Courses:

<table>
<tr><th>SPLIT – UP</th><th colspan="2">COMPONENTS</th><th>TOTAL MARKS</th></tr>
<tr><td>ONLY Theory
100 marks</td><td colspan="2"><u>ANNUAL EXAM</u>

Section A 5 X 20 = 100 3 Hours
One question from each unit
(Either / or type)
Both options from the same unit / same level
K1, K2,K3,K4,K5, K6 - ANY LEVEL</td><td>100</td></tr>
<tr><td rowspan="6">Both
Theory and
Practical

100 marks</td><td>Seminar</td><td>5</td><td rowspan="5">100</td></tr>
<tr><td>A student will be evaluated during the semester on her participation in class, case studies presentation, group discussion, surprise / informed quizzes that may be conducted online / offline with simple multiple choice questions, etc. Average marks in these activities will fetch her a maximum of 25 marks.</td><td>20</td></tr>
<tr><td>Completion of activities / experiments / exercises</td><td>15</td></tr>
<tr><td>Viva-Voce</td><td>10</td></tr>
<tr><td><u>ANNUAL EXAM</u>
Section A 5 X 10 = 50 1.5 Hours
One question from each unit
(Either / or type)
Both options from the same level

K1, K2,K3,K4,K5, K6 - ANY LEVEL</td><td>50</td><td></td></tr>
<tr><td>ONLY Practical</td><td>Record / Observation</td><td>10</td><td>100</td></tr>
</table>

100 marks	Completion of activities / experiments / exercises	20	
	2 experiments on the day of assessment	60	
	Viva-Voce	**10**	

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GUIDELINES FOR COURSES

GUIDELINES FOR SCHOLASTIC COURSES OFFERED UNDER PART III, IV AND V:

For courses under PART III

Score obtained in these courses WILL BE ACCOUNTED FOR CGPA CALCULATION..

a). Institutional training / Mini Project :

Course Code	Semester	Course	Evaluation	Credits
21CAP20	III	Mini Project	Both CIA and ESE	**3**

MINI PROJECT (GUIDELINES FOR MINI PROJECT):

a. The aim of the Mini Project is to lay a foundation for the Main Project.
b. Each student should carry out individually one Mini Project Work and it may be a case study using the software packages that they have learned or may be an implementation of a concept in a paper prescribed on a journal.
c. It should be compulsorily done in the college only under the supervision of the staff concerned.

Departments encouraging project work may adopt the following structure for evaluation of reports else, they shall define their own rubrics as per need. **The project reports** are evaluated at the end of semester by the **Internal & External Examiners** as appointed By COE. Following weightages shall be used to evaluate the Project report:

SPLIT - UP	COMPONENTS		TOTAL MARKS (100)
CIA	Review I and Presentation	25	50

	Review II and Presentation	25	
ESE*	Problem Identification	10	50
	Nature of Work / Logic behind the study	20	
	Learning Outcome	10	
	Viva – Voce	10	

*ESE Viva-Voce for Mini-projects will be jointly conducted by internal and external examiners.

b). Open Elective Course:

Course Code	Semester	Course	Evaluation	Credits
21CAP21	III	GREEN COMPUTING	Both CIA and ESE	2

Open elective courses are core courses offered DURING SEMESTER III under Part: III for students of other PG programmes, where a student can choose any course offered under this category from other than her parent department. Notification is handled on advice of the academic head and enrollment for the course is done on first come first serve basis depending upon the available strength. The course is taught and is administered by the norms pertaining to the department which offers the course. Adherence to the scheme, syllabus, distribution of marks and question paper pattern as found in the curriculum of the parent department is MANDATORY. Score obtained in this course will be accounted for CGPA calculation. Following is the list of courses available for the students of MCA programme.

List of open elective courses offered for the students admitted in MCA programme from the academic year 2021-22 and onwards

Course Code	Department	Course	Evaluation	Credits
	Department of English	English for Career Development	Both CIA and ESE	2
	Department of Tamil	தேர்வு நோக்கில் தமிழ் இலக்கியம் வரலாறு		
	Department of Mathematics	Mathematical Aptitude for Competitive Examinations		
	Department of Physics	Environmental Physics		
	Department of Commerce	Net Banking and Practice		
	Department of Management	Agri-Entrepreneurship		

c). Major Project & Viva-Voce :

Each student should carry out individually one Major Project Work using the software packages that they have learned or may be an implementation of a concept in a paper prescribed on a journal.It should be compulsorily done in the IT Industry or some other company only under the supervision of the staff concerned with due approval from the Department. A project report should be submitted by the student at the end of the fourth semester (ESE) to complete the programme and is duly evaluated jointly by the INTERNAL and EXTERNAL EXAMINERS appointed by the CoE. Departments encouraging project work shall define their own rubrics as per need and the components measured may vary depending on the nature of the course and is left to the discretion of the department.

SPLIT - UP	COMPONENTS		TOTAL MARKS (200)
CIA	Regularity	10	100
	Review I and Presentation	30	
	Review II and Presentation	30	
	Review III and Presentation	30	
ESE*	Problem Identification	20	100
	Nature of Work / Logic behind the study	20	
	Learning Outcome	10	
	Viva – Voce	50	

*ESE Viva-Voce for projects will be jointly conducted by internal and external examiners.

For courses under PART IV

Score obtained in these courses WILL NOT BE ACCOUNTED FOR CGPA CALCULATION.

Ability Enhancement Course:

Course Code	Semester	Course	Evaluation	Credits
21AEP01	II	Cyber Security	100% CIA NO ESE	2

On successful completion of these courses, students will be able to demonstrate skills necessary for tackling challenges in today's digitalized world driven by consumerism. They are also taught relating to the main stream of study and hence, ensure job readiness after completion of the PG programme.

For courses under PART V

Score obtained in these courses WILL NOT BE ACCOUNTED FOR CGPA CALCULATION.

a). Proficiency Enhancement Courses :

Course Code	Semester	Course	Evaluation	Credits
21PEP01	III	Management Information System (Self Study)	NO CIA 100% ESE	2

These courses are provided to enhance the academic proficiency of a student. No lecture hours are provided and therefore, these are SELF STUDY courses and the students are expected to prepare the courses on the prescribed syllabi by their own. Students have to appear for the ESE that would be conducted as per the curriculum specification of each department and scoring a passing minimum is mandatory for completion of the programme.

b). Competency Enhancement Courses:

Semester	Course	Course Completion	Credits
I - IV	Online course / Learning Object Repository	Self-paced, Upon personal choice and as guided by faculty mentor	1
	Certificate Course	Can be completed during any semester from I – IV NO CIA, NO ESE	1

Students are awarded with credits on submission of proofs for completion of the components mentioned therein during semester I - IV and these courses are not evaluated for marks.

i). <u>Online Course / Learning Object Repository:</u>

Course Code	Semester	Course	Course Completion	Credits
21CEPBA01	I - IV	Online Course / Learning Object Repository(LOR)	As guided by faculty mentor	1

Every student is expected to complete an online certificate course (obtaining a certificate is mandatory) or prepare a Learning Object Repository (based on any of her courses in the curriculum) in consultation with her faculty mentor and shall refer to web sites as referred by the department. Completing this category during any of the FOUR semesters (I / II / III / IV) will fetch her 1 credit.

ii). Certificate Course:

Course Code	Semester	Course	Course Completion	Credits
21CEPBA02	I - IV	Certificate Course	As guided by faculty mentor	1

Every student is expected to complete a certificate course (obtaining a certificate is mandatory) in consultation with her faculty mentor. Completing this category during any of the FOUR semesters (I / II / III / IV) will fetch her 1 credit.

GUIDELINES FOR CO-SCHOLASTIC COURSES:

The co-scholastic courses are offered with an intention to provide learner centric, skill oriented technical training that help an individual to showcase their competency, learn commitment for the profession, add value and build expertise in their area of study and helps with job advancement / career building opportune for students of all UG programmes. Evaluation in this category is done by INTERNAL EXAMINERS / COMPETENT CERTIFYING PROFESSIONAL BODIES / PROFESSIONAL INSTITUTIONS as is required, at the end of an academic year. However for the award of the degree, completion of co-scholastic MANDATORY courses is required. However, the score obtained in this category WILL NOT BE ACCOUNTED FOR CGPA CALCULATION.

Every course is taught 40 Hours in a year and assessment is made at the end of the academic year (even semester ESE ONLY). Students who score the passing minimum will be given certificates with grades, based on the marks scored during the final Examination.

CATEGORIES AVAILABLE:

a) VALUE ADDED COURSES

b) COURSES WITH CREDIT TRANSFERABILITY

c) EXTRA CREDIT COURSES

are the THREE categories of CO-SCHOLASTIC COURSES offered to nurture - choice based skill / ability / proficiency / competency enhancement of an individual in addition to the courses specified under the scheme of examinations.

a) VALUE ADDED COURSES:

Value added courses are intended to provide additional learner centric, graded and skill oriented technical training for students of all UG Programmes. These courses help students to gain knowledge from subject experts to meet industrial expectations, enhance employability skills and support student progression.

Value added courses are approved by the board of studies of the parent department and differ from the courses offered under the curriculum of the parent department as well as other

programmes. Industry experts / eminent academicians from other Institutes / Subject matter experts from the respective departments may be involved in facilitating the value added courses.

Category: Value Added Course		
Year of Study	**Course Code**	**Course Title**
I		Corporate Culture and Business Communication
II		Android Application Development

b) COURSES WITH CREDIT TRANSFERABILITY:

In lieu with the direction of the University Grants Commission, referring to the Credit Framework for online learning courses through SWAYAM - Regulation 2016 for universities and colleges, to use the Massive Open Online Courses (MOOC) available on the HRD Ministry's 'Swayam' platform for credit transfer, students who complete a course in their curriculum (the courses approved by Swayam board, that were ready to be offered in the July semester 2020 AND ONWARDS) are permitted to transfer their credit and can be exempted from appearing the particular course in their curriculum. The score obtained in will be accounted for CGPA calculation. The credits earned can be transferred under PART-III/PART-IV/PART-V of ANY SEMESTER with due recommendation of the Chairperson of the Board and approval from the CoE.

C). EXTRA CREDIT COURSES:

Flexibility to gain an extra credit in her tenure of study will help a student to learn a course offered under any UG programme that she is passionate about, along her main stream of study. A student who is interested shall take up any course(s) (one or many, PART-III only) and earn extra credits. No lecture hours (self-study only) are provided for extra-credit courses. Students will be notified at the beginning of every semester by the academic head, recommended by the class tutor, approved by the respective HoD, register with CoE for ESE, self-study the prescribed syllabi (the candidate shall study independently) and appear for the ESE. No CIA will be conducted and her score (out of 100) is based only upon evaluation during the ESE.

On attaining the passing minimum in such a course / subject, the student will earn credits pertaining to the curriculum that the course belongs to and the same will be notified in the mark statement enabling the student to demonstrate her ability in different domains. When a student fails to score the passing minimum, it will not be considered as an arrear and will not be mentioned in the mark statement. Students are permitted to transfer the credit thus earned as EXTRA-CREDIT with due recommendation of the Chairperson of the Board and approval from the CoE. There are FIVE categories in this:

(1). Courses offered by parent department for ALL STUDENTS OF THE PROGRAMME: A student shall choose to appear for the ESE for any (extra) course of her batch (one or many, PART:III only) which is/are offered by her own department and that she had not appeared in her regular stream of study, with due recommendation of the Chairperson of the Board and the CoE. Credits are awarded as mentioned in the scheme of examinations.

(2). Courses offered by parent department for ADVANCED LEARNERS OF THE PROGRAMME: Every department offers specific SELF-STUDY courses (FOUR courses) for the advanced learners (students with academic excellence and appreciable multiple intelligence as identified by the parent department) to appreciate their excellence in pursuing their curriculum. With due recommendation of the class tutor and approval of the Chairperson of the Board and the CoE, an advanced learner can register for the ESE (one or many, designated courses only).

Course Code	Courses offered for ADVANCED LEARNERS ONLY	Credits
	Agile Principles, Patterns and Practices in C#	4
	Building Block Chain App	4
	Fundamentals of Digital Marketing	4
	Deep Learning	4

(3). All Courses offered in a department under PART-III made available for students of other programmes – Inter-disciplinary courses:

A student shall choose to appear for the ESE for any course of her batch (one or many, PART:III only) which are offered in the curriculum of other departments with due approval of the

Chairperson of the Board preferred and the CoE. Credits are awarded as mentioned in the scheme of examinations.

(4). Credit transferability for Disciplinary / Inter-disciplinary / Trans-disciplinary / any course offered in UGC SWAYAM MOOCS:

In lieu with the direction of the University Grants Commission, referring to the Credit Framework for online learning courses through SWAYAM - Regulation 2016 for universities and colleges, to use the Massive Open Online Courses (MOOC) available on the HRD Ministry's 'Swayam' platform for credit transfer, students who complete a course (any Disciplinary / Inter-disciplinary / Trans-disciplinary / General course relating to skill enhancement/ employability enhancement/ proficiency enhancement/ competency enhancement/ others - the courses approved by Swayam board from July semester 2020 and onwards). Credits are awarded as mentioned in the scheme of examinations.

(5). Comprehension courses:

In the comprehension component, students are tested on their grasping ability of the courses of study. Comprehension in Computer Science - I, II, III, IV are SELF-STUDY courses that have only MCQ from Part III Courses. ONLINE EXAMINATION (END-SEMESTER) consisting of 50 Multiple Choice Questions (on Core and Core Elective courses studied in the respective semesters) will be conducted at the end of each semester I, II, III and IV respectively, for a maximum of 100 marks.

Course Code	Semester	Course	Evaluation	Credit
	I	Comprehension in Computer Science(PG)- I	To be conducted under the supervision of CoE at the end of each semester. Self Study, ONLY ESE	1
	II	Comprehension in Computer Science(PG) - II		1
	III	Comprehension in Computer Science(PG) - III		1
	IV	Comprehension in Computer Science(PG) – IV		1

No. of Questions	Marks	Total Marks

50	2 marks each	50 X 2 = 100

NOTE: Online Exams will be conducted in the computer laboratory at the end of each semester with one credit each.

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VALUE ADDED COURSE

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS
VALUE ADDDED COURSE	**CO-SCHOLASTIC COURSES (mandatory)**		**CORPORATE CULTURE AND BUSINESS COMMUNICATIONS**	**40**

Preamble

To provide a knowledge on the working nature of the corporate and various means of communication in and around the business.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define the classification and process of Communication.	K1
CO2	Determine the types of communications over the organizations.	K2
CO3	Analyze the various codes used in communication, skill and actions, ways of writing business letters and resume	K3
CO4	Define the role of ICT in business.	K4
CO5	Apply the features of interpersonal skills and Familiarize in concepts of report writing.	K5
CO6	Justify the change in organization and how practically it works.	K6

COURSE CONTENT:

UNIT-I: Nature And Scope Of Communication 8 Hours

Nature And Scope Of Communication - Definition, Classification – Process - Objectives - Purpose - Scope - Functions-Evaluation of Effective Communication - Organizational Communication.

UNIT-II: Oral And Written Communication 8 Hours

Oral And Written Communication – Introduction - Verbal Communication Oral – Verbal Communication Written.

UNIT-III: Non-Verbal Communication 8 Hours

Non-Verbal Communication – Introduction - Characteristics of Non-Verbal Communication – Relationship of Non-Verbal Messages With Verbal Message – Classification of Non-Verbal Communication

UNIT-IV: Report Writing 8 Hours

Report Writing – Significance, Type Of Reports, Routine Reports, Five W's And One H, Report Planning - Report Writing Process- Outline of A Report – Guidelines – Technicalities – Visual Aids – Effectiveness of A Report – Illustrations.

UNIT-V: Business Letter 8 Hours

Business Letter – Introduction – Different Types Of Business Letter – Knowing What Qualifies As A Bad Letter – Essentials Of A Business Letters – Layout Of Business Letter – Resume Writing – Introduction – Job Application Or Covering Letter – Resume / CV Writing.

REFERENCE BOOK

1. M K Sehgal Vandana Khetarpal – Business Communication, Excel Books Publications, I[st] Edition

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS
VALUE ADDDED COURSE	**CO-SCHOLASTIC COURSES (mandatory)**		**ANDROID APPLICATION DEVELOPMENT**	**40**

Preamble

To provide a basic knowledge on the Android programming features and android studio environment.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Describe the features of Android, packages and various resources used for developing an application.	K1
CO2	Determine the Object Oriented programming concepts and types of OS used in Android.	K2
CO3	What are the Technologies used to build a simple app.	K3
CO4	Define the steps to develop an Android Application.	K4
CO5	Explain the use of adding database to an application.	K5
CO6	Develop a simple game using android studio.	K6

COURSE CONTENT:

Unit I: Introduction to Android 8 Hours

Introduction –Android – The World's leading Mobile Operating System – Android Features – Android Operating System – Downloading Apps from Google Play – Packages –Android SDK – Object-Oriented Programming: A Quick Refresher – Building Great Android Apps –Android Development resources.

Unit II: Android Studio 8 Hours

Introduction – Technologies Overview –Creating an App – Android Studio Window –Building the App's GUI with the Layout Editor – Running the Welcome App – Making your app Accessible – Internationalizing your App.

Unit III: Customize your App 8 Hours

Developing a simple Tip Calculator App using android studio – Creating a Doodlz Application in Android.

Unit IV: Adding Database to App 8 Hours

Introduction –Test Driving Address book App – Technologies Overview – Building the GUI and Resource files – Database Description class – Address Book Database Helper Class – Address

Book Content Provider Class – Main Activity Class – Contacts Fragment Class – Contacts Adapter Class – Add Edit Fragment Class – Detail Fragment Class.

Unit V: Google Play and App Business Issues 8 Hours

Introduction – Preparing your Apps for Publication –Pricing your App: Free or Fee – Monetizing Apps with In-App Advertising – Monetizing Apps: Using In-App Billing to sell Virtual Goods – Registering at Google Play – Setting up a Google Payments Merchant Account – Launching Play store from within your App – Managing your Apps in Google Play – Other mobile App platforms and Porting your Apps.

ADVANCED LEARNERS COURSE

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
EXTRA CREDIT	ADVANCED LEARNERS COURSE		AGILE PRINCIPLES,PATTERNS, AND PRACTICES IN C#	-	4

COURSE CONTENT:

UNIT – I: Agile Development and Planning

Agile Practices – The Agile Practices-The Agile Alliance – Principles – Overview of Extreme Programming – The Practices of Extreme Programming – Planning – Initial Exploration – Release Planning – Iteration Planning – Defining "Done" – Task Planning – Iterating – Tracking.

Unit – II: Testing & Agile Design

Test – Driven Development – Acceptance Tests –Refactoring – A simple Example of Refactoring: Generating Primes - Agile Design – Design Smells – Why Software Rots – The Copy Program.

UNIT- III: Overview of UML for C# Programmers

Class Diagrams – Object Diagrams – Collaboration Diagrams –State Diagrams - Working with diagrams – Why Model?-Making Effective Use of UML – Iterative Refinement – When and How to Draw Diagrams.

UNIT – IV: State & Object Diagram

The Basics – Using FSM Diagrams – Object Diagrams – A Snapshot in Time – Active Objects.

Unit – V: Use Cases

Writing Use Cases – Diagramming Use Cases – Sequence Diagrams – The Basics – Advanced Concepts.

TEXTBOOK:

1.Robert C.Martin Micah Martin, "Agile Principles,Patterns, and Practices in C#", Pearson Publications

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
EXTRA CREDIT	ADVANCED LEARNERS COURSE		BUILDING BLOCKCHAIN APPS	-	4

COURSE CONTENT:

UNIT –I : Introduction to Blockchain

Introduction – introduction to Blockchain – the Blockchain – the Collaborative Ledger – Cryptocurrency – Smart Contracts - A Trustless Network - New Ways of Collaborating - The Fat Protocol-Reaching Consensus-What is Blockchain Consensus? - Proof of Stake (DpoS). Your First Blockchain APP – Smart Contract – Front-End HTML-JavaScript and web3.Js – In Action – Share Your Dapp.

UNIT – II: An Introduction to Ethereum

Getting Started – The Buliding Way – Ethereum Mainnet – Ethereum Classic Mainnet – CyberMiles Mainnet – The Hardway-Metamask Wallet – Concepts and Tools – EthereumWallet and Basic concepts –Etherscan-The TestRPC-Intracting with Ethereum via GETH-Intracting with Ethereum via web3 –Running an Ethereum Node- Running a Private Ethereum Network.

Unit – III: Smart Contracts

Learning Smart Contract Programming - Consensus vs. Nonconsensus Code- Data Structures – Function Parameters and Return Values – Payable Functions – Calling other Contracts. Building and Deploying the smart Contract – Solidity Tools – The BUIDL Integrated Development Environment – The Remix IDE – Calling smart Contract Functions – The BUIDL IDE – The Remix IDE – GETH Console.

UNIT – IV: Decentralized Applications(Dapps)

Dapp Stack – The web3 Library – External Services – Dapp Showcases – Uniswap – Crytokitties – Gambilg games – Interactive Dapps – Alternative to Dapps – JavaScript – The Full-Node Wallet – Raw Transactions – Python and others.

UNIT- V: Blockchain Data Services

Blockchain Data Services – Blockchain Explorers – Harvesting Data – Transaction and accounts – off-Chain Identities – Inside Smart Contracts – Query Interface – SQL Query – JSON Query-GraphQL –Google BigQuery-Smart Contract Search Engine – Introduction to the Smart Contract Search Engine – Getting Started with a Smart Contract Search Engine – The FairPlay Dapp Example – A Modular Architecture – Using the Smart Contract Search Engine- Use Cases – Crypto Assets – DeFi.

TEXTBOOK:

1.Michael Juntao Yuan, "Building Blockchain Apps", Pearson Publications,First Edition

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
EXTRA CREDIT	ADVANCED LEARNERS COURSE		FUNDAMENTALS OF DIGITAL MARKETING	-	4

COURSE CONTENT:

UNIT I: BASICS OF DIGITAL MARKETING

INTRODUCTION TO DIGITAL MARKETING : Evolution of Digital Marketing – Digital Marketing: An Introduction – Internet Marketing: Underlying Technology and Frameworks. DIGITAL MARKETING MODELS CREATION: Factors Impacting Digital Marketplace – Digital Marketing Business Models. THE CONSUMER OF DIGITAL MARKETING: Evolution of Consumer Behaviour Models – Managing Consumer Demand – Impact of Digital Channels on IMC.

UNIT II: DIGITAL MARKETING STRATEGY DEVELOPMENT

DIGITAL MARKETING ASSESSMENT PHASE: Elements of the Assessment phase – Digital Marketing Internal Assessment – Digital Marketing Objectives Planning. DIGITAL MARKETING STRATEGY DEFINITION: Digital Marketing Strategy Groundwork-Defining the Digital Marketing Mix.

UNIT III: DIGITAL MARKETING PLANNING AND SETUP

DIGITAL MARKETING COMMUNICATIONS AND CHANNEL MIX: Digital Marketing Planning Development – Designing the Communications Mix – Introduction to Digital Marketing Channels. DIGITAL MARKETING OPERATIONS SET-UP: Understanding Digital Marketing Conversion – Basics of Web Development and Management – User Experience, Usability and Service Quality Elements.

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UNIT IV: DIGITAL MARKETING EXECUTION

DIGITAL MARKETING CAMPAIGN MANAGEMENT: Basics Elements of Digital Campaigns – Basics Elements of Digital Campaign Management – Implementing Intent-Based Campaigns (Search Execution) – Implementing Brand- Based Campaigns (Display Execution) - Introduction to Google Analytics. DIGITAL MARKETING EXECUTION ELEMENTS: Managing Digital Marketing Revenue – Managing Service Delivery and Payment-Managing Digital Implementation Challenges.

UNIT V: DIGITAL BUSINESS – PRESENT AND FUTURE

DIGITAL MARKETING – LANDSCAPE AND EMERGING AREAS : Digital Marketing -- Global Landscape –Digital Marketing-- The Indian View – Digital Marketing -- Trends and Concepts .CAREER IN DIGITAL MARKETING : Emerging Opportunities for Digital Marketing Professionals.

TEXT BOOK :

Fundamentals of Digital Marketing, Puneet Singh Bhatia, Pearson.

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT (C)
EXTRA CREDIT	**ADVANCED LEARNERS COURSE**		**DEEP LEARNING**	**-**	**4**

COURSE CONTENT:

UNIT-I: INTRODUCTION

Artificial Intelligence, Machine Learning and Deep Learning, Research Domains and industry Applications, Tools and Technologies, NECESSARY MATHEMATICS FOR DEEP LEARNING : Linear Algebra, INTRODUCTION TO MACHINE LEARNING : Types of Machine Learning, Process of Machine Learning, Evaluating the Model, Model Representation and Interpretability

UNIT-II: FUNDAMENTALS OF NEURAL NETWORK

Understanding the Biological Neuron, Exploring the Artificial Neuron, Types of Activation Functions, Architectures of Neural Network, Learning Process in ANN, TRAINING DEEP NEURAL NETWORK : Mathematics Behind Backpropagation, Deep L-layer Neural Network, Initializing Weights in Neural Network, Other Optimization Algorithms, regularization, Normalization of Inputs

UNIT-III: COMPUTER VISION USING CONVOLUTIONAL NEURAL NETWORK

Introduction to Computer Vision, Building a Convolutional Neural Network, Popular CNN Architectures, Object Detection, Transfer Learning, REPRESENTATION LEARNING : Few Scenarios of Representation Learning, Traditional Representation Learning, Regularization and Autoencoder, Traditional Methods , Word & Document Embedding

UNIT-IV: SEQUENCE –BASED MODELS & DEEP LEARNING ARCHITECTURES

Introduction to sequence Data, Recurrent Neural Network, Long Short-term memory, Bi-directional Models, Language Modelling and Sequence Models, Encoder-decoder Architecture, Attention Mechanism, Transformer Architecture, Generative Adversarial Network (GAN)

UNIT-V: IMPORTANT DEEP LEARNING FRAMEWORKS & CASE STUDIES

Introduction : Refresher of Python Programming, review of Python scikit-learn Library – Tensorflow 2.0 with Keras Programming, PyTorch Programming, case study 1: Disease Detection from Chest X-ray Images, Case Study 2: Colourization of Grayscale Images

TEXT BOOK:

1.Deep Learning, Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra, Amlan Chakrabarti, Peson India Educational Services Pvt.Ltd, 2021

MCA- (2021-22) SYLLABUS WAS PREPARED AND FINALISED AS MENTIONED BELOW

Part	Category	Course Code	Title of the Course	Faculty name	% of Syllabus Changed
SEMESTER- I					
III	Core: I	21CAP01	Advanced Java Programming	Ms.S.Kiruthika	100%
III	Core: II	21CAP02	Relational Database Management System	Ms.O.P.Uma Maheswari	100%
III	Core: III	21CAP03	Computer Networks	Ms.R.Anushiya	100%
III	Core: IV	21CAP04	Operations Research	Dr.S. Gomathi	-
III	Core: V Elective: I	21CAP05A/ 21CAP05B/ 21CAP05C/ 21CAP05D	Mobile Computing/ Business Intelligence/ Cloud Computing/ Service Oriented Architecture	Ms.M.Prema/ Ms.G.S.Kausalya/ Ms.M. Indira/ Dr.S.Sampath	- 100% 100% 100%
III	Core: VI Practical: I	21CAP06	Advanced Java Programming – Practical	Ms.S.Kiruthika	100%
III	Core: VII Practical: II	21CAP07	Relational Database Management System– Practical	Ms.O.P.Uma Maheswari	100%
SEMESTER- II					
III	Core: VIII	21CAP08	Data Structures and Algorithms	Ms.C.Thangamani	100%
III	Core: IX	21CAP09	Web Programming	Ms.T.B.Saranya Preetha	100%

III	Core: X	21CAP10	Software Project Management	Ms.V.S.Lavanya	-
III	Core: XI	21CAP11	Operating System	Ms.O.P.Uma Maheswari	100%
III	Core: XII Elective: II	21CAP12A/ 21CAP12B/ 21CAP12C/ 21CAP12D	Artificial Intelligence/ Adhoc and Sensor Networks/ Digital Image Processing/ Virtual Reality Systems	Ms.S.Kiruthika/ Mr.S.Sampath/ Ms.M.Indira/ Ms.A.G.Vigneshwari	100% 100% 100% -
III	Core: XIII Practical: III	21CAP13	Data Structures And Algorithms Using Java-Practical	Ms.C.Thangamani	100%
III	Core: XIV Practical: IV	21CAP14	Web Programming – Practical	Ms.T.B.Saranya Preetha	100%
IV	Ability Enhancement	21AEP01	Cyber Security	Ms.M.Indira	-
SEMESTER III					
III	Core: XV	21CAP15	Data Mining and Big Data Analytics	Ms.O.P.Uma Maheswari	100%
III	Core: XVI	21CAP16	Machine Learning using Python	Dr.G.Dheepa	100%
III	Core: XVII	21CAP17	Network Security and Cryptography	Ms.P.Vijayalakshmi(PV2)	100%
III	Core: XVIII Elective: III	21CAP18A/ 21CAP18B/ 21CAP18C/ 21CAP18D	Internet of Things/ Soft Computing/ Theory of Computation/ Research Methodology	Dr.G.Dheepa/ Dr.S.Jayasankari / Ms.G.S.Kausalya/ Dr.P.M.Gomathi	60% 100% 100% 20%
III	Core :XIX Practical: V	21CAP19	Data Mining and Big Data Analytics - Practical	Ms.O.P.Uma Maheswari	100%
III	Core :XX Project: I	21CAP20	Mini Project and Viva voce	Ms.C.Thangamani	-
III	Core: XXI	21CAP21	Open Elective offered for students of other PG Programmes/Departments	Ms.R.Anushiya	100%
V	Proficiency Enhancement	21PEP01	Management Information System (Self Study)	Dr.P.M.Gomathi	100%
SEMESTER – IV					
III	Core: XXII Project: II	21CAP22	Major Project and Viva-voce	Ms.C.Thangamani	-
V	Competency Enhancement	Online Course / Learning Object Repository(LOR)		Ms.T.B.Saranya Preetha	-
		Certificate Course		Ms.T.B.Saranya Preetha	-

Curriculum Structure and syllabus for the MCA programme are prepared and verified in line with the guidelines of CDC.

Prepared by

(Name, Designation and Department)

Approved by