NATIONAL COLLEGE (AUTONOMOUS), Tiruchirapalli – 620 001
Nationally Re-Accredited at "A+" Level by NAAC

Post Graduate Programmes Structure under CBCS

M.Sc., COMPUTER SCIENCE (Revised Syllabus 2022 -2024 Onwards)

PROGRAMME OUTCOMES

PO1- Computational Knowledge: Apply knowledge of computing fundamentals and domain knowledge.

PO2- Problem Analysis: Identify, formulate and solve complex computing problems reaching substantiated conclusions.

PO3- Development of Solutions: Design and evaluate solutions for complex computing problems with appropriate consideration.

PO4- Investigations of complex Computing problems: Use research-based knowledge and research methods for analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5- Modern Tool Usage: Create, identify and apply appropriate techniques, resources, and modern computing tools to complex computing activities.

PO6- Professional Ethics: Understand and commit to professional ethics and cyber regulations for professional computing practices.

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Post Graduate Programmes Structure under CBCS
M.Sc., COMPUTER SCIENCE (Revised Syllabus 2022Onwards)

Semester	Course Code	Course Title	Hours	Credits	Marks		Total
					Internal	External	
I	P22CS1	Mathematical Foundations for Computer Science	6	5	25	75	100
	P22CS2	J2EE Technologies	6	4	25	75	100
	P22CS3P	J2EE Technologies Lab	3	3	25	75	100
	P22CS4E	Distributed Operating System/ Digital Asset Management	6	5	25	75	100
	P22CS5	Data Mining and Warehousing	6	4	25	75	100
	P22CS6P	Data Mining Lab	3	3	25	75	100
Papers: 6			**30**	**24**	**150**	**450**	**600**
II	P22CS7	Compiler Design	6	5	25	75	100
	P22CS8	Python Programmingwith Data Science	6	5	25	75	100
	P22CS9P	Python Programming Lab	3	3	25	75	100
	P22CS10E	OOAD & UML/System Analysis and Design	6	5	25	75	100
	P22CS11	Digital Marketing	6	5	25	75	100
	P22CS12P	Digital Marketing Lab	3	3	25	75	100
Papers: 6			**30**	**26**	**150**	**450**	**600**
III	P22CS13	Relational Database Management System	6	4	25	75	100
	P22CS14P	RDBMS Lab	3	3	25	75	100
	P22CS15	Web Programming	6	4	25	75	100
	P22CS16P	Web Programming Lab	3	3	25	75	100
	P22CS17E	Machine Learning/Artificial Intelligence	6	4	25	75	100
	P22CS18	Cloud computing	6	5	25	75	100
		Papers: 6	**30**	**23**	**150**	**450**	**600**
IV	P22CS19	Big Data Analytics	6	5	25	75	100
	P22CS20P	Big Data Analytics using R-Tool Lab	6	3	25	75	100
	P22CS21E	Software Testing/Agile Software Process	6	4	25	75	100
	P22CS22	Project	12	5	25	75	100
Papers: 4			**30**	**17**	**100**	**300**	**400**
Total			**120**	**90**			**2200**

Semester I	MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE	Hours/Week: 6
Core Course (P22CS1)		Credit: 5

PREAMBLE

A Computer Science student needs to have some basic mathematical tools and techniques to understand various designing concepts, storage methods, concepts in digital principles, managing databases etc. The main objective of this course is to understand the concepts and operations of Matrix Algebra needed for computing graphics model. This emphasizes the development of rigorous logical thinking for solving different kinds of problems that occur in computer science. Based on this the course aims at giving adequate exposure in the theory and applications of Graphs and PERT, Mathematical Modelling which helps the learner to use them eventually in practical applications of computer science.

COURSE OUTCOMES

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

CO1: Prove implication problems using Graph theory, Matrix representation of Graphs.

CO2: Obtain PERT and related techniques.

CO3: Check the validity of cryptography through Caesar cipher coding, matrix encoding AndHamming metric.

CO4: Construct reasoning using equivalence transformation, detective proof.

CO5: Represent the given relation in matrix, digraph and vice versa.

CO6: Verify preposition, precedence rules and Tautologies reasoning.

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	9	9	9	-	-
CO2	-	9	9	9	3	-
CO3	3	9	3	3	9	9
CO4	-	9	9	9	3	3
CO5	-	9	3	3	-	-
CO6	-	9	3	3	-	-

Level of Correlation between CO's and PO's } 1 – Low 3 – Medium 9 – High 0 – No Correlation (Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

UNIT-I:INTRODUCTION TO GRAPH THEORY: Basic concepts of graph theory-paths, reachability and connectedness -Matrix representation of graphs-Trees.

UNIT-II:GRAPH THEORY: Storage representation and manipulation of graphs: Trees and list structures and graphs-simple precedence grammars-PERT and related techniques.

UNIT-III:CODING THEORY: Introduction-cryptography-Caesar cipher coding-Matrix encoding-Scrambled codes-Hamming metric-Hamming distance-Error detecting capability of an encoding.

UNIT-IV: MATHEMATICAL LOGIC: Propositions-evaluation-precedence rules-Tautologies-reasoning using equivalence transformation-Laws of Equivalence-Substitution rules-a natural detection system-Detective proofs-Inference rules-Proofs and sub proofs.

UNIT-V:PROBABILITY THEORY: Historic perspective, Mathematical modelling-Equiprobable spaces-Mutually exclusive events-Conditional probability-Bayes theorem.

TEXT BOOKS :

1.Unit I&II- J.P.Tremblay,R.Manohar "Discrete mathematical structures with applications to computer science".2006
2.Unit III- James L.Fisher "Application oriented algebra",2004
3.Unit IV- David Gries "science of programming ",2007
4.Unit V- Harsh Bhasin,Dharminder Kumar "Discrete mathematical structures"

REFERENCE BOOKS:

1.Kenneth H.Rosen, " Discrete Mathematics and Its Applications", Tata McGraw Hill, Fourth Edition,2002 .
2. Hopcroft and Ullman, "Introduction to Automata Theory, Languages and Computation", Narosa Publishing House, Delhi, 2002.
3. A.Tamilarasi & A.M.Natarajan, "Discrete Mathematics and its Application", Khanna Publishers,2nd Edition 2005

Semester I	J2EE TECHNOLOGIES	Hours/Week: 6
Core Course (P22CS2)		Credit: 4

PREAMBLE: This course aims at facilitating the student to understand the advanced internetprogramming concepts and the programming concepts of JAVA towards developing Javabased applications and hands on practices by applying the concepts for implementing internetapplications.

COURSE OUTCOMES

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

CO1: Use the object oriented concepts of java for the given problem.
CO2: Use exceptions, threads, collections, logs of Java for the given problem.
CO3: Apply events through swing, RMI, JAR operations for the given application.
CO4: Select the proper library classes in Java based on the need of a Problem.
CO5: Apply JDBC with SQL and Servlets to solve Internet applications.
CO6: Design an application using EJB and JSP.

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	9	9	9	1	9	
CO2	9	9	9	1	9	
CO3	9	9	9	1	9	
CO4	9	9	9	1	9	
CO5	9	9	9	1	9	
CO6	9	9	9	1	1	

Level of Correlation between CO's and PO's } 1 – Low 3 – Medium 9 – High 0 – No Correlation (Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

UNIT-I:-Understood the internet program with database, client/server environment,distributed application & online processing using j2ee server. Introduction – RMI -Understanding RMI Architecture - Working With RMI - Application Development WithRMI - Created Distributed Application Development With RMI - Remote Object Activation- Object Activation. RMI Security Using SSL Bypassing Self-study: Understanding RMIArchitecture.

UNIT-II:-GUI Components: Simple GUI Based I/O With Joptionpane - Overview Of SwingComponents - Displaying Text And Images In A Window - Common GUI Event Types AndListener Interfaces - How Event Handling Works - Jbutton - Jcheckbox - Jradiobutton - Jlist -Multiple Selection Lists - Mouse Event Handling - Jpanel Subclass For Drawing With TheMouse - Key - Event Handling - Layout Managers. JDBC And Database Programming:Introduction To JDBC - JDBC Drivers - Using Data Source Object To Make A Connection-JDBC Process With Java.Sql - The Result Set - JDBC Processes With Javax.Sql. Self-study:Mouse Event Handling.

UNIT-III:-Understanding Servlet Programming: Overview - Features of Java Servlets – Package Javax.Servlet Description - Servlet Configuration - Servlet Life Cycle -Understanding Response and Request - Reading Form Data from Servlet. Self-study: ServletConfiguration.

UNIT-IV:-Understanding of JSP and JSTL: Section A: Understanding Java server Pages - Introducing JSP Technology - Understanding Page Life – Cycle - JSP Documents – JSP Elements -JSP Tag Extensions – Tag Libraries. Self-study: Understanding Page Life – Cycle.

UNIT-V:-Understanding EJB: EJB Fundamentals – EJB Architecture - The EJB Interfaces -EJB Roles - Session Bean - State full Versus Stateless Session Bean - Developing SessionBean. Entity Bean. Bean Managed Persistence in Entity Beans. Container ManagedPersistence - Deployment Descriptor.

TEXT BOOK:

1. Black Book, “Java Server Programming (J2EE 1.4)”, Platinum Edition, 2007

REFERENCE BOOKS:

1. Justin Cough & Daniel H Steinberg, “J2EE Bible”.
2. Koegh, “The Complete Reference J2EE”, Tata McGraw Hill
3. Pallavi Jain & Shadabsidigui, “J2EE Professional Projects”
4. Dr. C.Muthu, “Programming with java”, 2nd edition, 2008.

Semester I	J2EE TECHNOLOGIES LAB	Hours/Week: 3
Core Course (P22CS3P)		Credit: 3

PREAMBLE - To enable the students practice the concepts of J2EE and develop solutions for real
world problems.

PREREQUISITE - Internet and Java Programming.

COURSE OUTCOMES

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

CO1: Understand the enabling technologies for building internet applications.
CO2: Write Java programs for techniques and features of the networking and remote method development to Construct a internet application.
CO3: Implement packages, access specifies and interfaces in a program.
CO4: Implement Program for Events and interactivity using Layout Manager.
CO5: Generate program for network chatting Analyze.
CO6: Write technical report on the observations from the experiments.

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	9	9	9	-
CO2	9	3	9	3	9	-
CO3	9	9	9	3	9	-
CO4	9	9	9	9	3	-
CO5	9	3	9	9	3	-
CO6	9	3	9	9	3	-

Level of Correlation between CO's and PO's } 1 – Low 3 – Medium 9 – High 0 – No Correlation
(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

LIST OF PROGRAMS

1. Data Manipulation Application Using Swing/JFC and JDBC.
2. Simple Notepad Application Using Swing/JFC.
3. Calculator Using Swing/JFC.
4. User Authentication And Personalization Using Servlet andJDBC.
5. On-Line Shopping &Banking Using JSP and JDBC.
6. Data Manipulation Application Using JSTL and JDBC.
7. On-Line Examination Application Using JSTL and JDBC.
8. Java Beans: GUI Component, Conversion.
9. Java Program to add an Event Set to a Bean.

Semester I	DISTRIBUTED OPERATING SYSTEMS	Hours/Week: 6
Core Course (P22CS4E)		Credit: 5

PREAMBLE:

This course is designed to examine the fundamental principles of distributed systems, and provide students hands-on experience in developing distributed protocols. This course will address distributed systems in a broader sense. Emphasis will be placed on communication, process, naming, synchronization, consistency and replication, and fault tolerance.

COURSE OUTCOMES:

CO 1: Understanding about LAN, WAN and different communication protocols
CO 2: Apply encoding and decoding methods and handling of failures
CO 3: Understanding shared memory and approaches in handling of deadlock and mutual exclusions
CO 4: Analyze the various file models, transactions and design principles
CO 5: Understanding of potential attacks, digital signatures and cryptography
CO 6: Develop Networking technique in real time applications.

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	3	1	9	3
CO2	9	3	1		3	9
CO3	9	3	1	1	9	9
CO4	9	3	-	3	3	-
CO5	9	3	3	3	9	3
CO6	3	1	3	3	9	1

Level of Correlation between CO's and PO's } 1 – Low 3 – Medium 9 – High 0 – No Correlation (Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

UNIT I: FUNDAMENTALS: What is Distributed Operating System – Evolution of Distributed Computing System – Distributed Computing System Models – Why are Distributed Computing Systems gaining popularity – What is a Distributed Computing System – Issues in Designing Distributed Computing System – Introduction to Distributed Computing Environment. Introduction to Computer Networks – Network types – LAN –WAN – Communication protocols – Internetworking – ATM Technology.

UNIT II: MESSAGE PASSING: Introduction – Desirable features – Issues in PC Message Passing – Synchronization – Buffering – Multi-datagram Messages – Encoding and Decoding – Process Addressing – Failure Handling – Group Communication.

UNIT III: DISTRIBUTED SHARD MEMORY: Introduction – General Architecture of DSM system – Design and Implementation Issues of DSM – Granularity – Structure of Shared Memory – Consistency Models – Replacement Strategy – Thrashing – Other Approaches to DSM – Heterogeneous DSM – Advantages Synchronization: Introduction – Clock Synchronization – Event Ordering – Mutual Exclusion – Deadlock – Election Algorithm.

UNIT IV: DISTRIBUTED FILE SYSTEM: Introduction – Desirable features – File Models – File Accessing Models – File Sharing Semantics – File Caching Schemes – File Replication – Fault Tolerance – Atomic Transactions – Design Principles.

UNIT V:SECURITY: Introduction – Potential Attacks to Computer System – Cryptography – Authentication – Access Control – Digital Signatures – Design Principles

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TEXT BOOK:

1. Distributed Operating Systems – Concepts and Design, Pradeep K Sinha, PHI, 2003

REFERENCES:

1. Distributed Operating Systems 1e, Andrew S Tanenbaum, PHI
2. Introduction to Database Systems; Bipin C Desai; Galgotia

Semester I	DIGITAL ASSET MANAGEMENT	Hours/Week: 6
Core Course (P22CS4)		Credit: 5

Objectives:

To provide the fundamental concept of digital document and its applications.

COURSE OUTCOMES:

CO 1: Understanding about Creating Digital Content and Digital Interactive Television
CO 2: Applying compression and indexing in Database and mixed text image
CO 3: Understanding the concepts of content management
CO 4: Analyze the design of CMS
CO 5: Understanding the content and Processing XML

Unit I :

Creating Digital Content - Digital Primer, Any Content – Anywhere, Anytime, Digital Content Consumer, Tools And The Trade, Digital Recording, CGI And Digital Content Creation, Digital Audio, Rich Media, Streaming Media, Digital Interactive Television, Digital Cinema.

Unit II :

Compressing And Indexing - Document Databases, Compression, Indexes, Text Compression, Indexing Techniques, Image Compression, Mixed Text And Images.

Unit III :

Content Management - Systems For Managing Content, The Enterprise Content Management System (CMS), Major Parts Of A CMS, Need For A CMS, Roots Of Content Management, Branches Of Content Management.

Unit IV :

Design Of CMS - The Wheel Of CMS, Working With Metadata, Cataloging Audiences, Designing Publications, Designing Content Components, Accounting For Authors, Accounting For Acquisition Sources.

Unit V :

Building CMS - Content Markup Languages, XML and Content Management, Processing Content.

Text Books:

1.John Rice And Brian Mckerman (Editors), Peter Bergman, "Creating Digital Content", Mcgraw-Hill, USA, 2001[Unit 1]
2. Ian H Witten, Alistair Moffat, Timothy C Bell, "Managing Gigabytes", Academic Press, USA, 1999 [Unit 2]
3. Bob Boiko, "Content Management Bible", John Wiley & Sons, USA, 2001 [Units 3,4,5]

Reference Books:

1 .Abdreas Ulrich Mauthe And Peter Thomas, "Professional Content Management Systems – Handling Digital Media Assets", John Wiley & Sons, USA, 2004
2. Dave Addey, James Ellis, Phil Suh, David Thiemecke, "Content Management Systems (Tool Of The Trade)", Apress, USA, 2003.

Semester I	DATA MINING AND WAREHOUSING	Hours/Week: 6
Core Course (P22CS5)		Credit: 4

PREAMBLE:
This course aims at facilitating the student to understand the concepts of datawarehousing and data mining. Students to understand the various techniques involved in mining the data from the databases.

COURSE OUTCOMES
On the successful completion of the course, students will be able to
CO1: Identify data mining tools and techniques in building intelligent machines
CO2: Analyze various data mining algorithms in applying in real time applications.
CO3: Analyze unsupervised and supervised naive algorithms in real world applications
CO4: Demonstrate the data mining algorithms to combinatorial optimization problems
CO5: Illustrate the mining techniques like association, classification and clustering on transactional databases.
CO6: Compare various supervised and unsupervised learning techniques in data mining.

CO- PO Mapping (Course Articulation Matrix)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	-	-	-	-	3
CO2	9	9	9	9	3	3
CO3	9	9	9	9	9	3
CO4	9	-	3	3	-	3
CO5	9	9	9	9	9	-
CO6	3	-	9	9	9	-

UNIT I:Introduction to Data Mining SYSTEMS - Knowledge Discovery Process – Data MiningTechniques – Issues – Applications – Data Objects and attribute types - Statistical description of data.
UNIT II:DATA PREPROCESSING – Cleaning – Integration – Reduction - Transformation and discretization - Data Visualization - Data Similarity and dissimilarity measures.Mining Frequent Patterns - Market Basket Analysis - Frequent Item set Mining Methods.

UNIT III:CLASSIFICATION - Decision Tree Induction – Bayesian Classification –Rule Based Classification – Model Evaluation and Selection - Techniques to Improve Classification Accuracy -Classification by Back Propagation – Support Vector Machines- Lazy Learners – Model- Evaluation and Selection – Techniques to improve classification Accuracy.

UNIT IV:DATA WAREHOUSING& OLAP Basic Concepts-Data Warehouse Modeling: Data Cube and OLAP - Data Warehouse Design and Usage - Data Warehouse Implementation - Data Generalization by Attribute-Oriented Induction - Data Cube - Data Cube Computation Methods.

UNIT V:CLUSTERING Techniques Clusteranalysis – Partitioning Methods – Hierarchical Methods – Density Based Methods - GridBasedMethods –Evaluation of clustering- Clustering high dimensionaldata-Clusteringwithconstraints,Outlieranalysis-Outlierdetectionmethods.

TEXTBOOKS

1. JiaweiHanandMicheline Kamber, DataMiningConceptsandTechniques,ThirdEdition,Elsevier,201

REFERENCEBOOKS

1. AJex Bersonand Stephen J.Smith,-DataWarehousing, DataMining &OLAPI,Tata McGraw – Hill Edition,35thReprint2016.
2. 2K.P.Soman,ShyamDiwakarandVAjay,-insightintoDataMiningTheoryandPractice,Eastern EconomyEdition,PrenticeHalloflndia,2006.

Semester I	DATA MINING LAB	Hours/Week: 3
Core Course (P22CS6P)		Credit: 3

PREAMBLE:

In this laboratory, students will implement the various Data Warehousing and Data Mining concepts using Oracle and WEKA tool.

COURSEOUTCOMES

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

CO1: Develop various real time applications using data mining techniques.
CO2: Test the developed code using VB.net and Weka/R tool.
CO3: Apply text mining on the data warehouse.
CO4: Perform multi-dimensional data model using Oracle.
CO5: Develop a program using a R Tool to solve a association rule.
CO6: Develop a program to perform Clustering and Classification using various algorithm.

CO- PO Mapping (Course Articulation Matrix)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	-	-	-	-
CO2	9	9	9	9	9	3
CO3	9	9	9	9	9	-
CO4	9	-	3	3	-	3
CO5	9	9	9	9	9	-
CO6	9	9	9	3	3	-

LIST OF EXERCISES:

1. Table creation
2. Preprocessing Techniques
3. Applying Apriori Algorithm
4. Decision Tree
5. Classification Techniques
6. Clustering Analysis: Partition methods and Density method
7. Data cube computation methods
8. Apply Naïve-Bayes algorithm on Tables

Semester II	COMPILER DESIGN	Hours/Week: 6
Core Course (P22CS7)		Credit: 5

PREAMBLE:

To understand the various phases of a compiler and to develop skills in designing a compiler.

PRE REQUISITES:

Familiarity with programming languages, Basic knowledge in Theory of Computation and Data Structures and Algorithm Analysis.

COURSE OUTCOMES

At the end of this course, the students will be able to

CO1: To analyze and be able to know the various phases of compiler
CO2: To design and implement a Lexical analyzer.
CO3: To design and implement a parser
CO4: To know about storage allocation
CO5: To optimize and design code generator
CO6: To apply all these in development.

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	9	3	3	1
CO2	9	1	9	3	3	1
CO3	9	3	9	3	3	1
CO4	9	3	1	1	1	1
CO5	9	3	9	3	3	1
CO6	9	3	3	1	3	1

UNIT-I:**COMPILER**- Phases of Compiler – Compiler writing tools – Lexical Analysis – Role of Lexical analyzer – Finite Automata – Regular Expression – From a Regular expression to an NFA , NFA to DFA – Design of Lexical Analyzer.

UNIT-II:SYNTAX ANALYZER– CFG – Role of the Parser – CFG – Top Down Parsing – Recursive descent parsing, predictive Parsers – Bottom up Parsing – Shift reduce, operator precedence parsers, LR Parsers.

UNIT-III:SYNTAX DIRECTEDDEFINITION - Construction of Syntax trees – Intermediate code generation – Intermediate Languages – Syntax trees, post fix form, Three address code – Boolean expressions – Back Patching.

UNIT-IV:SYMBOL TABLE– contents of Symbol table – Data Structures for Symbol table – Runtime storage Administration – Implementation of Stack allocation scheme block structured Languages – Storage allocation in Fortran.

UNIT-V:CODE OPTIMIZATION AND CODE GENERATION– principles sources of optimization – loop optimization – Dag Representation of Basic blocks. Code generation – problems in code generation – a simple code generator –Register allocation and Assignment – Peephole optimization.

TEXT BOOK:

1. Alfred V. Aho, Ravi Sethi Jeffrey D. Ullman, "Compilers- Principles, Techniques, andTools",PearsonEducationAsia,2007.

REFERENCE BOOKS:

1. David Galles, "Modern Compiler Design", Pearson Education Asia, 2007

2. C. N. Fisher and R. J. LeBlanc "Crafting a Compiler with C", Pearson Education, 2000.

Semester II	PYTHON PROGRAMMING WITH DATA SCIENCE	Hours/Week: 6
Core Course (P22CS8)		Credit: 5

PREAMBLE:

This course aims at facilitating the student to understand the basic concepts of algorithmic problem solving, developing python programs using conditional, loops, functions and data structures, tuples and dictionaries.

PREREQUISITE:

Basic programming using C and C++.

COURSE OUTCOMES

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

CO1: Use the basic concepts of python and develop simple programs.
CO2: Use python interpreter and interactive mode.
CO3: Apply conditional statements to develop simple programs.
CO4: Use the concepts of list, tuples and dictionaries.
CO5: use and apply the concepts of files, modules and packages.

CO6: Development of projects for real time.

CO- PO Mapping (Course Articulation Matrix)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3				
CO2	9	3	9	3		3
CO3	9	3	3	1	3	
CO4	9	9	3	1	3	3
CO5	9	3	9	3	3	3
CO6	9	3	9	1		1

Level of Correlation } 1 – Low 3 – Medium 9 – High 0– No Correlation
between COs and Pos *(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)*

UNIT I:INTRODUCTION- Python – History of Python – Features of Python – Installing Python Running Python - Comments - Operators - Variables and Assignment - Python Objects – Standard Types - Other Built-in Types - Internal Types - Standard Type Operators - Standard Type Built-in Functions - Categorizing the Standard Types - Unsupported Types.

UNIT II:INTRODUCTION TO NUMBERS– Integers - Floating Point Real Numbers - Complex Numbers – Operators -Built-in Functions -Sequences – Strings - Strings and Operators - String-only Operators - Built-in Functions - String Built-in Methods - Special Features of Strings– Dictionary.

UNIT III: Lists –Tuples - Conditionals and Loops –Regular Expression – **Class** - Object and Classes - Principles of Object Orientation - Creating Classes.

UNIT IV:GUI PROGRAMMING WITH TKINTER– Introduction TKinter and Python Programming – Tkinter examples – Web page design.

UNIT V:INTRODUCTION TO DATA SCIENCE– Evolution of Data Science – Data Science Roles – Stages in aData Science Project – Applications of Data Science in various fields.

TEXT BOOKS

1. Chun, J Wesley, CORE Python Programming, 2nd Edition, Pearson, 2007 Reprint 2010.
2.

REFERENCE BOOK

1. Jeffrey Elkner, Chris Meyers Allen Downey, Learning with Python, Dreamtech Press, 2015

Semester II	PYTHON PROGRAMMINGLAB	Hours/Week: 3
Core Course (P22CS9P)		Credit: 3

PREAMBLE

To enable the students to understand and create programs on string functions, class, method and object and to train them to write a program thereby to develop various applications using python programming techniques.

PREREQUISITE

- Basic programming concepts of C
- Object Oriented Programming using C++

COURSE OUTCOMES:

CO1: Developing basic programs to make familiar with python structure
CO2: Applying simple concepts in the python programming
CO3: Creating programs using control statements and branching statements
CO4: Use the concepts of list, tuples and dictionaries.
CO5: Use and apply the concepts of files, modules and packages.

CO6: Development of a Webpage.

CO- PO Mapping (Course Articulation Matrix)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	3	3	0	1
CO2	9	3	3	3	0	3
CO3	9	3	3	1	3	0
CO4	9	9	3	3	3	3
CO5	9	3	9	3	3	3
CO6	9	3	9	3	3	3

Level of Correlation } 1 – Low 3 – Medium 9 – High 0– No Correlation between COs and Pos*(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)*

LIST OF PROGRAMS

1. Class and Object
2. Control Structure
3. List
4. Tuple
5. Dictionary
6. Regular Expressions
7. String Function
8. Tkinter
9. Web page application

Semester II	OOAD & UML	Hours/Week: 6
Core Course (P22CS10E)		Credit: 5

PREAMBLE:
This course is to understand the fundamentals of object modelling and differentiate Unified Process from other approaches. To design with static UML diagrams. To improve the software design with design patterns.

COURSE OUTCOMES:
At the end of the course, the students will be able to:
CO1: Express software design with UML diagrams
CO2: Design software applications using OO concepts.
CO3: Identify various scenarios based on software requirements
CO4: Transform UML based software design into pattern based design using design patterns
CO5: Understand the various testing methodologies for OO software
CO6: Development of Test Plans.

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	9	9	1	9	-
CO2	3	9	9	9	9	-
CO3	3	9	9	9	9	-
CO4	3	9	9	9	9	-
CO5	3	9	9	9	9	-
CO6	3	9	9	9	9	-

Level of Correlation between CO's and PO's } 1 – Low 3 – Medium 9 – High 0 – No Correlation (Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

UNIT I:INTRODUCTION TO OOAD- Unified Process – UML diagrams – Use Case –Case study – the Next Gen POS system, Inception -Use case Modelling – Relating Use cases – include, extend and generalization – When to use Use-cases.

UNIT II:UMLCLASS DIAGRAM– Elaboration – Domain Model – Finding conceptual classes and descriptionclasses – Associations – Attributes – Domain model refinement – Finding conceptual class - Hierarchies – Aggregation and Composition - Relationship between sequence diagrams and use cases – When to use Class Diagrams.

UNIT III:DYNAMIC DIAGRAMS– UML interaction diagrams - System sequence diagram – Collaborationdiagram – When to use Communication Diagrams - State machine diagram and Modelling –When to use State Diagrams - Activity diagram – When to use activity diagrams- Implementation Diagrams - UML package diagram - When to use package diagrams -Component and Deployment Diagrams – When to use Component and Deployment diagrams.

UNIT IV: DESIGN PATTERNS– GRASP Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioural – Strategy – observer –Applying GoF design patterns – Mapping design to code.

UNIT V: TESTING- Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans.

TEXT BOOKS:

1. Craig Larman, ―Applying UML and Patterns: An Introduction to Object-Oriented Analysis andDesign and Iterative Development‖, Third Edition, Pearson Education, 2005.
2. Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition - 1999

REFERENCES:

1. Erich Gamma, a n d Richard Helm, Ralph Johnson, John Vlissides, ―Design patterns: Elementsof Reusable Object-Oriented Software‖, Addison-Wesley, 1995.
2. Martin Fowler, ―UML Distilled: A Brief Guide to the Standard Object Modeling LanguageThird edition, Addison Wesley, 2003.www.padeepz.net

Semester II	SYSTEM ANALYSIS AND DESIGN	Hours/Week: 6
Core Course (P22CS10E)		Credit: 5

PREAMBLE:

This course is to understand the fundamentals of Business Organization, File Database System and Analysing system application.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

CO1: Express overview of Business Organization
CO2: Design File Database Systems.
CO3: Identify various scenarios based on Analysing and Designing Tools.
CO4: Applying the System Applications in various fields
CO5: Understand the various Security and Risk Management.

Unit I

Business Problem & Computers: Overview of Business Organization – Information needs & systems – Some typical problems – System life cycle – System study – Feasibility Study

Unit II

System Analysis – Initiation of Analysis – The Process of Analysis – System Design – Design factors – Design Constraints – Processing Techniques – The Process of design – Output Design – input Design – Process Design – File Data Base Design

Unit III

Analysis & Design Tools – Data Flow Diagram – Data Dictionary – Entity Relationship Diagram – Decision Tree – Decision Table – Structured English – Structure Charts – Grid Charts – Layout Charts – Configuration Selection & Acquisition – Detailing the configuration – Storage requirements – Internal Memory – Processors – Terminals – Printers

Unit IV

File Organization & Design : Functional Classification of Files – File Structure – File Organization – Inverted File – Security & Controls – Risk management – Physical Security – Access Control – Data Control – Other Security & control measures

Unit V

Post – Design phases – Develop Software – Installation & Changes-over-System Operation & maintenance – Systems Applications – Financial Accounting – Inventory Accounting System – Equipment Maintenance – Bank Operations – Production Planning & control – Process Control – Robotics

Text Book:

1.System Analysis & Business Applications – Rajesh Nalk & Swapna Kishore, Wheeler Publishing – 1st edition 1994

Reference Book:

1.Introducing Systems Analysis & Design – Ellas M. Awad – Galgotia Publications (P) Ltd., (SecondEdition)

Semester II	DIGITAL MARKETING	Hours/Week: 6
Core Course (P22CS11)		Credit: 5

PREAMBLE: To introduce basic concepts of Digital marketing.

COURSE OUTCOMES:
On the successful completion of this course students can
CO1: Able to understand the key concepts of Digital Marketing.
CO2: Able to understand advantages and limitations in Digital marketing.
CO3: Able to identify the different types of digital marketing.
CO4: Get the knowledge about applications and trends in digital marketing.
CO5: To understand the types of Tracking Codes.
CO6: To design a Marketing Advertisement

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1			3	3	9	9
CO2	1	3	1		3	9
CO3	1	3		9	9	9
CO4		3			3	
CO5	1		1		3	
CO6	1	3		9		9

Level of Correlation between CO's and PO's } 1 – Low 3 – Medium 9 – High 0 – No Correlation (Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

UNIT-I: DIGITAL MARKETING Introduction to Digital Marketing: Internet Users – Digital Marketing Strategies –Skills Required in Digital Marketing – Digital Marketing Plan. Display-Advertising: Introduction – Concept of Display Advertising – Types of Display- Ads – Buying Models – Display Plan – Targeting – Make a Good Ad.

UNIT-II: ADVANCED DISPLAY ADVERTISING Programmatic Digital Advertising – Analytics Tools – YouTube Advertising. Search EngineAdvertising: Introduction – Pay for Search Advertising – Understanding Ad - Placement – Understanding AdRanks. Social Media Marketing: Introduction – To build a Successful Strategy.

UNIT-III: FACEBOOK MARKETING Introduction – Facebook for Business- Anatomy of an Ad Campaign – Adverts - Other Marketing Tools - Other Essentials. Twitter Marketing: Introduction – Getting Started with Twitter – Building a Context Strategy – Twitter Usage - Twitter Ads – Twitter Analytics – Twitter Tools and Tips for Marketers. Instagram and Snapchat: Introduction – Instagram- snapchat.

UNIT-IV: SEARCH ENGINE OPTIMISATION Introduction – Search Engine - Concept of Search Engine Optimisation- SEO Phases – On page Optimisation- Off page Optimisation- Social Media Reach – Maintenance.

UNIT-V: WEB ANALYTICS Introduction – Data Collection - Key Metrics - Marketing Web AnalyticsActionable – Types of Tracking codes – Mobile Analytics.

TEXT BOOK

1. Seema Gupta, Digital Marketing, First Edition, Mc-Graw Hill, New Delhi, 2017.

REFERENCE BOOKS

1. Ian Dodson, The Art of Digital Marketing, Wiley, New Jersey, USA, 2018.
2. Prof. Nitin C. Kamat, Mr.Chinmay NitinKamat, Digital Social MediaMarketing, Himalaya Publishing House Pvt. Ltd., India, 2018
3. Ryan Deiss & Russ Henneberry, Digital Marketing for Dummies, 2 ndEdition, John Wiley & Sons, Inc., New Jersey, 2020.

Semester II	DIGITAL MARKETING LAB	Hours/Week: 3
Core Course (P22CS12P)		Credit: 3

PREAMBLE: This lab is aimed to understand the applications of digital marketing to undertake Marketing Campaign in digital format and how to apply the tools of Digital Marketing to gain competitive advantage in the Market.

COURSE OUTCOME:

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

CO1: Learn digital marketing tools like search engine optimization and associated analytics.

CO2: Apply digital marketing tools.

CO3: Analyze relative importance of digital marketing strategies to optimize digital marketing campaign.

CO4: Improve brands reach which physically is relatively difficult and less effective.

CO5: Evaluate the performance of different social media in conjunction with overall digital marketing plan.

CO6: Development of Advertisements in social media.

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	3	3	9	
CO2	9	9	3		3	
CO3	3	9	3	9	9	
CO4	3	9	3		9	
CO5	3	9	9	9	9	
CO6	1	9	3	9	9	1

Level of Correlation between CO's and PO's } 1 – Low 3 – Medium 9 – High 0 – No Correlation (Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

LIST OF PROGRAMS

1. Digital Marketing Implementation in Business Scenario.
2. Digital Marketing Webpage.
3. Search Engine Optimization and Search Engine Marketing
4. Google Analytics to analyze website performance.
5. Promotional banner through canvas.
6. Facebook Promotion using banners.
7. YouTube channel for Marketing.
8. Twitter Marketing
9. Instagram Marketing.
10. Email Marketing.

Semester III	RELATIONAL DATABASE MANAGEMENT SYSTEM	Hours/Week: 6
Core Course (P22CS13)		Credit: 4

PREAMBLE

This course aims at facilitating the student to understand the various functionalities of DBMS software and perform many operations related to creating, manipulating and maintaining databases for Real-world applications and student to understand the various designing concepts, storage methods, querying and managing databases.

COURSE OUTCOMES

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

CO1: Explain the structure and model of the relational database system

CO2: Design multiple tables, and using group functions, sub queries

CO3: Design a database based on a data model considering the normalization to a specified level

CO4: Estimate the storage size of the database and design appropriate real world storage techniques

CO5: Analyze the requirements of transaction processing, concurrency control and creating different views and also data modification through views.

CO6: Explain the basic requirements for Backup and recovery.

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	-	-	3	-
CO2	9	3	3	-	9	-
CO3	9	3	9	3	9	-
CO4	3	1	3	-	9	3
CO5	3	1	9	1	9	-
CO6	3	1	9	1	3	1

Level of Correlation between CO's and PO's } 1 – Low 3 – Medium 9 – High 0 – No Correlation (Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

UNIT –I: INTRODUCTION History of Database Systems - Purpose of Database Systems- Database System Applications -View of Data -Database Languages -Relational Databases - Database Design – Data Storage and Querying -Transaction Management -Database Architecture -Data Mining and Information Retrieval -Specialty Databases -Database Users and Administrators**.**

UNIT-II: RELATIONAL DATABASES Structure of Relational Databases - Database Schema - Keys - Relational Query Languages - SQL Query Language –DDL –DML - Set Operations - Null Values – Aggregate Functions - Nested Subqueries - Modification of the Database - Join Expressions - Views - Transactions -Integrity Constraints -SQL Data Types and Schemas - Authorization – Advanced SQL - Functions and Procedures -Triggers - Recursive Queries - Aggregation Features – OLAP.

UNIT-III: DATABASE-SYSTEM ARCHITECTURES Database-System Architectures - Centralized and Client –Server Architectures – Server System Architectures - Parallel Systems - Distributed Systems - Network Types. Database Design and the E-R Model Design Process -The Entity-Relationship Model - Constraints - Entity Sets – ER Diagrams- Relational Schemas - Entity-Relationship Design Issues –Normalization – Functional Dependency - Database-Design Process.

UNIT-IV: DATA STORAGE AND QUERYING Physical Storage Media - RAID - File Organization – Data Dictionary Storage – Ordered Indices - B+-Tree Index Files –Hashing – Query processing –Transaction management.

UNIT-V: CONCURRENCY CONTROL Concurrency Control - Lock-Based Protocols - Deadlock Handling - Multiple Granularity - Timestamp-Based Protocols - Validation-Based Protocols - Multiversion Schemes – Snapshot Isolation - Insert Operations, Delete Operations, and Predicate Reads – Weak Levels of Consistency.

Text books:

1. ”Database System Concepts “Fifth Edition, Abraham Silberschtz Henry F.Korth, S.Sudarshan MC GRAW – HILL INTERNATIONAL EDITION. “The Practical SQL Handbook Using Structured Query Language” Third Edition, Judith
2. S.Bowman Sandra L.Emerson Marcy Darnovsky.

Reference Books:

1. “The Complete Reference My SQL” Tata McGraw Hill Edition, Vikaram Vaswani
2. Sharon Allen, Second edition, Published 2005”Beginning Relational Data Modeling”.

Semester III	RDBMS LAB	Hours/Week: 3
Core Course (P22CS14P)		Credit: 3

PREAMBLE

This course aims at giving adequate exposure to students on the Database design and E-R modelling. The course also facilitates students with hands on training on SQL and programming language extension to SQL within the RDBMS environment.

COURSE OUTCOMES

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

CO1: Model Entity Relationship with E-R diagrams.
CO2: Design database schema considering normalization and relationships within database.
CO3: Write SQL queries to user specifications.
CO4: Develop triggers, procedures, user defined functions and design accurate and PLSQL programs in Oracle and DB2.
CO5: Use the database from a front end application.
CO6: Prepare technical report on the observations of the experiments.

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	1	-
CO2	9	9	9	-	3	-
CO3	9	-	3	9	3	-
CO4	9	-	9	-	9	-
CO5	9	-	9	9	9	-
CO6	3	-	9	9	3	3

LIST OF PROGRAM:

1. DDL ,DML, DCL Commands:
2. Characters functions:
   - CONCAT(Concatenation)
   - REPLACE
   - SUBSTR(Substring)
   - LENGTH
3. Aggregate functions:
   - GROUPBY
   - HAVING
4. Date &Number functions:
   - SYSDATE
   - ABS,FLOOR,CEIL,ROUND,POWER
5. JOINS:
   - Union ,Intersection & Unionall
   - Simple Join
   - Self-Join
   - Outer Join
6. CONSTRAINTS:
   - Domain Integrity(Not Null, Check)
   - Entity Integrity(Unique& Primary Key)
   - Referential Integrity(Foreign Key)
7. VIEW:PL/SQL
   - PL/SQL Programs with Control Structures
   - PL/SQL Programs with Exception Handling
   - PL/SQL Programs with Cursors
   - Creating & Calling Procedure

Semester III	WEB PROGRAMMING	Hours/Week: 6
Core Course (P22CS15)		Credit: 4

PREAMBLE:

The course facilitates the students to understand the .Net framework and able to use features including forms and various controls of C# language for developing .Net based applications.

PREREQUISITE:

Basic programming concepts of C and Object Oriented Programming using C++.

COURSE OUTCOMES:

CO1: Understanding the .NET framework
CO2: Apply the general programming structure of C# in developingsoftware solutions based on user requirements.
CO3: Develop windows application and web applications in .NET.
CO4: Designing of document with GUI applications in .NET programming.
CO5: Exploring the database operations using ADO.Net.
CO6: Creating web application using C#.Net.

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	-	9	-	9	-
CO2	9	1	9	-	9	-
CO3	9	-	9	-	9	-
CO4	9	-	3	-	9	-
CO5	9	-	9	-	9	-
CO6	9	1	9	1	9	

Level of Correlation between CO's and PO's } 1 – Low 3 – Medium 9 – High 0 – No Correlation (Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

UNIT I:INTRODUCING C# AND THE .NET PLATFORM: The philosophy of .Net - Introducing the building blocks of the .Net platform (CLR, CLS and CTS) - .Net assemblies – Common type system - Namespaces/types distinction.

UNIT II:CORE C# PROGRAMMING CONSTRUCTS: System.Environment class – System.Console class - String-Data type Conversion - C# iteration constructs-Decision Constructs - methods - arrays-structure - understanding values types and reference types - C# nullable.

UNIT III:OBJECT ORIENTED PROGRAMMING WITH C#: Introducing the C# class type - understanding constructor - this keyword - static keyword - defining pillars of OOP - C# access modifiers-inheritance and polymorphism-understanding exception handling-understanding object lifetime - working with interfaces – delegates – events - Introducing LINQ.

UNIT IV:WINDOWS FORMS: windows forms fundamentals-windows MDI forms-Handling events-Adding Controls to forms. Windows Controls: Textboxes – labels – Linkablebutton – checkboxes – radiobuttons – ListBoxes – CheckedListBoxes – ComboBoxes – PictureBox – ImageList – DateTimePicker – ListView – Richtextbox – Toolbars – TabControl-MenuStrip. Advanced Window Programming: File Handling.

UNIT V:DATAACCESS WITH ADO.NET:ADO.Net Architecture – Advantages - ADO.Net Objects. Handling Databases in code: Connection class-Command class – DataAdapter – DatasetClass – DataReader class – DataTable Class – DataRow, DataColumn classes – Datarelation Class. Handling Data Manipulation in code: Record navigation-record updation - inserting record - deleting record.

TEXT BOOKS:

1. Andrew Troelson, "C# 2010 and .Net Platform", A press, 6 th Edition, 2010 (Unit I, II,III)
2. J. G. R. Sathiaseelan and N. Sasikaladevi, "Programming with C#.Net", Pearson Education, 1 st Edition, 2009 (Unit-IV& V)

REFERENCE BOOK:

1. Herbert Schildt, "The Complete Reference: C#", Tata McGraw Hill Publications, 2004.

Semester III	WEB PROGRAMMING LAB	Hours/Week: 3
Core Course (P22CS16P)		Credit: 3

PREAMBLE: To enable the students to develop simple applications in ASP.Net using C# and design web based application using ADO.Net with C#.

PREREQUISITE

- Basic programming concepts of C
- Object Oriented Programming using C++
-

COURSE OUTCOMES

CO1: Creating projects using disconnected and connected environments
CO2: Understanding various view controls to display records
CO3: Generating the crystal reports from the database
CO4: Designing webpage using various controls and security features
CO5: Exploring Mobile web application developments
CO6: Developing web service with ASP.Net

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	-	9	-	9	1
CO2	9	-	9	-	9	1
CO3	9	-	9	-	9	-
CO4	9	-	9	-	9	3
CO5	9	-	9	-	9	9
CO6	9	-	9	-	9	9

Level of Correlation between CO's and PO's } 1 – Low 3 – Medium 9 – High 0 – No Correlation
(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

LIST OF PROGRAMS

1. ADO.NET
2. View Controls
3. Crystal report
4. Ad Rotator Control.
5. Wizard Control.
6. Image Control.
7. Master Pages.
8. Establish the security features
9. Mobile web application.
10. Web service - ASP.Net client.
11. Web site creation: (Online Application form, Railway reservation form, Bank Application form, Online hotel booking form).

Semester III	MACHINE LEARNING	Hours/Week: 6
Core Course (P22CS17E)		Credit: 4

PREAMBLE- This course introduce the comprehend, understand and analyze Computer ScienceEngineering problems related to real life which can be better resolved by artificialintelligence and machine learning.

COURSE OUTCOMES

CO1: Develop an appreciation for what is involved in Learning models from data
CO2: Understand a wide variety of learning algorithms
CO3: Understand how to evaluate models generated from data
CO4: Apply the algorithms to a real problem, optimize the models learned andreport on the expected accuracy that can be achieved by applying the models
CO5: Discover which actions yield the highest reward by trying reinforcement learning.

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	3	3	9	-
CO2	3	9	-	9	3	-
CO3	9	3	-	3	9	-
CO4	9	9	3	3	9	-
CO5	9	3	-	3	9	-

Level of Correlation between CO's and PO's } 1 – Low 3 – Medium 9 – High 0 – No Correlation (Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

UNIT – I: INTRODUCTION Machine Learning Foundations – Overview – Design of a Learning System – Types ofMachine Learning – Supervised Learning and Unsupervised Learning – MathematicalFoundations of Machine Learning – Applications of Machine Learning.

UNIT – II: SUPERVISED LEARNING – I Simple Linear Regression – Multiple Linear Regression – Polynomial Regression – RidgeRegression – Lasso Regression – Evaluating Regression Models – Model Selection –Bagging – Ensemble Methods.

UNIT – III: SUPERVISED LEARNING – II Classification – Logistic Regression – Decision Tree Regression and Classification –Random Forest Regression and Classification – Support Vector Machine Regression andClassification - Evaluating Classification Models.

UNIT – IV: UNSUPERVISED LEARNING Clustering – K-Means Clustering – Density-Based Clustering – Dimensionality Reduction –Collaborative Filtering.

UNIT –V: ASSOCIATION RULE LEARNING AND REINFORCEMENT LEARNING Association Rule Learning – Apriori – Eclat – Reinforcement Learning – Upper Confidence Bound – Thompson Sampling – Q-Learning

TEXT BOOK

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.
3. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.

Semester III	Artificial Intelligence	Hours/Week: 6
Core Course (P22CS17E)		Credit: 4

PREAMBLE

This course aims at facilitating the student to understand and describe artificial intelligence techniques, knowledge representation, automated planning and agent systems, machine learning, and probabilistic reasoning.

Prerequisite

Basic programming with knowledge in Algorithm

Course Outcomes

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

CO1: Understand artificial intelligence and AI problem solving techniques.

CO2: Explore logic for solving various AI problems.

CO3: Grasp the techniques of knowledge representation in machine and advanced techniques (Fuzzy logic)

CO4: Understanding the basic knowledge of Expert system

CO5: Ability to apply the knowledge of Expert system development process and Tools

UNIT I :

The AI problems – AI techniques – problems, problems space & search – Defining the problem as a state Search – Production systems – problem characteristics – heuristic search techniques – Generate & test – Hill climbing – Best first search. Problem reduction – constraint satisfaction – means – ends analysis.

UNIT II :

Game playing : Mini – max procedure – Adding Alpha – Beta cutoffs – Additional refinements – Searching AND/OR Graphs – Iterative deepening. Using Predicate Logic – Representing simple facts & logic – Representing instance & IS a Relationships – Computable functions & Predicates – Use of the predicate calculus in AI – Resolution – natural deduction.

UNIT III:

Representing knowledge using Rules – Procedural verses declarative knowledge logic programming – forward versus backward reasoning – Resolving within AND/OR Graphs matching – control knowledge – symbolic Reasoning under uncertainity – non – monotonic reasoning – Implementation Issues – Augmenting a problem solver - Implementation of depth first & breadth first search. Statistical reasoning – Bayee's theorem – Certainity factors & Rule based Systems – Bayesian Networks – Dempstor– Shafer theory – Fuzzy logic.

UNIT IV :

Expert Systems – Architectural Components – Explanation facilities – knowledge acquisition.

UNIT V :

Expert System Development process – Non – formal representation of knowledge – semantic Networks – Frames – Scripts – Production Systems –Expert Systems tools.

Text Books:

1.Elaine Rich & Kevin Kaight, Artificial Intelligence, Tata McGraw Hill, Second Edition, 1991.
UNIT I : Chapter I : Sections 1.1, 1.3, Chapter II : Sections 2.1-2.3 Chapter III : Sections 3.1-3.6
UNIT II : Chapter XII: Sections 12.2-12.5, Chapter V : Sections 5.1-5.5
UNIT III : Chapter VI : Sections 6.1-6.5, Chapter VII : Sections 7.1,7.3-7.6
2.David W. Roltson, Principles of Artificial Intelligence & Expert Systems Development, McGraw Hill, 1988.
UNIT IV : Chapter I : Sections 1.1, 1.6, Chapter VII : Sections 7.1-7.7 ,Chapter IX : Sections 9.1-9.9
UNIT V : Chapter VIII : Sections 8.1-8.8, Chapter IV : Sections 4.1-4.4, Chapter X : Sections 10.1-10.7

Reference Books:

1.Data W. Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI, 2009.
2.Stuart Russell and Peter Norvig, Artificial Intelligence A Modern Approach, Second Edition, Pearson Education Series, 2003.
3.Keith Darlington, The essence of Expert Systems, Pearson First Impression, 2011.

Semester III	CLOUD COMPUTING	Hours/Week: 6
Core Course (P22CS18)		Credit: 5

PREAMBLE:- Cloud computing paradigm covers a range of distributed computing, hosting and access solutions, including service-based computing. The objective of the course is to provide comprehensive and in-depth knowledge of Cloud Computing concepts, technologies,architecture and researching state-of-the-art in Cloud Computing fundamental issues,technologies, applications and implementations.

PREREQUISITE:- Computer Networks.

COURSEOUTCOMES:-

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

CO1: Describe the key technologies, architecture, strengths, limitations and applications of cloud computing

CO2: Explain the types and service models of cloud.

CO3: Describe the core issues such as security, privacy and interoperability in cloud platform.

CO4: Apply suitable technologies, algorithms, and applications in the cloud computing driven systems .

CO5: Provide appropriate cloud computing solutions for the given scenario.

CO6: Analyze how applications are deployed in cloud.

CO- PO Mapping (Course Articulation Matrix):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	-	3	-	-
CO2	9	3	1	3	-	1
CO3	9	-	1	3	-	3
CO4	9	-	-	1	1	9
CO5	9	-	-	3	3	-
CO6	9	-	-	3	3	1

Level of Correlation } 1 – Low 3 – Medium 9 – High 0 – No Correlation (Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)between CO's andPO's

UNIT I: DEFINING CLOUD COMPUTING:-Cloud Types - The NIST model - The Cloud Cube Model - Deployment models - Service models - Examining the Characteristics of Cloud Computing - Paradigm shift - Benefits of cloud computing - Disadvantages of cloud computing - Assessing the Role of Open Standards. ASSESSING THE VALUE PROPOSITION:Early adopters and new applications - The laws of cloudonomics – Cloud computing obstacles - Behavioral factors relating to cloud adoption.

UNIT II: UNDERSTANDING CLOUD ARCHITECTURE:-Exploring the Cloud ComputingStack– ComposabilityInfrastructure – Platforms - Virtual Appliances – CommunicationProtocols – Applications. UNDERSTANDING SERVICES AND APPLICATIONS BYTYPE:Defining Infrastructure as a Service (IaaS) - Defining Platform as a Service (PaaS) -Defining Software as a Service (SaaS) - SaaS characteristics - Open SaaS and SOA.

UNIT III: UNDERSTANDING ABSTRACTION AND VIRTUALIZATION:- Using Virtualization Technologies - Load Balancing and Virtualization - Advanced load balancing - The Google cloud - Understanding Hypervisors - Virtual machine types - VMware vSphere - Understanding Machine Imaging - Porting Applications - The Simple Cloud API - AppZero Virtual Application Appliance. CAPACITY PLANNING - Load testing - Resource ceilings Server and instance types.

UNIT IV: USING MICROSOFT CLOUD SERVICES:-ADMINISTRATING the Clouds - Management responsibilities - Lifecycle management - Emerging Cloud ManagementStandards. UNDERSTANDING CLOUD SECURITY:Securing the Cloud – Securing Data –Establishing Identity and Presence.

UNIT V: USING THE MOBILE CLOUD: -Working with Mobile Devices – Defining the Mobile Market – Using Smartphones with the Cloud. WORKING WITH MOBILE WEB SERVICES: Understanding Service Types – Performing Service Discovery – Using SMS – Defining WAP and other Protocols – Performing Synchronization.

TEXT BOOK:

1. Barrie Sosinsky, "Cloud Computing Bible", Wiley Publishing Inc., 2011.

REFERENCE BOOKS:

1. Michael Miller, "Cloud Computing", Pearson Education Inc., 7th Edition, 2012.
2. Rajkumar Buyya and James Broberg, "Cloud Computing: Principles and Paradigms", John Wiley & Sons Publications, 2011.

Semester IV	BIG DATA ANALYTICS	Hours/Week: 6
Core Course (P22CS19)		Credit: 5

PREAMBLE: This course is designed to introduce the basics of data analytics and apply them in the real time analysis of data.The course is intended to facilitate the students to apply statistical methods of exploring data and introduce machine learning methods for data analytics.

COURSE OUTCOMES:
CO1: To impart knowledge in Fundamentals, Big Data Analytics, Technologies and databases, Hadoop and MapReduce Fundamentals.
CO2: Understand the fundamentals of Big data analytics
CO3: Describe the Hadoop architecture and File system
CO4: Apply the Map Reduce Programming model for real-world problems
CO5: Explore the concepts of NoSQL databases
CO6: Develop a complete business data analytics solution

CO- PO Mapping (Course Articulation Matrix):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	-	1	-	-
CO2	9	3	-	3	-	-
CO3	9	3	-	3	-	-
CO4	9	1	3	1	-	3
CO5	9	1	1	1	-	3
CO6	9	1	1	-	1	3

Level of Correlation } 1 – Low 3 – Medium 9 – High 0 – No Correlation
(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)between CO's andPO's

UNIT I:TYPES OF DIGITAL DATA: Classification of Digital Data - Characteristics of Data-Evolution of Big Data-Definition of BigData-Challenges with Big Data- Characteristics of Big Data-Other characteristics of data - Need for Big Data.

UNIT II:BIG DATA ANALYTICS: Characteristics of Big Data analytics- Need for Big Data analytics Classification of analytics-Greatest challenges that prevent businesses from capitalizing on Big Data –Importance of Big Data analytics – Data science-Data scientist- Terminologies used in Big Data environments-Analytics tools.

UNIT III:BIG DATA TECHNOLOGY: NoSQL - Hadoop. Introduction to Hadoop: Introducing Hadoop- Need for Hadoop-Limitations ofRDBMS -RDBMS versus HADOOP-History of Hadoop –Hadoop overview-Interacting with Hadoop ecosystem –HDFS - Processing Data with Hadoop MapReduce – Managing resources and applications with Hadoop YARN Introduction toMAPREDUCE programming.

UNIT IV:INTRODUCTION TO MONGODB: Need for MongoDB -Terms used in RDBMS and MongoDB - Data types in MongoDBMongoDB - Query Language.

UNIT V:INTRODUCTION TO CASSANDRA: An introduction -Features of Cassandra-CQL data types-CQLSH Key spaces-CRUDCollections-Using a Counter – Time to live – Alter commands – Import and Export

TEXT BOOK:

1. Seema Acharya and Subhashini Chellappan, “Big Data and Analytics”, Wiley India Pvt. Ltd., 2016

REFERENCES:

1. V. Bhuvaneswari T. Devi, Bigdata Analytics A Practitioner’s Approach Wiley Publications,

B harathiyarUniversity, Coimbatore2016.

2. Michael Minelli, Michele Chambers, Big data Big Analytics” Wiley 2013.
3. “Analytics in a Big data World”, Bart Baesens, Wiley 2014.
4. “DT Editorial Services: Big data Black Book”, Dreamtech Press, 2016.

Semester IV	BIG DATA ANALYTICS USING R - LAB	Hours/Week: 6
Core Course (P22CS20P)		Credit: 3

PREAMBLE - This course is designed to introduce the basics of data analytics and apply them in the real time analysis of data.

COURSE OUTCOMES

CO1: To explore the statistical analysis techniques using Rprogramming languages.
CO2: Experiencing the Rlanguage to use it for further research.
CO3: Analysing statistical techniques on variety of data.
CO4: Evaluating the collected data with different types of algorithms.

CO- PO Mapping (Course Articulation Matrix):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	-	1	9	1
CO2	9	9	-	3	9	3
CO3	9	9	-	3	9	1
CO4	9	3	3	1	9	3

Level of Correlation } 1 – Low 3 – Medium 9 – High 0 – No Correlation
(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)between CO's andPO's

List of Program

1. Levelsoffactor- Vector.
2. Fiveofthelevelsof factor Rdistribution.
3. Built-in-datasetairquality.
4. 'SolarR'and'Wind'anddisplaythedataframe (Removing).
5. Matrix Operations.
6. Apriorialgorithm.
7. KNNalgorithm.
8. DecisionTreealgorithm.

Semester IV	SOFTWARE TESTING	Hours/Week: 6
Core Course (P22CS21E)		Credit: 4

PREAMBLE - This course is designed to introduce Plan a software engineering process life cycle, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements.

COURSE OUTCOMES

The students will be able to:

CO1: Able to elicit, analyze and specify software requirements through a productive working relationship with various stakeholders of the project

CO2: Analyze and translate a specification into a design, and then realize that design practically, using an appropriate software engineering methodology.

CO3: Know how to develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice

CO4: Able to use modern engineering tools necessary for software project management, time management and software reuse.

CO5: Develop a complete business data analytics solution

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	9	1	9	-
CO2	9	3	9	1	1	-
CO3	9	3	3	1	9	-
CO4	9	9	9	1	9	-
CO5	9	9	9	1	3	-
CO6	9	3	3	3	9	

Level of Correlation between CO's and PO's } 1 – Low 3 – Medium 9 – High 0 – No Correlation (Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

UNIT –I: THE PRODUCT AND THE PROCESS:

The Evolving 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.

UNIT –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.

UNIT- 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.

UNIT- IV: CONVENTIONAL METHODS FOR SOFTWARE ENGINEERING:

System Engineering: System engineering: System engineering hierarchy – Analysis concepts and principles – Requirements analysis – Communication techniques- Analysis, principles – Software prototyping – Specification modelling and information flow- Behavioural modelling – 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.

UNIT- 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. Re-engineering- Business ProcessRe-engineering- Business Process Re-engineering, software Re-engineering.

TEXT BOOKS:

1. J. Roger S pressman, "Software Engineering**: A Practitioner" S Approach, McGrawhill**
(2000)

Semester IV	AGILE SOFTWARE PROCESS	Hours/Week: 6
Core Course (P22CS21E)		Credit: 4

PREAMBLE:

This course imparts knowledge to students in the basic concepts of agile Software Process, methodology and its development

COURSE OUTCOMES

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

CO1: Understand the basic concepts of Agile Software Process
CO2: Comprehend various Agile Methodologies
CO3: Understand agile software development practices
CO4: Demonstrate Agile development and testing techniques
CO5: Know the benefits and pitfalls of working in an Agile team

UNIT I - AGILE METHODOLOGY

Theories for Agile management – agile software development – traditional model vs. agile model - classification of agile methods – agile manifesto and principles – agile project management – agile team interactions – ethics in agile teams - agility in design, testing – agile documentations – agile drivers, capabilities and values.

UNIT II - AGILE PROCESSES

Lean production - SCRUM, Crystal, Feature Driven Development, Adaptive Software Development, and Extreme Programming: Method overview – lifecycle – work products, roles and practices.

UNIT III - AGILITY AND KNOWLEDGE MANAGEMENT

Agile information systems – agile decision making - Earl_s schools of KM – institutional knowledge evolution cycle – development, acquisition, refinement, distribution, deployment , leveraging – KM in software engineering – managing software knowledge – challenges of migrating to agile methodologies – agile knowledge sharing – role of story-cards – Story-card Maturity Model (SMM).

UNIT IV - AGILITY AND REQUIREMENTS ENGINEERING

Impact of agile processes in RE – current agile practices – variance – overview of RE using agile – managing unstable requirements – requirements elicitation – agile requirements abstraction model – requirements management in agile environment, agile requirements prioritization – agile requirements modeling and generation – concurrency in agile requirements generation.

UNIT V - AGILITY AND QUALITY ASSURANCE

Agile Interaction Design - Agile product development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile approach to Quality Assurance - Test Driven Development – Pair programming: Issues and Challenges - Agile approach to Global Software Development.

REFERENCES:

1.Craig Larman, ―Agile and Iterative Development: A manager_s Guide‖, Addison-Wesley, 2004
2.David J. Anderson; Eli Schragenheim, ―Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results‖, Prentice Hall, 2003
3.Dingsoyr, Torgeir, Dyba, Tore, Moe, Nils Brede (Eds.), ―Agile Software Development, Current Research and Future Directions‖, Springer-Verlag Berlin Heidelberg, 2010
4.Hazza& Dubinsky, ―Agile Software Engineering, Series: Undergraduate Topics in Computer Science‖, Springer, VIII edition, 2009.

Semester IV	PROJECT	Hours/Week: 12
Core Course (P22CS22)		Credit: 5

- Individual Student Project