

**CURRICULUM FRAMEWORK AND SYLLABUS
FOR OUTCOME BASED EDUCATION IN**

MASTER OF SCIENCE IN COMPUTER SCIENCE

**FOR THE STUDENTS ADMITTED FROM THE
ACADEMIC YEAR 2019-2020**



HICAS

**HINDUSTHAN COLLEGE OF ARTS AND SCIENCE
(AUTONOMOUS)**

(Affiliated to Bharathiar University and Accredited by NAAC)

COIMBATORE-641028

TAMILNADU, INDIA.

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HINDUSTHAN COLLEGE OF ARTS AND SCIENCE
PG & RESEARCH DEPARTMENT OF COMPUTER SCIENCE

VISION

To cater the needs of industrial development innovation to be among the nation's premier research and teaching programs in Computing Informatics with leadership and recognition in identified focus areas

MISSION

To develop independent thinkers who can provide leadership in the computing industry or academia, as well as deep insights with a broad perspective on the established and emerging fields of computing.

Programme Educational Objectives (PEO)

Post Graduates of Computer Science program will be

PEO1: Implement domain knowledge of core technologies and deliver professional services in career by incorporating creativity in computing profession.

PEO2: Explore leadership skills and incorporate ethics as an entrepreneurship to inculcate problem solving capability, design skills and other diverse career paths.

PEO3: Expose Knowledge to various contemporary issues which will enable to become ethical and responsible towards themselves as a co-worker for society and the nation.

PROGRAM OUTCOME (PO):

PO1: Ability to apply the knowledge of Mathematics, science and engineering to the complex problems applicable to the discipline.

PO 2: Ability to analyze, design, develop and evaluate computer based system, process or program to meet the desired solutions.

PO 3: Ability to apply research based knowledge and methodologies in software based project development using innovative ideas and open ended programming tools to deliver a quality product for business success.

PO 4: Ability to realize Professional and ethical responsibility and act in accordance to social welfare.

PO 5 : Ability to engage in life-long learning to acquire knowledge of contemporary issues to face the career challenges.

PROGRAM SPECIFIC OUTCOME (PSO):

PSO 1: Attain the ability to design and develop hardware and software based systems evaluate and recognize potential risk and provide creative solutions.

PSO 2 : Gain knowledge in diverse area of computer science and experience an environment conducive in cultivating skills for successful career, entrepreneurship and higher studies.

PSO3:. Explore technical knowledge in the field of computing and in latest trends, to pursue teaching research and development activities to work effectively in a team.

**HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)
COIMBATORE-641 028**

M.Sc. COMPUTER SCIENCE

SCHEME OF EXAMINATIONS-CBCS PATTERN

(For the students admitted from the academic year 2019-2020 and onwards)

Course Code	Course Type	Course Title	Lecture Hours/Week	EXAM DURATION	IE	EE	Total	Credit points
Semester – I								
19CEP01	DSC	Mobile Application Development	5	3	30	70	100	4
19CEP02	DSC	Analysis & Design of Algorithms	5	3	30	70	100	4
19CEP03	DSC	Advanced Java Programming	5	3	30	70	100	4
19CEP04	DSC	Advanced Software Engineering	5	3	30	70	100	4
19CEP05	DSC	Practical I: Mobile Application Programming	5	3	40	60	100	4
19CEP06	DSC	Practical II: Java Programming	5	3	40	60	100	4
Semester – II								
19CEP07	DSC	Advanced Operating System	5	3	30	70	100	4
19CEP08	DSC	Open source Database management system	5	3	30	70	100	4
19CEP09	DSC	Web Programming using Open source Technologies	5	3	30	70	100	4
19CEP10	DSC	Machine Learning & Robotics	4	3	30	70	100	4
19CEP11	DSC	Practical III : Web programming	5	3	40	60	100	4
19CEP12	DSC	Practical IV: Open source Database management system	4	3	40	60	100	4
19GSP01	AEE	Skill Based : Cyber Security	2	3	100	-	100	2
Students Should Complete Value Added Courses, online courses at the End of the First Year								
Semester – III								
19CEP13	DSC	Digital Image Processing	5	3	30	70	100	4
19CEP14	DSC	Distributed Computing	5	3	30	70	100	4
19CEP15	DSC	Internet of Things	5	3	30	70	100	4
19CEP16	DSC	Data Mining & Warehousing	5	3	30	70	100	4
19CEP17	DSC	PRACTICAL V: Programming Internet of things	5	3	40	70	100	4

19CEP18A	DSE	Elective - I (A)Multimedia & its Applications (OR)	4	3	30	70	100	3
19CEP18B		(B)WebTechnology						
Semester –IV								
19CEP19	DSC	Big Data Analytics	5	3	30	70	100	4
19CEP20	DSC	Business Intelligence	5	3	30	70	100	4
19CEP21	DSC	Practical VI : Big Data Analytics Using R	5	3	40	60	100	4
19CEP22A	DSE	ELECTIVE II A) Research Methodology (OR)	4	3	30	70	100	3
19CEP22B		B) Wireless Communication and technology						
19CEP23	DSE	Project Work	-	-	50	150	200	3
							TOTAL	91
Students Should Complete Value Added Courses, Online Courses / Entrepreneurship/Startups/ Job Oriented Courses and Placement Training at the end of the Final Year								

No of papers	Course Type	Total Credit Points
1	Ability Enhancement Elective (AEE)	2
20	Discipline Specific course(DSC)	80
3	Discipline Specific Elective(DSE)	9
23	TOTAL	91

PG- REGULATION(2019-2020 And Onwards)

1.Internal Marks for all PG

Components	Marks
Test I	5
Model Exam	10
Assignment	5
Attendance*	5
Seminar	5(3+2)**
TOTAL	30

***Split-up of Attendance Marks for PG**

- 75-79-1marks
- 80-84-2marks
- 85-89-3marks
- 90-94-4marks
- 95-100 - 5 marks

**3-For External paper presentation/ Mini Project

**2-Internal paper presentation/ Mini Project

Question Paper Pattern for IE test I

Duration: TwoHours

Maximum: 50Marks

Section-A (3 x 6=18 Marks)

Answer **ALL** Questions

Either or Type

ALL questions carry EQUAL Marks

Section-B (4 x 8=32 Marks)

Answer **ALL** Questions

Either or Type

ALL questions carry EQUAL Marks

Question Paper Pattern for IE Model Exam

Duration: Three Hours

Maximum: 70Marks

SECTION – A (5x6=30 marks)

Answer ALL Questions
ALL Questions carry EQUAL Marks

Q.No 1 to 5: Either or type questions
(One question from each Unit)

SECTION – B (5x8=40 Marks)

Answer ALL Questions
ALL Questions carry EQUAL Marks

Q.No 6 to 10: Either or type questions
(One question from each Unit)

2 a) Components for Practical I.E.

Components	Marks
Test –I	20
Test – II	20
Total	40

2 b) Components for Practical E. E.

Components	Marks
Completion of Experiments	50
Record	5
Viva	5
Total	60

3. Institutional/ Industrial Training, Mini and Major Project Work

<u>Institutional / Industrial Training</u>		<u>Mini Project</u>	<u>Project Work</u>	
Components	Marks		Components	Marks
I.E			I. E	
Work Diary	25	-	a) Attendance Marks	20
Report	50	50	b) Review Marks	30
Viva-voce Examination	25	50		
Total	100	100		
			*1	
			a) Final Report Marks	120
			b) Viva-voce Marks	30
			Total	200

*1 Evaluation of report and conduct of viva voce will be done jointly by Internal and External Examiners.

4. Components for Cyber Security Paper

Components	Marks
Two Tests (2 x 40)	80
Two assignments (2 x 10)	20
Total	100

The question paper pattern is as follows:

- a) Test I – 2 hours [4 out of 7 essay type questions] 4 x 10 = 40Marks
 b) Test II – 2 hours [4 out of 7 essay type questions] 4 x 10 = 40Marks

Total = 80Marks

- The passing minimum for Cyber Security is 50

- In case the candidate fails to secure 50 marks which is the passing
- Minimum, he/she may have to reappear for the same in subsequent semester.

5. Question Paper Pattern for EE Theory

Duration: Three Hours

Maximum: 70Marks

SECTION – A (5x6=30 marks)

Answer ALL Questions

ALL Questions carry EQUAL Marks

Q.No 1 to 5: Either or type questions

(One question from each Unit)

SECTION – B (5x8=40 Marks)

Answer ALL Questions

ALL Questions carry EQUAL Marks

Q.No 6 to 10: Either or type questions

(One question from each Unit)

Programme Code:	CEP	Master of Science in Computer Science		
Course Code:	19CEP01	Course Title	Batch:	2019 and onwards
		MOBILE APPLICATION DEVELOPMENT	Semester:	I
Hrs/Week:	5		Credits:	4

Course Objective

1. Apply the fundamental concepts of Android studio and other application
2. Explore Life cycle of an application in Android
3. Design to create a new application in Mobile environment.
4. Develop Debug and Deploy Android applications
5. Construct user interface with Built in view & Layouts

Course Outcomes (CO)

K1	CO1	Understand to develop simple GUI Applications
K2	CO2	Analyze and able to use widgets and components in their android applications
K3	CO3	Apply to work with database locally & cloud
K4	CO4	Design to deploy the applications by inheriting web services.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	M	M	M	L
CO3	S	S	S	M
CO4	L	M	M	L

S - Strong; M-Medium; L-Low.

19CEP01	MOBILE APPLICATION DEVELOPMENT	I
Unit No.	Topics	Hours
I	INTRODUCTION TO ANDROID: What is Android - History and Version - Installing software's - Setup Eclipse - Hello Android example - Internal Details - Dalvik VM - Software Stack - Android Core Building Blocks - Android Emulator - AndroidManifest.xml - R.java file - Hide Title Bar - Screen Orientation.	12
II	WIDGETS & USER-INTERFACE: Working with Button - Toast - Custom Toast - Button - Toggle Button - Switch Button - Image Button - Check Box - Alert Dialog - Spinner - Auto Complete Text View - Rating Bar - Date Picker - Time Picker - Progress Bar - Quick Contact Budge -Analog Clock and Digital Clock - Working with hardware Button - File Download	12
III	ACTIVITY, INTENT & FRAGMENT Activity Lifecycle - Activity Example - Implicit Intent - Explicit Intent - Fragment Lifecycle -Fragment Example - Dynamic Fragment . Android Menu. LAYOUT&VIEW: Option Menu - Context Menu - Popup Menu - Relative Layout - Linear Layout - Table Layout - Grid Layout	12
IV	ANDROID ADAPTOR VIEW: Array Adaptor - Array List Adaptor - Base Adaptor - Grid View - Web View - Scroll View - Search View - Tab Host - Dynamic List View - Expanded List View. ANDROID SERVICES: Android Service - Android Service API - Android Started Service - Android Bound Service - Android Service Life Cycle - Android Service Example	12
V	Data Storage: Shared Preferences - Internal Storage - External Storage SQLite: SQLite API - SQ Lite Spinner - SQLite List View - API - Android Web Services	12

Text Book :

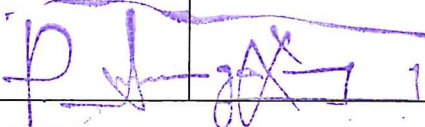
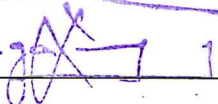
1. *Android Developer Fundamental course - Learn to Develop Android Applications - Google Developer Training Team 2016.*

Reference Books:

1. *Android Application Development for Dummies 3rd Edition published by John Wiley& Sons, Inc. 2015*

2. *Android Programming for Beginners John Horton - December 2015*

3. *Complete Introduction for Beginners –Step By Step Guide How to Create Your Own Android App Easy! - Matthew Gimson - 2015.*

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	CEP	Master of Science in Computer Science		
Course Code:	19CEP02	Course Title	Batch:	2019 and onwards
		ANALYSIS & DESIGN OF ALGORITHMS	Semester:	I
Hrs/Week:	5		Credits:	4

Course Objective

1. Enable the students to learn the basic of Designing .
2. Make the students learn mathematical background for analysis of algorithm
3. Demonstrate a familiarity with major algorithms and data structures.
4. Reinforce basic design concepts (e.g., pseudocode, specifications, top-down design.
5. Apply important algorithmic design paradigms and methods of analysis.

Course Outcomes (CO)

K1	CO1	Understand mathematical foundation in analysis of algorithms.
K2	CO2	Understand different algorithmic design strategies
K3	CO3	Apply design principles and concepts to algorithm design
K4	CO4	Ability to choose appropriate algorithm design techniques for solving problems.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	L
CO2	S	M	S	L
CO3	S	S	S	L
CO4	L	M	M	L

S - Strong; M-Medium; L-Low.




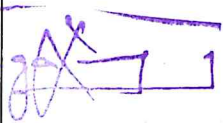
19CEP02	ANALYSIS & DESIGN OF ALGORITHMS	I
Unit No.	Topics	Hours
I	Design of Efficient Algorithms: Data Structures: lists, queues, and stacks-set representation-graphs-trees-recursion-Divide and Conquer-Balancing-Dynamic programming-Epilogue Data Structure for Set manipulation Problems: Fundamental operations on sets-Hashing-Binary Search-Binary Search trees-Optimal binary trees-A simple Disjoint –Set union algorithm- Balanced Tree schemes-Partitioning.	12
II	Elementary Data Structures: Stacks and Queues – Trees – Binary Trees–Binary Search Trees–Iterative and Recursive Search of BST–Graphs– Konigsberg Bridge Problem – Graph Representations - Graph Traversals. Greedy Methods: Knapsack Problem, Minimum Cost Spanning Trees, Optimal Storage on Tapes and Single Source Shortest Path Problem.	12
III	Dynamic Programming: General method – multistage graphs – all pair shortest path – optimal binary search trees – 0/1 Knapsack – traveling salesman problem – flow shop scheduling	12
IV	Backtracking: General method – 8-Queens problem – sum of subsets – graph coloring – Hamiltonian cycles – knapsack problem – Branch and bound:-The method– 0/1 Knapsack Problem – traveling salesperson.	12
V	Branch and Bound: The Method- Least Cost Search. Bounding: FIFO Branch and Bound and LCBranch and Bound-0/1 Knapsack Problem-Travelling Salesman Problem-Efficiency Considerations.	12

Text Books:

1. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "The Design and analysis of Computer Algorithms", Pearson Education, 1999. (UNIT I – Chapter 2 & 4)
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithm", Galgotia Publications, 2007. (UNIT II – Chapter 2 & 4, UNIT III – Chapter 5, UNIT IV – Chapter 7, UNIT V – Chapter 8)

Reference Books:

1. Goodman and S.T. Hedetniem, "Introduction to the Design and Analysis of Algorithms" MGH.
2. Aho A.V, John E. Hopcroft Jeffrey D. Ullman, "The Design and Analysis of Computer Algorithms", Pearson Education.
3. Lakshmi varahan S, Sudarshan K Dhall. "Analysis and Design of Parallel Algorithms", Mcgraw hill series.

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Programme Code:	CEP	Master of Science in Computer Science		
Course Code:	19CEP03	Course Title	Batch:	2019 and onwards
		ADVANCED JAVA PROGRAMMING	Semester:	I
Hrs/Week:	5		Credits:	4

Course Objective

1. Able to code, compile, and execute programs while learning advanced programming concepts.
2. Demonstrate the use of good object-oriented design principles including encapsulation and information hiding.
3. The implementation will demonstrate the use of a variety of basic control structures including selection and repetition
4. Create to learn Framework Technologies like Spring , Struts, Hibernate.
5. Understand to create RMI application with Framework

Course Outcomes (CO)

K1	CO1	Identify classes, objects, members of a class and relationships among them needed for a specific problem.
K2	CO2	Understand and Compile dynamic web pages, using Servlets and JSP.
K3	CO3	Ability to develop RMI application using Java Spring Framework
K4	CO4	Analyze and classify the type of framework and its advantages

Mapping of Outcomes

PO \ CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	M	S
CO3	M	S	S	S
CO4	M	S	S	S

S - Strong; M-Medium; L-Low.

19CEP03	ADVANCED JAVA PROGRAMMING	I
Unit No.	Topics	Hours
I	Overview: Object Oriented Programming - Simple Program - Second short program-Two control statements. Introducing Classes - class fundamentals - Declaring objects - assigning object reference-Variables - introducing methods - constructors.	12
II	Multithreaded Programming: The Java Thread Model - Main Thread- creating a Thread - Creating Multiple Threads - using is Alive () and join () - Thread Priorities - Synchronization – Inter thread communication - Suspending ,resuming and stopping Threads.	12
III	Networking: Networking basics - java and the Net - Inet Address - Inet4Address and Inet6Address - TCP/IP Client Sockets - URL - URL Connection - TCP/IP Server Sockets - Datagrams - URL Class.	12
IV	Struts : Introduction to Struts : What is Struts - Features –Model1 vs Model2 -Custom Validation – Bundled Validators – Ajax Validation View – Controller MVC Design Pattern – tags – UI Components. Hibernate: Introduction to Hibernate Framework –ORM Tool- Architecture- Hibernate using XML – Web application	12
V	Spring : Introduction to Spring Framework – Framework of Swing- Advantages of Spring Framework - Modules – Application –IoC Container- Dependency Injection - Constructor Injection- RMI- Integration of RMI in Spring.	12





Text Book:

1. Herbert Schildt - "The complete Reference Java ", Tata McGrawHill, 5th edition, 2005.

Reference Books:

1. Deitel & Deitel, "Java How to Program", Prentice Hall, 5th Edition, 2002.

2. The Complete Reference 2nd Edition James Holmes "Tata Mcgrawhill 2nd Edition 2007.

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Programme Code:	CEP	Master of Science in Computer Science		
Course Code:	19CEP04	Course Title		Batch:
		ADVANCED SOFTWARE ENGINEERING		Semester:
Hrs/Week:	5		Credits:	4

Course Objective

1. Knowledge of basic SW engineering methods and practices, and their appropriate Application.
2. Describe software engineering layered technology and Process frame work.
3. A general understanding of software process models such as the waterfall and evolutionary Models.
4. Understanding of software requirements and the SRS documents.
5. Understanding the role of project management including planning, scheduling, risk Management etc..

Course Outcomes (CO)

K1	CO1	Understanding of approaches to verification and validation including static analysis, and reviews.
K2	CO2	Understanding of software testing approaches such as unit testing and integration testing
K3	CO3	Describe software measurement and software risks
K4	CO4	Understanding on quality control and how to ensure good quality software.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	L	M	S
CO3	S	M	M	M
CO4	L	M	M	S

S - Strong; M-Medium; L-Low.

19CEP04	ADVANCED SOFTWARE ENGINEERING	I
Unit No.	Topics	Hours
I	The Product and The Process: The Evolving role of Software – Process methods and tools – Software process models – Linear sequential model – Prototyping model – Real model – Evolutionary software process model – Formal methods model – Fourth generation techniques – Project management concepts – Software process and project metric.	12
II	Software Project Planning: Software Project Planning – Observation on estimating software Scope, Resources, Project estimation, Decomposition techniques, Empirical estimation models – The Make Busy divisions – Risk management – Software risk identification –Risk projection, Risk mitigation – Monitoring and management.	12
III	Project Scheduling and Tracking: Project Scheduling and Tracking-Basic concepts – Defining a task set for the software project –Scheduling plan – Software quality assurance – Quality concepts and assurance – Software reliability – ISO 9000 Quality standards –Software configuration management – Software reviews – Formal technical reviews – Statistical quality assurance.	12
IV	Conventional Methods For Software Engineering: System Engineering: System engineering hierarchy – Analysis concepts and principles – Requirements analysis – Communication techniques – Analysis, principles– Software prototyping – Specification modeling and information flow – Behavioral modeling – Mechanics of structured analysis – Design concepts and principles – Design process – Principles – Concepts – Effective modular design. Architectural design – Data design – Transform mapping–Transaction Mapping – User Interface Design.	12
V	Software Testing Methods : Fundamentals–Test case design–White box testing – Basis path testing – Control structure testing – Black box testing– Testing for specialized environment – Testing strategies – Unit testing –Integration – Validation – System testing – Art of debugging. Object Oriented Software Engineering-Concept and Principles, Design. Reengineering-Business Process Re-engineering, Software Re-engineering.	12

Text Book:

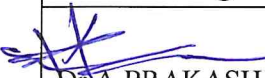



1. Roger S Pressman, "Software Engineering: A Practitioner's Approach, McGraw Hill (2000)

Reference Books:

1. Richard Fairley, "Software Engineering Concepts", McGraw-Hill 2004.

2. Aggarwal KK, Yogesh Singh, "Software Engineering", Newage International Publishers, Third Edition.

3. Pankaj Jalote, "An Integrated Approach to Software Engineering", Narosa Publishing House, Delhi, 3rd Edition.

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Programme Code:	CEP	Master of Science in Computer Science		
Course Code:	19CEP05	Course Title	Batch:	2019 and onwards
		PRACTICAL I : MOBILE APPLICATION PROGRAMMING	Semester:	I
Hrs/Week:	5		Credits:	4

Course Objective

1. Ability to understand about Android studio and Eclipse Environment
2. Able to Create GUI application with Multi-screen Templates
3. Deploy SQLite with Application
4. Design their application using Web Services
5. Construct user interface with Built in view & Layouts

Course Outcomes (CO)

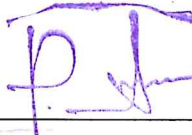
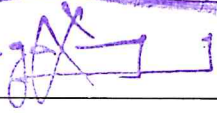
K1	CO1	Design a Mobile Application using Android Studio
K2	CO2	Analyze and able to use widgets and components in their android applications
K3	CO3	Apply to work with database locally & cloud
K4	CO4	Design to deploy the applications by inheriting web services.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	M	M	M	L
CO3	S	S	S	M
CO4	L	M	M	L

S - Strong; M-Medium; L-Low.

19CEP05	Practical I : Mobile Application Programming	I
Ex. No.	PROGRAM LIST	
1.	Create a simple Login App using Using Database	
2.	Design and implement a single screen app that displays information about a fictional small business	
3.	Build a Score Keeper app, which gives a user the ability to keep track of the score of two different teams playing a game of your choice	
4.	Create a simple file upload program with user authentication	
5.	Create a simple application to find a Location of your android device	
6.	Create a simple dictionary App	
7.	The Quiz App	
8.	Musical Structure App	
9.	Tour Guide App	
10.	News App	

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Programme Code:	CEP	Master of Science in Computer Science		
Course Code:	19CEP06	Course Title	Batch:	2019 and onwards
		PRACTICAL II : JAVA PROGRAMMING	Semester:	I
Hrs/Week:	5		Credits:	4

Course Objective

1. Deploy simple application using object oriented concepts using java
2. Understanding the concepts of Framework applied in java.
3. Evaluate the techniques of RMI in java
4. Create a Simple application in GUI Environment.
5. Understanding the concepts of Java Networking

Course Outcomes (CO)



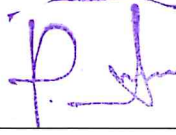
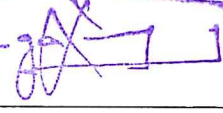
K1	CO1	Understand to develop simple GUI Applications
K2	CO2	Knowledge on developing RMI Application
K3	CO3	Deploy an application using Framework
K4	CO4	Ability to understand the concepts of Hibernate

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	M	M	M	L
CO3	S	S	S	M
CO4	L	M	M	L

S - Strong; M-Medium; L-Low.

19CEP06	PRACTICAL II : JAVA PROGRAMMING	I
Ex. No.	PROGRAM LIST	
1.	Demonstrate REMOTE METHOD INVOCATION application using Java	
2.	Create an Event Driven Java Application. (Mouse Events/Keyboard Events)	
3.	Exhibit Socket Programming for Two way communication in java.	
4.	Create a Java program to display IP ADDRESS and HOST NAME of the machine	
5.	Illustrate a concept of inheritance with Servlet	
6.	Design a java program to implement GUI WITH BORDER LAYOUT.	
7.	Create a Event Handler program using Spring Framework	
8.	Create a File upload program using Struts Framework	
9.	Create a program for handling exceptions using Struts.	
10.	Demonstrate simple JAVA BEANS applications.	
11.	Build a java program to execute NETWORKING concept.	
12.	Design a java program to perform ANIMATION of different shapes.	

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	CEP	Master of Science in Computer Science		
Course Code:	19CEP07	Course Title	Batch:	2019 and onwards
		ADVANCED OPERATING SYSTEM	Semester:	II
Hrs/Week:	5		Credits:	4

Course Objective

1. Main components of an OS & their functions.
2. Mechanisms of OS to handle processes and threads and their communications.
3. Gain insight into the components and management aspects of real time and mobile operating systems.
4. Develop real-time algorithm for task scheduling.
5. Design how Distributed Shared Memory is managed.

Course Outcomes (CO)

K1	CO1	Describe the important computer system resources and the role of operating system in their management policies and algorithms.
K2	CO2	Discuss the working of real-time operating systems and real-time database.
K3	CO3	Manipulate hardware and software issues in modern distributed systems.
K4	CO4	Evaluate the requirement for process synchronization and coordination handled by operating system

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	M	M	M	S
CO2	M	S	M	S
CO3	S	M	M	S
CO4	M	M	M	M

S - Strong; M-Medium; L-Low.

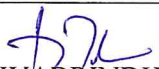
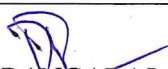
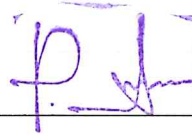
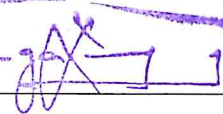
19CEP07	ADVANCED OPERATING SYSTEM	II
Unit No.	Topics	Hours
I	Basics of Operating Systems: What is an Operating System? – Main frame Systems – Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems – Real-Time Systems – Handheld Systems – Feature Migration – Computing Environments - Process Scheduling – Cooperating Processes – Inter Process Communication- Deadlocks – Prevention – Avoidance – Detection – Recovery.	12
II	Distributed Operating Systems: Issues – Communication Primitives – Lamport’s Logical Clocks – Deadlock handling strategies – Issues in deadlock detection and resolution distributed file systems –design issues – Case studies – The Sun Network File System-Coda.	12
III	Real time Operating Systems : Introduction – Applications of Real Time Systems – Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling	10
IV	Operating Systems for Handheld Systems: Requirements – Technology Overview – Handheld Operating Systems – Palm OS- Symbian Operating System- Android –Architecture of android – Securing handheld systems	13
V	Case Studies: Linux System: Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS : Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.	13

Text Books:

1. William Stallings, "Operating systems", Pearson Prentice Hall, 6th Edition, 2009.
2. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.

Reference Books:

1. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Seventh Edition, John Wiley & Sons, 2004 .
2. .Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.
3. Pramod Chandra P.Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010

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Programme Code:	CEP	Master of Science in Computer Science		
Course Code:	19CEP08	Course Title	Batch:	2019 and onwards
		OPEN SOURCE DATABASE MANAGEMENT SYSTEM	Semester:	II
Hrs/Week:	5		Credits:	4

Course Objective

Course Objective

1. A good formal foundation on the relational model of data and usage of Relational Algebra.
2. Create a relational database using a relational database package.
3. Design at facilitating the student to understand the various functionalities of DBMS software.
4. Analyze many operations related to creating, manipulating and maintaining databases for Real-world Applications.
5. Understand the various designing concepts, storage methods, querying and managing databases

Course Outcomes (CO)

Students will able to:

K1	CO1	Explain the structure and model of the relational database system
K2	CO2	Design multiple tables, and using group functions, sub queries
K3	CO3	Build a database based on a data model considering the normalization to a specified level
K4	CO4	Estimate the storage size of the database and design appropriate storage techniques

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	S
CO3	S	M	M	S
CO4	M	S	M	S

S - Strong; M-Medium; L-Low.

19CEP08	OPEN SOURCE DATABASE MANAGEMENT SYSTEM	II
Unit No.	Topics	Hours
I	Database internals and Advanced concepts: Introduction- Data Models - Entity Relationship model - Relational model – Relational Database - Introduction - SQL - Other Relational languages - Integrity and Security – Relational Database design.	12
II	Transaction Management: Overview of Transaction Management- The ACID properties – Transactions and Schedules– Concurrent execution of Transactions – Lock based concurrency control – Performance of locking - Transaction support in SQL – Introduction to crash recovery – The log – Other recovery related structures – Check pointing – Recovering from a system crash – Media Recovery.	12
III	Object based Databases and XML: Structured Data Types - Operations on Structured Data - Encapsulation and ADTs –Inheritance - Objects, OIDs, and Reference Types - Database Design for an ORDBMS – ORDBMS Implementation Challenges – OODBMS - Comparing RDBMS, OODBMS, and ORDBMS –XML – Background – Structure of XML Data – XML Document Schema – Querying and Transformation - The Application program interface – Storage of XML data- XML Application -Case Study in XML.	12
IV	Parallel and Distributed Databases: Distributed Databases – Homogeneous and Heterogeneous Databases - Distributed Data Storage - Distributed Transactions - Commit Protocols – Concurrency Control in Distributed Databases – Availability - Distributed Query Processing - Heterogeneous Distributed Databases -Directory Systems - Parallel Databases – Introduction - I/O Parallelism – Inter query Parallelism –Intra operation Parallelism - Interoperation Parallelism - Design of Parallel Systems – Case Studyin Oracle.	12
V	No SQL: No SQL Basics - Interfacing and Interacting with No SQL – Storage Architecture – CRUD Operations – No SQL Stores Queries - Data Stores Modifications and Evolution Management -Indexing and Ordering Data Sets – No SQL in Cloud – Case Study in Mongo DB.	12

Text Books:

1. Silberschatz, Korth, Sudarshan, "Database system concepts", 4th Edition, Tata McGraw Hill-2013 (For UNITS I,III, IV).
2. Shashank Tiwari, "Professional NoSQL", 1st Edition-2011(For UNIT V).

Reference Books:

1. Ramakrishnan, Gehrke, "Database Management Systems", Tata McGraw Hill
2. RamezElmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education,2008.
3. G.K.Gupta, "Database Management Systems", Tata McGraw Hill, 2011.

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Programme Code:	CEP	Master of Science in Computer Science		
Course Code:	19CEP09	Course Title		Batch:
		WEB PROGRAMMING USING OPENSOURCE TECHNOLOGIES		Semester:
Hrs/Week:	5		Credits:	4

Course Objective

1. Apply to get familiar with basics of the Internet Programming.
2. Acquire knowledge and skills for creation of web site considering both client and server side.
3. Implement interactive web page(s) using HTML, CSS and JavaScript.
4. Ability to develop responsive web applications
5. Explore different web extensions and web services standards

Course Outcomes (CO)

K1	CO1	Implement interactive web page(s) using HTML, CSS and JavaScript.
K2	CO2	Design a responsive web site using HTML5 and CSS3.
K3	CO3	Build Dynamic web site using server side PHP Programming and Database connectivity.
K4	CO4	Describe and differentiate different Web Extensions and Web Services.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	L
CO2	S	M	S	L
CO3	S	S	S	L
CO4	L	M	M	L

S - Strong; M-Medium; L-Low.

19CEP09	WEB PROGRAMMING USING OPENSOURCE TECHNOLOGIES	II
Unit No.	Topics	Hours
I	Introduction : Server-Side Web Scripting - Syntax and Variables-Control and Functions. Passing Information between Pages: GET Arguments - POST Arguments - Formatting Form Variables - PHP Super global Arrays	12
II	Data Manipulations: Strings in PHP - String Functions-Arrays and Array Functions: Creating Arrays - Retrieving Values - Multidimensional Arrays - Inspecting Arrays - Deleting from Arrays - Iteration. Advanced Array Functions: Transformation of Arrays. Number Handling: Numerical Types - Mathematical Operators - Simple Mathematical Functions - Randomness.	12
III	Session and Cookies : Regular Expressions: Tokenizing and parsing Functions - Regular Expressions - Perl - Compatible Regular Expressions - Advanced String Functions. Working with the File system: PHP File Permissions - File Reading and Writing Functions - File system and Directory Functions - Network Functions - Date and time Functions - Calendar Conversion Functions. Working with Sessions and Cookies: Sessions work in PHP - Session Functions - Configuration Issues - Cookies - Sending HTTP Headers	12
IV	Structured Query Language (SQL): Relational Database and SQL-SQL standards-The Workhorses of SQL-Database Design-Privileges and Security. PHP and MySQL: Connecting to MySQL - Making MySQL Queries - Fetching Data Sets - Multiple Connections - Error Checking - Creating MySQL Databases with PHP - MySQL Functions.	12
V	CONTENT MANAGEMENT SYSTEM : What is CMS - Wordpress - Joomla - Drupal -Magento - Prestashop - Comparison of Content Management System , Opencart , Cscart. Search Engine Optimization - How it Works - How SEO in marketing	12

Text Book :

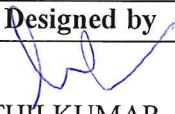


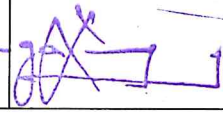
1. Steve Suehring Tim Converse and Joyce Park , "PHP6 and MySQL Bible", Wiley-India. New Delhi 2009

Reference Books:

1. Dacie Cristian, "Pack Pub AJAX and PHP" -2006

2. Scouarnec Yann, Stolz Jeremy Jeremy and Glass Michael , "Beginning PHP5, APACHE, MYSQL Web Development" , Wiley-India. New Delhi, 2005 Steven

Holzner, "The Complete Reference" , Tata McGraw Hill Edition, New Delhi, 2009

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Programme Code:	CEP	Master of Science in Computer Science		
Course Code:	19CEP10	Course Title	Batch:	2019 and onwards
		MACHINE LEARNING & ROBOTICS	Semester:	II
Hrs/Week:	5		Credits:	4

Course Objective

1. Describe what artificial intelligence (AI) means and how machines can be made to process information intelligently.
2. Identify the different fields that comprise AI, namely search techniques.
3. Understanding the fundamental concepts of Machine learning of data, model selection.
4. Able to know about Robotics & its application.
5. Describing about sensors and its functions.

Course Outcomes (CO)

K1	CO1	Ability of problem solving technique in AI
K2	CO2	Apply Search engine optimization technique to resolve problem reduction
K3	CO3	Understanding about robotics application developments
K4	CO4	Ability to understand about different type of sensors and its implementation procedures

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	L
CO2	S	M	S	L
CO3	S	S	S	L
CO4	L	M	M	L

S - Strong; M-Medium; L-Low.



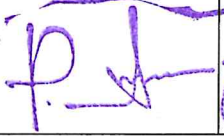
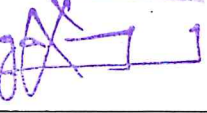
19CEP10	MACHINE LEARNING& ROBOTICS	II
Unit No.	Topics	Hours
I	The AI Problems: AI technique – Criteria for success – Define the Problem as a state space search – Production System – Characteristics – Problem Characteristics. Heuristic Search Techniques: Generate and Test – Problem Reduction – Constraints Satisfaction – Means End Analysis.	10
II	Knowledge Representation Issues: Approaches to knowledge Representation – The Frame Problem – Computable Functions & Predicates – Resolution – Procedural versus Declarative Knowledge. Machine learning: Introduction-Defining Planning-Building a data team-Data Processing-Data Storage	10
III	Decision trees-Basics of decision tree-uses-Advantages-Limitations-Different Algorithm-working-Training Data-Testing the Classifier code-Bayes's Theorem- Bayesian Network-Assigning Probabilities- Calculating Results-Node counts.	15
IV	Fundamentals of Robotics: Introduction, classification of Robots, History of Robots, Advantages and Disadvantages of Robot, Robot components, Robot degree of freedom, Robot joints and coordinates, Robot workspace, Robot reach, Robot languages	10
V	Sensors: Introduction to internal and external sensors of the robot. Position sensors, Velocity sensors, Acceleration sensors, SONAR and IR sensors, Touch and tactile sensors. Applications of Robots: Applications of robots, selection of robots, economic factors and justification for robotic application; safety requirements.	15

Text Books:

1. ElaineRichandKevinKnight, “ArtificialIntelligence ”, TataMcGrawHill,SecondEdition, Tata McGraw Hill 2003.
2. ”Machine Learning for Big data”, Author :JASON BELL Publication:WILEY
3. CraigJJ, “IntroductiontoRobotics,MechanicsandControl ”,PearsonEducation,New Delhi,2004.

Reference Books:

- 1.SaeedBNiku, ”Introductiontorobotics ”, PearsonEducation,NewDelhi2003
2. GeorgeFLuger, “ArtificialIntelligence ”, PearsonEditionPublication,4thEdition,2002
- 3 SudhaSadasivam, “ArtificialIntelligence ”, CharulathaPublications,2013

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Programme Code:	CEP	Master of Science in Computer Science		
Course Code:	19CEP11	Course Title	Batch:	2019 and onwards
		PRACTICAL III : WEB PROGRAMMING	Semester:	II
Hrs/Week:	5		Credits:	4

Course Objective

1. Ability to Understand markup languages and Scripting languages
2. Deploy a simple web application using PHP & MYSQL
3. Knowledge on Creating a Simple Forum based application
4. Design Develop Debug and Deploy an application with Admin Panel
5. Understanding knowledge on Wordpress.

Course Outcomes (CO)




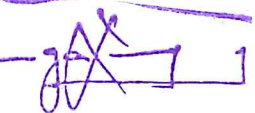
K1	CO1	Understand to develop simple GUI Applications
K2	CO2	Analyze and able to Develop a web application using PHP & MYSQL
K3	CO3	Applying Template in Web Applicaiton
K4	CO4	Create an application using Client / Server Panel in Web Environment.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	M	M	M	L
CO3	S	S	S	M
CO4	L	M	M	L

S - Strong; M-Medium; L-Low.

19CEP11	PRACTICAL III : WEB PROGRAMMING	II
Objective	Construct simple and complex queries using My SQL and PHP, Implement the basics of My SQL database tables by Adding and Editing Data.	
Ex. No.	PROGRAM LIST	
1.	Design and create a program for implementing Inheritance.	
2.	Develop a program to send an HTML formatted Email with attachment in PHP.	
3.	Develop and demonstrate a program for login authentication using PHP and My SQL.	
4.	Creating Crud Grid For A Student Database Using PHP and My SQL.	
5.	Develop a program to upload a file in PHP.	
6.	Design and create a RSS feed using PHP and My SQL.	
7.	Create a Pay slip for an employee using PHP and My SQL.	
8.	Create a simple Discussion board for students to share their knowledge .	
9.	Build a college website using Word press Theme.	
10.	Create a home page and customize the data through Admin Panel	

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Programme Code:	CEP	Master of Science in Computer Science		
Course Code:	19CEP12	Course Title	Batch:	2019 and onwards
Hrs/Week:	5	Practical IV: OPEN SOURCE DATABASE MANAGEMENT SYSTEM	Semester:	II
			Credits:	4

Course Objective

1. A strong formal foundation in database concepts.
2. Introduction to systematic database design approaches covering conceptual design, logical design and an overview of physical design.
3. To present the concepts and techniques relating to ODBC and its implementations.
4. The concepts of transactions and transaction processing.
5. To present the issues and techniques relating to concurrency and recovery in multi-user database environments.

Course Outcomes (CO)

Students will able to:

K1	CO1	Understand and explain the underlying concepts of database technologies
K2	CO2	Design and implement a database schema for a given problem domain
K3	CO3	Declare and enforce integrity constraints on a database
K4	CO4	Programming PL/SQL including stored procedures, stored functions, cursors and packages

Mapping of Outcomes

PO CO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	M	S	M	S

S - Strong; M-Medium; L-Low.

19CEP12	PRACTICAL IV - OPEN SOURCE DATABASE MANAGEMENT SYSTEM	II
Objective	This course gives practical training in design and implementation of relational data bases for the selected set of problems.	
Ex. No.	PROGRAM LIST	
1	Creation of a database and writing SQL queries to retrieve information from the database by performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records.	
2	Creation of database for Procedures, Triggers and Functions.	
3	Creation of Views, Synonyms, Sequence, Indexes, save point.	
4	Creating an Employee database to set various constraints and joins.	
5	Creating a database for college admission system by using relationship between the databases.	
6	Implement PostgreSQL for Personal Information System.	
7	Create a function that calculates tax on a personal member's salary.	
8	Exhibit Web Based User Identification System using Oracle/ My SQL	
9	Demonstrate Railway Reservation System using Oracle/ My SQL	
10	Create Timetable Management System using Oracle/ My SQL	

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Programme Code	M.Sc	Master of Science in Computer Science		
Course Code	19CEP13	Course Title	Batch	2019 and Onwards
		Digital Image Processing	Semester	III
Hrs/Week	5		Credits	4

Course Objective:

- Ability to learn digital image processing techniques and apply in practical problems.
- Learn the advanced concepts of image processing and its implementation.

Course Outcomes (CO)

K1	CO1	Understand the need for image transforms and their properties
K2	CO2	Develop image processing application
K3	CO3	Learn different techniques employed for the enhancement of images
K4	CO4	Understand the need for image compression and to learn the spatial and frequency domain techniques of image Compression.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
C01	S	S	S	S
C02	S	S	M	M
C03	S	S	S	L
C04	S	M	S	L

S - Strong; M-Medium; L-Low.

19CEP13	DIGITAL IMAGE PROCESSING	III
Unit No.	Topics	Hours
I	Introduction: Introduction to Digital Image Processing – The Origins of Digital Image Processing- Gamma Ray Imaging – X Ray Imaging – Imaging in Ultra Violet band – Fundamental steps in Digital Image Processing – Components of an Image Processing System.	10
II	Digital Image Fundamentals: Elements of Visual Perception – Light and the electromagnetic spectrum – Image sensing and Acquisition – Image Acquisition using a single sensor - Image Acquisition using sensor strips - Image Acquisition using sensor arrays – A simple image formation model. Image Sampling and Quantization: Basic Concepts in Sampling and Quantization - Representing digital images – Spatial & Intensity Resolution – Image Interpolation	10
III	Image Processing:- Functions - read write and show image - image reverse - image mirroring - Image shift -Image Resize-Image enhancement : Brightness & contrast - Negative- Histogram - Threshold - color -HSI-YIQ- GRAY IMAGE - Morphologic operations .Dilation - Erosion- Convolution - Edge Detection- Labeling - Create a simple application for image processing using Mat lab	15
IV	Image Compression: Fundamentals – Spatial and Temporal Redundancy - Irrelevant Information - Measuring Image Formation – Image Compression Models – Compression Methods – Huffman’s coding – Arithmetic coding – Digital image watermarking	10
V	Image Segmentation: Fundamentals of Image Segmentation – Thresholding – Using image smoothing to improve Global Thresholding – Using edges to improve Global Thresholding – Region based segmentation: Region growing – Region splitting – Region Merging	15




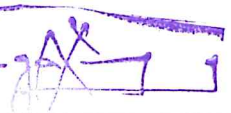
Text Book:

1. Gonzalez R.C and Woods R.E- "Digital Image Processing"- Addison Wesley- third edition.

Reference Books:

1. Anil K. Jain- "Fundamentals of Digital Image Processing"- Prentice Hall.

2. Chanda & Majumdar- "Digital Image Processing and Analysis"- Prentice Hall- third edition. Delhi,2004.

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Programme Code	M.Sc	Master of Science in Computer Science		
Course Code	19CEP14	Course Title	Batch	2019 and Onwards
		Data Mining And Warehousing	Semester	III
Hrs/Week	5		Credits	4

Course Objective

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools.

Course Outcomes (CO)

K1	CO1	Understand to simple KDD process and Data Warehouse
K2	CO2	Analyze and Apply Classification Techniques
K3	CO3	Apply Clustering Algorithms on Various dataset using WEKA
K4	CO4	Design to deploy the Data Mining tasks Using Algorithms

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
C01	S	S	M	S
C02	M	M	M	L
C03	S	S	S	M
C04	M	M	M	M

S - Strong; M-Medium; L-Low.

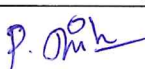

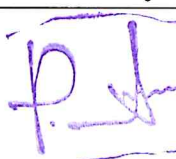
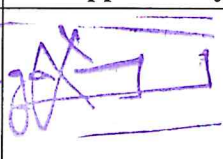
19CEP14	DATA MINING AND WAREHOUSING	III
Unit No.	Topics	Hours
I	INTRODUCTION Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.	12
II	FREQUENT PATTERN ANALYSIS Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns	12
III	CLASSIFICATION AND CLUSTERING Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines – Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis- outlier detection methods.	12
IV	WEKA TOOL Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners	12
V	DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP) Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations OLAP and OLTP.	12

TEXT BOOK:

1. Jiawei Han and Micheline Kamber, —Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.

REFERENCES:

1. Alex Berson and Stephen J. Smith, —Data Warehousing, Data Mining & OLAP, Tata McGraw–Hill Edition, 35th Reprint 2016.
2. K.P. Soman, Shyam Diwakar and V. Ajay, —Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.
3. Ian H. Witten and Eibe Frank, —Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.

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Programme Code	M.Sc	Master of Science in Computer Science		
Course Code	19CEP15	Course Title	Batch	2019 and Onwards
Hrs/Week	5	Internet of Things	Semester	III
			Credits	4

Course Objective

The course should enable the students to:

- Understand the architecture of Internet of Things and connected world.
- Explore on use of various hardware, communication and sensing technologies to build IoT applications.
- Illustrate the real time IoT applications to make smartworld.
- Understand challenges and future trends in IoT.

Course Outcomes (CO)

K1	CO1	Understand and intuition of the whole process line of extracting knowledge from data about the Internet of Things.
K2	CO2	Experience in deriving theoretical properties of methods involved in IoT.
K3	CO3	Design and implementation/modification of methods involved in IoT.
K4	CO4	Create effective results of IoT future approaches.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	M	M	M	S
CO2	M	S	M	S
CO3	S	M	M	S
CO4	M	M	M	M

S - Strong; M-Medium; L-Low.

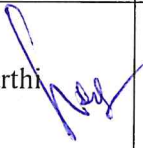

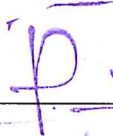
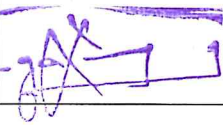
19CEP15	INTERNET OF THINGS	III
Unit No.	Topics	Hours
I	INTRODUCTION TO INTERNET OF THINGS (IoT): Definition and characteristics of IoT- physical design of IoT- logical design of IoT - IoT enabling technologies- IoT levels and deployment- domain specific IoTs.	8
II	IoT AND M2M : Introduction- M2M- difference between IoT and M2M- software defined networking (SDN) and network function virtualization (NFV) for IoT -M2M and IoT technology fundamentals.	12
III	IoT PLATFORMS DESIGN METHODOLOGY : IoT Architecture: State of the art introduction- state of the art- Architecture reference model- Introduction- reference model and architecture- IoT reference model. Logical design using Python: Installing Python- Python data types and data structures control flow- functions- modules- packages- file handling.	15
IV	IoT PHYSICAL DEVICES AND ENDPOINTS Introduction to Arduino- Installing and setting up the Arduino- sketches- shields interfacing with Arduino -Introduction to Node MCU-Programming Node MCU RFID- GPS -Introduction to Raspberry pi- installation- usage.	14
V	IoT PHYSICAL SERVERS AND CLOUD OFFERINGS Introduction to cloud storage models and communication-IOT cloud building blocks- Interfacing with cloud- About Thing speak- Channels- working with thing speak.	13

Text Book

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on-Approach", VPT, 1st Edition, 2014.
2. Matt Richardson, Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly (SPD), 3rd Edition, 2014.

Reference Books:

1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", John Wiley and Sons 2014.
2. Matthew N.O Sadiku "Emerging Internet Based Technologies", Taylor & Francis (P) 2019 Taylor & Francis.

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Programme Code	M.Sc	Master of Science in Computer Science		
Course Code	19CEP16	Course Title	Batch	2019 and Onwards
		Practical V: DIP Programming Using MAT LAB	Semester	III
Hrs/Week	4		Credits	4

Course Objective:

- Acquire an appreciation for the image processing issues and techniques and be able to apply these techniques to real world problems.
- Be able to conduct independent study and analysis of image processing problems and techniques.

Course Outcomes (CO)





K1	CO1	Understand the relevant aspects of digital image representation and their practical implications
K2	CO2	Have the ability to design point wise intensity transformations to meet stated specifications.
K3	CO3	Have an understanding of the underlying mechanisms of image compression, and the ability to design systems using standard algorithms to meet design specifications.
K4	CO4	Understand a command of basic image restoration techniques .

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	M	S	S	S
CO2	S	S	M	M
CO3	M	S	S	L
CO4	S	M	S	S

S - Strong; M-Medium; L-Low.

19CEP16	PRACTICAL V - DIP PROGRAMMING USING MAT LAB	III
Objective	This course gives practical training in design and implementation of Creating data set for the selected set of problems.	
Ex. No.	PROGRAM LIST	
1	Write a Mat lab Program for Creating Database	
2	Write a Mat lab Program for importing an external data set.	
3	Write a Mat lab Program for Basic Clustering	
4	Write a Mat lab Program for K- Means Clustering .	
5	Write a Mat lab Program for Hierarchal Clustering.	
6	Write a Mat lab Program for Find nearest neighbors using exhaustive search or <i>kd</i> -tree search .	
7	Write a Mat lab Program for Markov models for data generation.	
8	Write a Mat lab Program for Support vector machines for binary or multiclass classification.	
9	Write a Mat lab Program for Binary decision trees for multiclass learning	
10	Write a Mat lab Program Acquisition Using the Image Acquisition tool.	

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Programme Code	M.Sc	Master of Science in Computer science		
Course Code	19CEP17	Course Title	Batch	2019 and onwards
Hrs/Week	5	Practical VI: Programming the Internet of Things	Semester	III
			Credits	4

Course Objective

- In this course, student will explore various components of Internet of things such as Sensors, internetworking and cyber space.
- In the end they will also be able to design and implement IoT circuits and solutions.

Course Outcomes (CO)

Students will able to:

K1	CO1	Recognize various devices, sensors and applications (Knowledge)
K2	CO2	Analyze various M2M and IoT architectures (Analyze)
K3	CO3	Evaluate design issues in IoT applications (Evaluate)
K4	CO4	Create IoT solutions using sensors, actuators and Devices (Create)

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	M	S	M	S

S - Strong; M-Medium; L-Low.

19CEP17	PRACTICAL VI - PROGRAMMING THE INTERNET OF THINGS	III
Ex. No.	PROGRAM LIST	
1	Introduction to various sensors and various actuators & its Application (Students have to prepare Report for the same). a) PIR Motion Sensor. b) Rain Drop Sensor. c) Moisture Sensor. d) Temperature Sensor. e) Touch Sensor. f) Infrared Sensor. g) Servo Moto. h) RFID Sensor. i) Bluetooth Module. j) Wi-Fi Module.	
2	Getting Started with ESP8266 Wi-Fi SoC(wifi configuration).	
3	Create a simple project of study room automation using wifi.	
4	Global data communication using thing speak.	
5	Demonstrate Arduino and its pins. Case study.	
6	Perform Experiment using Arduino Uno to measure the distance of any object using Ultrasonic Sensor.	
7	Create a Program using Arduino to Learn the Working of Servo Motor	
8	Send a data to the web server using wifi module with arduino plat form	
9	Display GPS location on goggle map using thing speak	
10	Demonstration of Setup & Working of Raspberry Pi. (Students have to prepare the Report for the same.).	

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Programme Code	M.Sc	Master of Science in Computer Science		
Course Code	19CEP18A	Course Title	Batch	2019 and onwards
		Elective -I(A) Distributed Computing	Semester	III
Hrs/Week	4		Credits	3

Course Objective:

- To introduce fundamental principles of distributed systems and key design issues.
- Impart knowledge of the distributed computing models algorithms and the design of distributed system.

Course Outcomes (CO)

K1	CO1	Identify the core concepts of distributed systems.
K2	CO2	Illustrate the mechanisms of inter process communication in distributed systems.
K3	CO3	Compare the concurrency control mechanism in distributed transactional environment..
K4	CO4	Outline the need for mutual exclusion and election algorithms in distributed systems.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	L
CO2	S	S	S	L
CO3	S	S	S	L
CO4	S	S	S	M

S - Strong; M-Medium; L-Low.



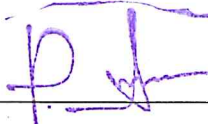
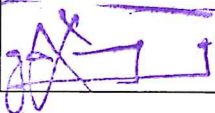
19CEP18A	Elective I(A) Distributed Computing	III
Unit No.	Topics	Hours
I	INTRODUCTION: Evolution of Distributed Computing -Issues in designing a distributed system- Challenges- Minicomputer model – Workstation model Workstation-Server model–Processor - pool model - Trends in distributed systems	12
II	System models: Physical models - Architectural models -Fundamental models. Inter process communication: characteristics – group communication - Multicast Communication –Remote Procedure call - Network virtualization.	12
III	Distributed file system: File service architecture – Network file system- Andrew file system- Name Service.	12
IV	Transactional concurrency control: Transactions, Nested transactions- Locks-Optimistic concurrency control	10
V	Mutual Exclusion: Distributed mutual exclusion – central server algorithm – ring based algorithm- Maekawa's voting algorithm – Election: Ring -based election algorithm – Bully algorithm	14


Text Books:

1. George Coulouris, Jean Dollimore and Tim Kindberg , *Distributed Systems: concepts and Design*, Fifth Edition , Pearson Education, 2011
2. Pradeep K Sinha, *Distributed Operating Systems : Concepts and Design*, Prentice Hall of India.

Reference Books:

1. A S Tanenbaum and M V Steen , *Distributed Systems: Principles and paradigms*, Pearson Education, 2007
2. M Solomon and J Krammer, *Distributed Systems and Computer Networks*, PHI.

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Programme Code	M.Sc	Master of Science in Computer Science		
		Course Title	Batch	2019 and onwards
Course Code	19CEP18B	Elective-II(B) Web Technology	Semester	III
Hrs/Week	4		Credits	3

Course Objective:

- On completion of this course, the students will be able to develop web applications using HTML, DHTML, ASP and server side scripting languages.

Course Outcomes (CO)

K1	CO1	Ability to design a dynamic webpage.
K2	CO2	Ability to understand about different type of scripting languages and use it to develop websites.
K3	CO3	Apply the skill to develop applications using various scripting languages.
K4	CO4	Design to create structure of web page, to store the data in web document, and transport information through web.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	L
CO2	S	S	S	L
CO3	S	S	S	L
CO4	S	S	S	M

S - Strong; M-Medium; L-Low.



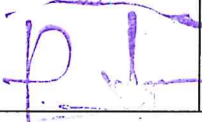

19CEP18B	Elective I(B): WEB TECHNOLOGY	III
Unit No.	Topics	Hours
I	HTML: Introduction to HTML: The development process, Html tags and simple HTML forms, web site structure Introduction to XHTML: XML, Move to XHTML, Meta tags, Character entities, frames and frame sets, inside browser Web Design: Website design principles, planning the site and navigation.	10
II	Java Script: Client side scripting, What is Java script, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition. Advance script, Java script and objects, Java Script own objects, the DOM and web browser environments, forms and validations.	12
III	XML: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Well formed, using XML with application.XML, XSL and XSLT. Introduction to XSL, XML transformed simple example, XSL elements.	12
IV	PHP: Starting to script on server side, Arrays, function and forms, advance PHP Databases :Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting dat and tables.	12
V	Introduction to Servlets: Common Gateway Interface (CGI), Lifecycle of a Servlet, deploying a Servlet, The Servlet API, Reading Servlet parameters, and Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC.	14

Text Books:

1. Steven Holzner, "HTML Black Book", Dreamtech press.
2. Web Technologies, Black Book, Dream tech Press.
3. Web Technologies, Uttam K Roy, Oxford University Press.
4. Web Programming, building internet applications, Chris Bates 2nd edition, Wiley Dreamtech.
5. The Complete Reference PHP – Steven Holzner, Tata McGraw-Hill.
6. Java Server Pages –Hans Bergsten, SPD O'Reilly.

Reference Books:

1. Web Applications: Concepts and Real World Design, Knuckles, Wiley-India.
2. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson.

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Programme Code	M.Sc	Master of Science in Computer Science		
Course Code	19CEP19	Course Title	Batch	2019 and onwards
		Big Data Analytics	Semester	IV
Hrs/Week	4		Credits	4

Course Objective:

- Explore the fundamental concepts of big data analytics Learn to analyze the big data using intelligent techniques.
- Understand the applications using Map Reduce Concepts Understand the various search methods and visualization techniques.

Course Outcomes (CO)

K1	CO1	Student have an ability to work with big data platform and explore the big data analytics techniques business applications .
K2	CO2	Analyze the HADOOP and Map Reduce technologies associated with big data analytics
K3	CO3	Students can Perform statistical analysis on variety of data .
K4	CO4	Perform appropriate statistical tests using R and visualize the outcome.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
C01	S	S	S	L
C02	S	S	S	L
C03	S	S	S	L
C04	S	S	S	M

S - Strong; M-Medium; L-Low.

19CEP19	BIG DATA ANALYTICS	IV
Unit No.	Topics	Hours
I	Introduction - History of Big Data / Data Science - Google White papers - Map Reduce - Google File system - clusters . Big data handlers - SPSS - SAS Introduction about Software Tools - Mongo DB - R - Hadoop - Hadoop Ecosystem - What makes it Big Data .What is Data science - Tools in Data Science - Type of Data Analytics - I/O issues - Big data usage - Future of Big Data . Algorithms in Big Data - Classification - Predictive learning - Deterministic behavior algorithms	12
II	Installing Hadoop - Overview of Hadoop Ecosystem - HDFS and Map Reduce - Installing Dataset - HDFS using Command Line - Map Reduce in Distributed processing. case studies .	12
III	Software Tools : Overview of R - Installing R - Built in Datasets - Data Imports - Creating Charts and Graphs - Creating histograms and box plots - Frequencies and Descriptive - Transformation of Variables - Coding missing data .	12
IV	Mathematical Approach to Data Science - Decision Trees - Tree based methods - creating a decision tree in R - Rules - r part - R packages.	12
V	Statistical Approach in Data Science : Regression - Trees - Classification - Diagnostics - Descriptive vs inferential statistics - Basic measures of Central tendency - Relationships - basic measures of central tendency using R- Linear Models - Least Squares methods - Creating and Using Linear Models with the Least Squares methods and its implementation in R.	12

Text Book:

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.

References:

1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
3. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.

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Programme Code	M.Sc	Master of Science in Computer science		
Course Code	19CEP20	Course Title	Batch	2019 and Onwards
Hrs/Week		5	Research Methodology	Semester IV
			Credits	4

Course Objective

- Achieve competence and proficiency in the theory of and practice to research
- To develop the subject of their research.
- Encourage the formation of higher level of trained intellectual ability.
- To develop critical analysis and independence of thought.
- Develop skills in writing research proposals, reports and dissertation.

Course Outcomes (CO)

K1	CO1	Describe what research is and what is not. To raise awareness of crucial aspect of the nature of Knowledge and the value of scientific method
K2	CO2	Evaluate literature, from a variety of sources, pertinent to the research objectives
K3	CO3	Justify how researchers will collect data
K4	CO4	Warn the common mistakes in the field of research methodology

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	M
CO2	M	S	S	M
CO3	M	S	S	M
CO4	M	M	S	M

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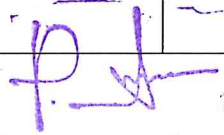
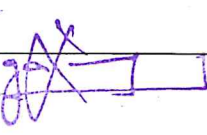
19CEP20	RESEARCH METHODOLOGY	IV
Unit No.	Topics	Hours
I	RESEARCH FORMULATION AND DESIGN Motivation and objectives – Research methods vs. Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature And research database, development of working hypothesis.	10
II	DATA COLLECTION AND ANALYSIS Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools ,data analysis with statically package (Sigma STAT,SPSS for student t-test, ANOVA, etc.), hypothesis testing.	16
III	SOFT COMPUTING Computer and its role in research, Use of statistical software SPSS, GRETL in research. Introduction to evolutionary algorithms Fundamentals of Genetic algorithms, Simulated Annealing, Neural Network based optimization, Optimization of fuzzy systems.	12
IV	RESEARCH ETHICS, IPR AND SCHOLARY PUBLISHING Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.	10
V	INTERPRETATION AND REPORT WRITING Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of L T P C 45 15 0 4 Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports, Conclusions. .	12


Text Book

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. *An introduction to Research Methodology*, RBSA Publishers.
2. Wadehra, B.L. 2000. *Law relating to patents, trade marks, copyright designs and geographical indications*. Universal Law Publishing.

References:

1. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. *Research Methods: A Process of Inquiry*, Allyn and Bacon.
2. Carlos, C.M., 2000. *Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options*. Zed Books, New York.
3. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
4. Day, R.A., 1992. *How to Write and Publish a Scientific Paper*, Cambridge University Press.
5. Fink, A., 2009. *Conducting Research Literature Reviews: From the Internet to Paper*. Sage Publications
6. Leedy, P.D. and Ormrod, J.E., 2004 *Practical Research: Planning and Design*, Prentice Hall.
7. Satarkar, S.V., 2000. *Intellectual property rights and Copy right*. EssEss Publications.

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Programme Code	M.Sc	Master of Science in Computer Science		
Course Code	19CEP21	Course Title	Batch	2019 and onwards
		Practical VII: Big Data Analytics Using R Tool	Semester	IV
Hrs/Week	4		Credits	4

Course Objective:

- To explore the statistical analysis techniques using R programming languages.
- Students can expand their knowledge in R to use it for further research

Course Outcomes (CO)

K1	CO1	To optimize business decisions and create competitive advantage with Big Data analytics
K2	CO2	Implement statistical analysis techniques for solving practical problems.
K3	CO3	Perform statistical analysis on variety of data
K4	CO4	Perform appropriate statistical tests using R and visualize the outcome

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	L
CO2	S	S	S	L
CO3	S	S	S	L
CO4	S	S	S	M

S - Strong; M-Medium; L-Low.

Code No.	Subject	Semester No.
19CEP21	Practical VII - BIG DATA ANALYTICS USING R TOOL	IV
Objective	On successful completion of the course The student can able to Demonstrate Statistical Applications Using R.	
Ex. No.	PROGRAM LIST	
1	Write a R program to find the levels of factor of a given vector	
2	Write a R program to extract the five of the levels of factor created from a random sample from the LETTERS (Part of the base R distribution)	
3	Write a R program to call the (built-in) dataset air quality. Remove the variables 'Solar R' and 'Wind' and display the data frame	
4	Write a R program to create two 2x3 matrix and add, subtract, multiply and divide the matrixes.	
5	Implement a central limit theorem using R	
6	Demonstrate Apriori algorithm using R	
7	Implementation of KNN algorithm using R	
8	Demonstrate a Decision Tree algorithm using R	

Course Designed by	Verified by HOD	Checked by	Approved by
K.S.SENTHILKUMAR	Dr.R.RANGARAJ		

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Programme Code	M.Sc	Master of Science in Computer Science		
Course Code	19CEP22A	Course Title	Batch	2019 and onwards
		Elective II(A) Business Intelligence	Semester	IV
Hrs/Week	5		Credits	3

Course Objective

- Understood the industry and overall business environment.
- Know the business processes and information flow

Course Outcomes (CO)

K1	CO1	To enable the students to learn about the foundations, definitions, and capabilities of DSS, data analytics and BI
K2	CO2	Will gain knowledge about the impact of business reporting, information visualization, and dashboards.
K3	CO3	illustrate a working knowledge of how to plan, execute and close business to required standards
K4	CO4	use a range of proprietary and non- proprietary management tools to carry out and report on your team projects

Mapping of Outcomes

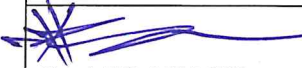


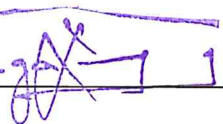
CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	L	L
CO2	S	S	S	S
CO3	M	S	S	S
CO4	S	S	S	M

S - Strong; M-Medium; L-Low.

19CEP22A	Elective I(A):BUSINESS INTELLIGENCE	IV
Unit No.	Topics	Hours
I	INTRODUCTION TO BUSINESS INTELLIGENCE: Introduction – Data Information and Knowledge – What is Business intelligence? – Business Intelligence and related technologies – Obstacles to Business Intelligence – Factors driving Business Intelligence – Improving the Decision making Process – Why a Business intelligence Program?.	12
II	BUSINESS INTELLIGENCE CAPABILITIES: Introduction – Four Synergistic capabilities – Organizational Memory – Technologies Enabling Organizational Memory Capability - Information Integration Capability – Insight Creation – Technologies Enabling Insight Creation Capability.	12
III	THE BUSINESS INTELLIGENCE PROGRAM: Business Intelligence Architecture and Design – Data Preparation – Data Integration – Business Intelligence Platforms – Analysis – Delivery and Presentation - The Organizational Business Framework – Metadata management – Data Modeling – Data Profiling – Data Quality – Data Integration – Text Analysis – Predictive Analysis – Data Security - Data Governance.	12
IV	BUSINESS PROCESSES AND INFORMATION FLOW: Information Processing and Information flow – Transaction Processing – operational Processing – Batch Processing – Analytical Processing - The Information Flow Process : Information flow model : Processing Stages - Directed Channels - Business Process Model and Notation (BPMN) – Data Recruitment Analysis : Business Use of Information – Metrics : Facts , Qualifiers and Models – What is Data Requirements Analysis ?	12
V	EMERGING BUSINESS INTELLIGENCE TRENDS AND KNOWLEDGE DELIVERY: Introduction in Searching a Business Intelligence Technique – Text Analysis – Entity Extraction and Entity Recognition – Sentiment Analysis – Mobile Business Intelligence – Event Stream Processing – Big Data Analytics - Knowledge Delivery : Standard Reports –Dimensional Analysis – Visualization: Charts, Graphs, Widgets – Score cards and Dashboards – Geographic visualization – Integrated Analytics.	12

Text Books:

1. *Business Intelligence, Practice, Technologies and Management*, Rajiv Sabherwal, Irma cerra Fernandez.
2. *Business Intelligence: The Savvy Manager's Guide*, David Loshin , 2013 Edition, 2010.

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Programme Code	M.Sc	Master of Science in Computer Science		
Course Code	19CEP22B	Course Title	Batch	2019 and onwards
		Elective II(B): E-Commerce	Semester	IV
Hrs/Week	5		Credits	3

Course Objective

- To provide exposure to the students about business through information technology.
- To provide them with the fundamental knowledge of the use of computers in business.
- To understand the various concepts of e-commerce.

Course Outcomes (CO)

K1	CO1	Understand the methodology for online business
K2	CO2	Analyze and Applying digital transaction using e-commerce infrastructure.
K3	CO3	Strategic approach to define how mobile phones can be integrated into marketing strategy in organizations.
K4	CO4	Deploy Electronic data flow in organization

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	M	M	M	L
CO3	S	S	S	M
CO4	M	M	M	M

S - Strong; M-Medium; L-Low.

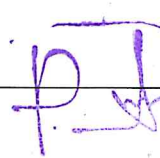
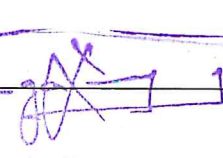
19CEP22B	Elective II(B) E-COMMERCE	IV
Unit No.	Topics	Hours
I	Electronic commerce fundamentals: History and basic idea of EDI and electronic messaging, definition of e-commerce; administration, business, and consumer models of e-commerce; e-commerce enablers- cost reduction, trust issues, products, processes, and markets. Client-server computing in e-commerce Client-server computing basics, design technologies	12
II	Core Technology: Electronic Commerce Models -Shopping Cart Technology - Data Mining - Intelligent Agents – Internet Marketing - XML and E-Commerce	12
III	Electronic Payment Systems: Types of Electronic Payment Systems – Digital Token based Electronic Payment Systems – Smart Card and Credit Card Based Electronic Payment Systems – Risk and Electronic Payment Systems – Designing Electronic Payment Systems.	12
IV	Security: Threats to Network Security - Public Key Cryptography - Secured Sockets Layer - Secure Electronic Transaction - Network Security Solutions - Firewalls	12
V	Inter/Intra Organizations Electronic Commerce: EDI - EDI application in business - legal, Security and Privacy issues - EDI and Electronic commerce - Standards - Internal Information Systems - Macro forces - Internal commerce - Workflow Automation and Coordination - Customization and Internal commerce - Supply chain Management	12

TEXT BOOK:

1. Laudon, K. C. & Traver, C. G.; *E-Commerce Business, Technology, Society*; Addison Wesley, 2014
2. Ravi Kalakota and Andrew B Whinston , *Frontiers of Electronic commerce*, 50 Pearson Education, 2003.

REFERENCES:

1. David Whiteley, *e - Commerce : Strategy, Technologies and Applications* - McGraw Hill, 2000.
2. *E-Commerce*, M.M. Oka, EPH 2. Kalakotia, Whinston : *Frontiers of Electronic Commerce*, Pearson Education.

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