MSC – DATA SCIENCE

The American College

(An Autonomous Institution Affiliated to Madurai Kamaraj University)

(Re-accredited [2nd Cycle] by NAAC with Grade 'A' & CGPA of 3.46 on a 4 point scale)

Madurai

Proposed PG Grid for June 2020

Sem.	Course Code	Course Title	Hr.	Cr.	Mark
I	PDS 1501	Concepts of Data Science	5	5	75
	PDS 1503	Data Analytics (T + L)	6	5	75
	PDS 1505	Artificial Intelligence	5	5	75
	PDS 1607	Python Programming	5	6	80
	PDS 1409	Python Programming Lab	4	4	60
	PDS 1511	Probability and Statistics	5	5	75
	Total		**30**	**30**	**420**
II	PDS 1502	Data Mining and Warehousing	5	5	60
	PDS 1404	Big Data Analytics	4	4	60
	PDS 1406	Big Data Analytics Lab	4	4	80
	PDS 1408	Machine Learning	4	4	60
	PDS 1410	Computer Vision	4	4	80
	PDS 1512	Linear Algebra	5	5	80
	PDS 1414	Elective I	4	4	60
	Total		**30**	**30**	**420**
III	PDS 2501	Natural Language Processing (T + L)	5	5	60
	PDS 2403	Deep Learning	4	4	80
	PDS 2405	Reinforcement learning	4	4	80
	PDS 2507	Operation Research	5	5	80
	PDS 2409	Effective Communications	4	4	80
	PDS 2411	Elective II	4	4	60
	PDS 2413	Mini Project Lab	4	4	40
	Total		**30**	**30**	**480**
IV	PDS 2302	Industry Project	30	30	480
	Total		**30**	**24**	**480**
	GRAND TOTAL		**120**	**90**	**1800**

Concepts of Data Science

Unit I : Introduction

Benefits and uses of data science - Facets of data - The big data ecosystem and data science - data science process.

Unit II: Machine Learning

What is machine learning and why should you care about it? - The modeling process - Types of machine learning. Handling large data on a single computer: General techniques for handling large volumes of data - General programming tips for dealing with large data sets - Case study 1: Predicting malicious URLs.

Unit III: Big Data

Distributing data storage and processing with frameworks - Case study: Assessing risk when loaning money - Introduction to NoSQL - Case study: What disease is that? - Introducing connected data and graph databases - Connected data example: a recipe recommendation engine.

Unit IV: Text mining and text analytics

Text mining in the real world - Text mining techniques: Bag of words - Stemming and lemmatization - Decision tree classifier - Case study: Classifying Reddit posts

Unit V: Data visualization to the end user

Data visualization options - Crossfilter, the JavaScript MapReduce library - Creating an interactive dashboard with dc.js - Dashboard development tools

Text Book:

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Introducing Data Science, Manning Publications Co, 2016.

Reference Book:

1. John D. Kelleher and Brendan Tierney, “Data Science”, First Edition, The MIT Press, London, 2018.

2. Lillian Pierson, “Data Science for Dummies”, 2nd Edition, John Wiley & Sons publications, 2017.

3. EMC Education Services, Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, John Wiley & Sons, Inc, 2015.

4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning Data Mining, Inference, and Prediction, Second Edition, Springer, 2017.

Data Analytics

Course Objectives:

- To develop problem solving abilities using Mathematics
- To apply algorithmic strategies while solving problems
- To develop time and space efficient algorithms
- To study algorithmic examples in distributed, concurrent and parallel environments

Course Outcomes:

On completion of the course, student will be able to–

- To write case studies in Business Analytic and Intelligence using mathematical models.
- To present a survey on applications for Business Analytic and Intelligence.
- To write problem solutions for multi-core or distributed, concurrent/Parallel environments

Unit I: Data Analytics Overview

Introduction – Importance- Types of Data Analytics – data analytics life style: overview – discovery- data preparation – model planning – model building – communicate result - Operationalize. Case study: Global Innovation Network and Analysis (GINA).

Unit II: Statistics for Analytics

Statistical Methods for Evaluation: Hypothesis Testing - Difference of Means- Wilcoxon Rank-Sum Test - Type I and Type II Errors – Power and Sample Size - ANOVA

Unit III: Time Series & Text Analysis

Overview of Time Series Analysis: - Box-Jenkins Methodology - ARIMA Model - Additional Methods. Text Analysis: Text Analysis Steps – A Text Analysis Example - Collecting Raw Text - Representing Text - Term Frequency-Inverse Document

Frequency (TFIDF - Categorizing Documents by Topics - Determining Sentiments - Gaining Insights.

Unit IV: Supervised Learning

Introduction - Variable Types and Terminology - Least Squares and Nearest Neighbors - Statistical Decision Theory - Structured Regression Models - Classes of Restricted Estimators. Support Vector Machines and Flexible Discriminants: The Support Vector Classifier - Support Vector Machines and Kernels. Prototype Methods and Nearest-Neighbors: Prototype Methods

Unit V: Unsupervised Learning

Introduction - Association Rules - Cluster Analysis - Random Forests: Definition of Random Forests - Details of Random Forests - Analysis of Random Forests - Undirected Graphical Models - Markov Graphs and Their Properties - Undirected Graphical Models for Continuous Variables - Undirected Graphical Models for Discrete Variables.

Text Book

1. EMC Education Services, Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, John Wiley & Sons, Inc, 2015.

2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning Data Mining, Inference, and Prediction, Second Edition, Springer, 2017.

Uint I (Text Book 1): Chapter 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,

Unit II (Text Book 1): Chapter 3.3.

Unit III (Text Book 1): Chapter 8.1, 8.2, 8.3, 9.1 – 9.8.

Unit IV (Text Book 2): Chapter 2.1, 2.2, 2.3, 2.4, 2.7, 2.8, 12.2, 12.3, 13.2.

Unit V (Text Book 2): 14.1, 14.2, 14.3, 15.2, 15.3, 15.4, 17.2, 17.3, 17.4

Reference Book:

1. Anil Maheshwari, Data Analytics**,** McGraw Hill Education; First edition, 2017.

2. Annalyn Ng, Data Science for the Layman, Shroff Publishers; First edition, 2018.

3. Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence, Analytics, and Data Science: A Managerial Perspective, Pearson Education, Fourth edition, 2019.

4. Gulshan Shrivastava, Sheng-Lung Peng, Himani Bansal, Kavita Sharma, Meenakshi Sharma, New Age Analytics: Transforming the Internet through Machine Learning, IoT, and Trust Modeling, Apple Academic Press; First edition, 2020.

Artificial Intelligence

Course outcome

CO1: Explain the key characteristics of intelligent agents -Understand

CO2: Describe the pre-processing methods for Information Retrieval - Understand

CO3: Apply the suitable search strategy to solve the search problems - Apply

CO4: Apply adversarial search to find the optimal move for a given game - Apply

CO5: Construct a plan graph for the given problem like Constraints satisfaction problems and STRIPS problems - Apply

Unit I: INTRODUCTION

The foundations of AI - The History of AI- Intelligent agents- Agent based system. PROBLEM SOLVING: Searching for solution- Uninformed/Blind search - Informed/ Heuristic search - A* search - Hill-climbing search -Constraint satisfaction problem.

Unit II: KNOWLEDGE REPRESENTATION AND PLANNING

Logics – First order logic, Inference in first order logic, Knowledge representation. PLANNING: The planning problem - Planning with state space search - Partial order search - Planning with proportional logic - Planning and acting in the real world. Adversarial planning.

Unit III: UNCERTAIN KNOWLEDGE AND PROBABILISTIC REASONING: Uncertainty-

Probabilistic reasoning - Semantics of Bayesian network -Approximate inference in Bayesian network, exact inference in Bayesian network - Probabilistic reasoning over time.

Unit IV: LEARNING

Learning from observation - Knowledge in learning -Statistical learning methods - Reinforcement learning

Unit V: DECISION-MAKING

Basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications. ROBOTICS: Introduction

Text Books

1. Stuart Russell and Peter Norvig, ―Artificial Intelligence: A Modern Approach‖, Pearson Education, 2018.

2. David Pool, Alan Mackworth, ―Artificial Intelligence: Foundations of Computational agents, Cambridge University, 2015.

3. Nils J. Nilsson, ―The Quest for Artificial Intelligence: A History of Ideas and achievements, Cambridge University Press, 2010.

PYTHON PROGRAMMING

This course enables the students to learn program and programming skills in python. It covers basic syntax, List, Tuples, Dictionaries, File Handling and Regular Expressions, Database Connectivity and Object Oriented Programming. It acquire programming skills in core Python, skills of designing Graphical user Interfaces, ability to write database applications in Python.

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

- To describe the Fundamentals of Python and Functions
- Demonstrate the basic concepts of Python Strings and List
- Gain knowledge about Tuples, Sets and Dictionaries
- To implement Files and data base connectivity
- To develop Web applications using python and learn basic of Python Classes and Objects

UNIT I – INTRODUCTION TO PYTHON, FUNCTIONS

Introduction – Python History – Python Installation and Execution – Variables, Expressions and Statements: Values and types, Variables, Variable names and keywords, Statements, Operators and operands, Expressions, Order of operations, String operations, User input, Comments - Decision Statements – Loop Control Statements.

Conditional Execution: Modulus Operator, Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Functions – Syntax – Use of a Function – Parameters and Arguments - Recursion, Return Values.

UNIT II – STRING, LIST, LIST PROCESSING

Strings: A string is a sequence, Getting the length of a string using len, Traversal through a string with a loop, String slices, Strings are immutable, Searching, Looping and counting, The in operator, String comparison, String methods, Format operator.

Lists: A list is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Deleting elements, Lists and functions, Lists and strings, Objects and values, Aliasing, List Comprehension, List arguments, Passing List to a function, List Processing

UNIT-III TUPLES, SETS AND DICTIONARIES

Tuples: Tuples are immutable, Tuple Assignment, Tuple as Return value, Variable length argument tuples, List and Tuples, Comparing tuples, Indexing and Slicing, Sort Tuple, Tuple assignment, Dictionaries and tuples, Multiple assignments with dictionaries.

Sets: Creating sets, Set in and not in operator, Set operations.

Dictionaries: Need, Dictionary as a set of counters, Looping and dictionaries, Reverse Lookup, Dictionaries and lists, Formatting Dictionaries, Deleting Items, Global Variables,

UNIT IV – FILE HANDLING, EXCEPTIONS, DATABASE CONNECTIVITY

Files: Persistence, Opening files, Reading and Writing files, Format Operator, File names and Paths, Searching through a file, Letting the user choose the file name, Exceptions: Errors in a Python Program, Exceptions, Exception Handling, Types of Exceptions, -The Except Block, The assert Statement, User-Defined Exceptions

Python’s Database Connectivity: Types of Databases Used with Python, Working with MySQL Database, Using MySQL from Python, Retrieving All Rows from a Table,

Inserting Rows into a Table, Deleting Rows from a Table, Updating Rows in a Table, Creating Database Tables through Python

UNIT-V CLASSES AND OBJECTS, GUI PROGRAMMING

Classes and Objects: User-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying. Classes and Functions: Time, Pure functions, Modifiers, Prototyping development versus planning. Classes and Methods: Object-oriented features, Printing objects, The init method, Operator overloading, Polymorphism GUI: Buttons and Callbacks, Canvas Widgets, Coordinate Sequence, More Widgets, Packing Widgets, Menus and Callbacks, Binding

Reference Books:

1. Ashok Namdev Kamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python", McGraw Hill Education India, 2018.
2. James Tudor, "Python Programming For Beginners: Learn The Basics Of Python Programming", Amazon Digital Services LLC - KDP Print US, 2019.
3. Think Python: How to Think Like a Computer Scientist, Allen B. Downey, Updated for Python 3, Shroff/O'Reilly Publishers,2nd edition, 2016.
4. Howard Hayes, "Python Programming: The Ultimate Crash Course for Beginners with All the Tools and Tricks to Learn Coding with Python", Amazon Digital Services LLC - KDP Print US, 2019.

Python LAB

PROBABILTIY & STATISTICS

PDS **Data Mining and Warehousing** **5 Hrs**

Outcome:

The aim of the course is to help the students to understand the basic concepts of data mining and its classification along with its applications.

This course introduces data mining and data warehousing and its architectures, Tasks under data mining, Association Rules, Classifications of data mining and Application in data mining.

Learning outcomes:

Upon completion of this course students will be able to:

- Understand the basic functionalities and concepts of data mining and data warehousing.
- Analyse the need for data pre-processing and various steps involved in it.
- Categorize the methodologies and algorithms and be familiar with association rule mining techniques and constraint based association mining.
- Analyse the usages of Decision tree Algorithm, Bayesian Classification and Back Propagation techniques.
- Understand Clustering and Outline the applications and trends in Data mining.

UNIT I: Introduction to Data mining & Data warehousing

Introduction – Data mining – Data mining functionalities – kinds of patterns can be mined – classification – major issues. Data warehouse – A multidimensional data model – Data warehouse architecture – Data warehouse implementation – From data warehouse to data mining

UNIT II: Data pre-processing

Data pre-processing – Data cleaning – Data Integration and Transformation – Data Reduction – Discretization and concept hierarchy generation – Data mining primitives – Data mining Task – A data mining query language - Architecture of Data mining systems – Characterization and comparison

UNIT III: Association Rule Mining

Association Rule Mining – Mining single dimensional Boolean association rules from transactional databases – mining multilevel association rules from transaction databases- mining multidimensional association rules from Relational databases and Data warehouses – From association mining to correlation analysis

UNIT IV: Classification and prediction

Classification and prediction – Issues regarding classification and prediction – classification by decision Tree Induction – Bayesian Classification – Classification by Back propagation –classification based on concepts from association rule mining – prediction – classifier accuracy

UNIT V: Clustering & Trends in Data Mining

Clustering – Introduction to types of Clustering - Applications and Trends in Data Mining – Data mining system products and Research prototypes – Additional themes on Data mining – Social Impacts of Data Mining – Trends in Data mining

TEXT BOOK:

1. Jiawei Han, Michelien Kamber, "Data Mining Concepts and Techniques", 3rd Edition, 2014.

Reference books:

1. Arun K. Pujari, "Data Mining Techniques", Universities Press (India) Limited,2 nd Edition, 2013.
2. Alex Berson, Stephen j Smith , Data Warehousing ,Data mining and OLAP (Data warehousing / Data Management) , McGraw Hill 2012.
3. George M Marakas, Modern Data warehousing, Mining and Visualization: core concepts, Prientice Hall , First Edition, 2002
4. John Wang, Encyclopaedia of Data warehousing and Mining, Idea Group Publishing, 2009.
5. Shawkat Ali A B M, Saleh A. Wasimi, "Data Mining: Methods and Techniques ,Third Indian Reprint, Cengage Learning, 2010.
6. Soman K. P., ShyamDiwakar, Ajay V. "Insight into Data Mining Theory and Practice" , Fifth Printing, PHI Learning, 2011.

	Unit 1	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**
Bloom's Taxonomy	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	✓				
K2: Understanding	✓	✓	✓		
K3: Applying		✓	✓	✓	✓
K4: Analyzing		✓			
K5: Evaluating			✓	✓	✓
K6: Creating					✓

BIG DATA ANALYTICS

This course Big Data Analytics largely involves collecting data from different sources, Optimize and creates advantage with Big Data analytics. It optimizes business decisions and explore the fundamental concepts of big data analytics. This understand the applications using Map Reduce Concepts and introduce programming tools PIG & HIVE in Hadoop echo system.

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

- Identify the knowledge of big data analytics
- Understand the tool R Language and Hadoop for handling Big data
- List the components of Hadoop and Hadoop Eco-System
- Apply technical skills to Integrate R and Hadoop
- Develop various tools like PIG, HIVE, HIVEQL, HBASE

UNIT I – INTRODUCTION TO BIG DATA

Big Data Analytics - What is Big Data – Meaning – Building Blocks of Big Data Analytics – Types of Big Data – Sources of Big Data – 4Vs of Big Data –Selection of Hardware Stack – Selection of Software Stack - Big data analytics – Components of Analytics Toolkit - Big data applications

UNIT II – INTRODUCTION TO R, HADOOP

Installing R, RStudio – Features of R Language – Data Operations – Data Modelling in R – Installing Hadoop – Hadoop Modes – Hadoop Features – Understanding HDFS – Characteristics of HDFS – Understanding MapReduce – HDFS and MapReduce Architecture- HDFS, MapReduce Components – Hadoop MapReduce scenario

UNIT-III HADOOP ECOSYSTEM AND YARN

Hadoop and its Ecosystem – Hadoop Core components – Hadoop Ecosystem Components – Schedulers - Hadoop Pipes – Hadoop Distributed File System – Hadoop MapReduce Framework – MapReduce Programming model – Hadoop Yarn – Running MRv1 in YARN - Hadoop Ecosysems Tools

UNIT IV – INTEGRATING R AND HADOOP

Introducing RHIPE – Installing RHIPE – Architecture of RHIPE – Introduction of RHadoop – Architecture – Hadoop Streaming – Hadoop Streaming with R – Data Analytics Project Cycle - Data Analytics Problems

UNIT-V PIG, HIVE AND HIVEQL, HBASE

PIG – Installing and Running PIG, Comparison with Database, PIG Latin – Hive – Installing HIVE, Running HIVE, Comparison with Traditional Database, HiveQL - Querying Data HBase – Hbasics, Concepts, HBase Versus RDBMS, Zookeeper – Zookeeper Services.

Text book:

1. Nataraj Dasgupta, "Practical Big Data Analytics: Hands-on techniques to implement enterprise analytics and machine learning using Hadoop, Spark, NoSQL and R", 2018 Packt Publishing. [Unit I]

2. Vignesh Prajapati, "Big Data Analytics with R and Haoop", Packet Publishing 2013

[Unit II, IV]

3. Raj Kamal, Preeti Saxena, "BIG DATA ANALYTICS: Introduction to Hadoop, Spark, and Machine-Learning", McGraw-Hill Education, 2019. [Unit III]

4. Tom White, "HADOOP: The definitive Guide", O Reilly 2012. [Pages: 365 – 388, 411 – 426, 441 – 447, 457 – 459, 477 – 479, 497 – 509] Unit V

Big DATA Lab

MACHINE LEARNING

Course Outcome

CO1: Gain knowledge about basic concepts of Machine Learning develop an appreciation for what is involved in learning from data. - Understand

CO2: Develop learning algorithms based on logistic regression, Support Vector Machines to predict discrete-valued output given a training data comprising of features and corresponding class labels. - Apply

CO3: Design and implement machine learning solutions to classification, regression, and clustering problems; and be able to evaluate and interpret the results of the algorithms.- Apply

CO4: Develop Linear Models for Regression using Bias-Variance Decomposition, Bayesian Linear Regression.- Apply

CO5: Design Linear Models for Classification using Probabilistic Discriminative Models, The Laplace Approximation, Bayesian Logistic Regression. - Analyze

Unit I

Introduction: to Machine Learning, Probability Theory, Model Selection, The Curse of Dimensionality, Decision Theory, Information Theory.

Unit II

Probability Distributions: Binary Variables, Multinomial Variables, The Gaussian distribution, The Exponential Family, Nonparametric Methods

Unit III

Linear Models for Regression: Linear Basis Function Models, The Bias-Variance Decomposition, Bayesian Linear Regression, Bayesian Model Comparison, The Evidence Approximation, Limitations of Fixed Basis Functions.

Unit IV

Linear Models for Classification L: Discriminant Functions, Probabilistic Generative Models, Probabilistic Discriminative Models , The Laplace Approximation, Bayesian Logistic Regression.

Unit V

Neural network: Perceptron, multilayer network, backpropagation, introduction to deep neural network.

Books:

1. Christopher M. Bishop, ―Pattern Recognition and Machine Learning‖, Springer, 2013.
2. AlpaydinEthem, ―Introduction to Machine Learning‖, Prentice Hall, 2015.

3. Richard O. Duda, Peter E. Hart and David G. Stork, ―Pattern Classification, Wiley and Sons, 2017.
4. Tom Mitchell, ―Machine Learning, McGraw Hill, 2018.

COMPUTER VISION

Unit I

Computer Vision Introduction: Computer vision-Image Formation: Geometric primitives and transformation-Photometric image formation-The digital camera

Unit: II

Image Processing: Point operation-Linear filtering-More neighbourhood operators-Fourier transforms-Pyramids and wavelets – Geometric Transformations – Global optimization

Unit III

Feature detection and matching: Points and patches – Edges – Lines

Unit IV

Segmentation: Active Contours – Split and merge – Mean shift and mode finding – Normalized cuts –Graph cuts and energy –based methods

Unit V

Recognition: Object detection – Face recognition – Instance recognition – Category Recognition – Context and scene understanding –Recognition datasets and test sets

Text Book:

Computer Vision-Algorithms and Applications "Richard Szeliski",Springer-verlang London Limited 2011.

Page Number:

Unit I: Computer Vision- Algorithms and Applications **Page no (1 - 10),(29 - 93)**

Unit: II: Computer Vision- Algorithms and Applications **Page no (99 – 194)**

Unit III: Computer Vision- Algorithms and Applications **Page no(205 - 259)**

Unit IV: Computer Vision- Algorithms and Applications **Page no(267 - 306)**

Unit V: Computer Vision- Algorithms and Applications **Page no (655 - 725)**

LINEAR ALGEBRA

Electives 1

MDS Digital Principles and Computer Organization 5 Hrs

OUTCOME:

The aim of this course is to give the students with basic ideas regarding digital hardware components at the level of Gate and realization of sequential circuits and combinatorial circuits.

This course will enable the students to design digital systems employing the techniques and also give better insights into the basic digital hardware building blocks.

Learning Outcome:

Upon completion of this course students will be able to:

- Understand the need for digital system & perform conversion and arithmetic calculations on Numbers system.
- Gain knowledge to apply digital principles to Create and synthesize combinatorial logic circuits and simplify problems using Boolean algebra and K-map.
- Evalulate and Design the Data Processing Circuits & various types of Flip flops.
- Design and synthesize the Sequential Logic circuits.
- Acquire knowledge on Memory subsystem organization and different types of memory.

UNIT I: DIGITAL SYSTEM CONCEPTS

Introduction to digital systems and computers – Applications of digital systems Number systems and Codes - Conversion Binary to Decimal – Hexa decimal – octal – Representation of Negative Numbers, Complements in other Number systems 1's Complement – 2's Complement _ BCD Representation. ASCII, Excess_3, Gray, Weighted and unweighted codes

UNIT II: Basic Building Blocks

Introduction to logic circuits – Basic building blocks - Boolean algebra - Universal gates - De Morgan's Law - Truth tables - Boolean Expressions –Sum of products - Products of sum methods - Karnaugh map – Don't care conditions

UNIT III: Data Processing Circuits & Sequential Logic Circuits Multiplexers - De_Multiplexers - Decoder- Encoder - Introduction to Flip Flops -RS Flip-flop - Clocked Flip Flop – D Flip Flop - JK Flip Flop -JK Master - Slave Flip Flop.

UNIT IV: Memory Element & Basic Computer Organization

Introduction to Registers -Types of Registers - Introduction to Counters – Counter Design - Basic computer Organization – System buses – instruction cycles. CPU Organization

UNIT V: Memory Subsystem Organization

Memory subsystem organization – Types of memory – memory subsystem configuration – I/O Subsystem Organization.

REFERENCE:

1. TC Bartee, "Digital Computer Fundamentals", Tata McGraw Hill, 6th Edition, 2011.
2. Malvino AP & Leach DP, "Digital Principles and Applications", Tata McGraw Hill Publications, 6th Edition 2002.
3. Morris Mano, "Digital Design", Prentice Hall of India Pvt. Ltd, 2012.
4. John D Carpinelli, Computer systems Organization & Architecture, Pearson Education, 1st Edition, 2012.
5. John P. Hayes, Computer Architecture and Organization, Tata McGraw Hill, 2nd Edition, 2013.

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Bloom's Taxonomy	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**

K1: Remembering	✓				
K2: Understanding	✓			✓	✓
K3: Applying		✓	✓	✓	
K4: Analysing		✓	✓	✓	
K5: Evaluating		✓			
K6: Creating		✓			

PARALLEL COMPUTING

Unit I: ARCHITECTURE AND PIPELINE

Introduction – Parallel Computing Architecture – Performance metrics – Parallel programming models – Algorithms – Distributed Processing – Pipeline processing – performance – Arithmetic pipelines – pipeline Instruction processing – Pipeline Stage Design – Dynamic Instruction scheduling – Memory systems in pipelined processes – pipeline scheduling theory – High Performance – Processor Designs – Branch prediction.

Unit II: SYNCHRONOUS PARALLEL PROCESSING

Introduction – SIMD – architecture and programming principles – SIMD parallel algorithms – Data Mapping and memory in array processors – Mapping data to processors on processor arrays and multicomputers – Dynamic load balancing on multicomputer – static scheduling on UMA multiprocessors - deterministic models – graham's list scheduling algorithm – Coffman – graham scheduling algorithm – non deterministic models.

Unit III: PRAM ALGORITHMS

Pram algorithms – Pram models of parallel computation – Pram algorithms – Reducing the no. of processors – Processor organizations – mesh networks – Binary tree networks – hypertree networks – Processor - Processor Arrays – Multiprocessors – UMA – NUMA – Multicomputers – Flynn's taxonomy.

1. Parallel Computing, M.R.Bhujade, New Age International, 2009
2. Parallel Computing: Theory and Practics 2nd Edition – Tata McGraw-Hill Education – 2002.

Electives 2

MDS **Software Engineering** **5 Hrs**

Outcomes:

The aim of the course is to train the students to analyse, estimate and design new software with quality standards.

In this course the Essentials in Software Engineering, software processes and the various software engineering paradigms are introduced. Software testing methods and quality maintenance strategies are included.

COURSE OUTCOME:

Upon completion of this course students will be able to:

- Define diverse software application domains with different process models used in software development.
- Elucidate the need for software specifications and requirements with their gathering techniques.
- Transform requirements model into design model and demonstrate software and UI design principles.
- Differentiate SCM and SQA models, classify testing strategies and tactics and evaluate them.
- Generate project schedule and construct, design and develop network diagram for different type of Projects.

UNIT I: Introduction to Software and Software Engineering

Software and Software Engineering – TheNature of Software – The Unique Nature of WebApps – Software Engineering - The Software Process- Software Engineering Practice – Software Myths – **THE SOFTWARE PROCESS: Process Models:** A Generic process Model – Process Assessment and improvement - Prescriptive process Models – Specialized Process Models- Unified process - personal and team process models.

UNIT II: MODELING: Principles that Guide Practice

MODELING: Principles that Guide Practice: Software Engineering

Knowledge – Core Principles – Principles that guide Each Framework Activity. **Understanding Requirements:** Requirements engineering Establishing the Groundwork – Eliciting Requirements – **Requirements Modeling: Scenarios, Information, and analysis Classes:** Requirements Analysis-Scenario-Based Modeling - UML Models that supplement that use case – Data Modeling Concepts – Class-Based Modeling.

UNIT III: Design Concepts

Design Concepts: Design with the Context of software Engineering – The Design Process – Design Concepts – The design Model. **Architecture Design:** Software Architecture- Architecture Genres – Architecture Styles - Architecture Design. **QUALITY MANAGEMENT: Quality Concepts**: What is quality? – Software Quality –The Software Quality Dilemma – Achieving Software Quality.

UNIT IV: Software Testing Strategies

Software Testing Strategies – A Strategic Approach to Software Testing-Strategic Issues – Test Strategies for Conventional Software – Validation Testing – System Testing – **Testing Conventional Applications:** Software Testing Fundamentals – Internal and External Views of Testing – White Box Testing – Basis Path Testing – Control Structure Testing - Black Box Testing.

UNIT V: MANAGING SOFTWARE PRODUCTS

MANAGING SOFTWARE PRODUCTS: Project Management Concepts: - The Management Spectrum – People – The Product –The Process – The Project – The W5HH Principle – Critical Practices. **Project Scheduling:** Basic Concepts - Project Scheduling – Scheduling. **Risk Management:** Reactive versus Proactive Risk Strategies - Software Risks – Risk Identification - Risk Projection – Risk Refinement.

TEXT BOOK:

1. **"Software Engineering a Practitioners Approach",** Roger S. Pressman, McGraw – Hill International Edition, Seventh Edition 2013.

REFERENCE:

1. Roger S Pressman, " Software Engineering -A Practical Approach" Tata McGraw Hill, 7th Edition, 2013
2. Stephen R Schach, " Object Oriented and Classical Software Engineering", Tata McGraw Hill, 8th Edition,2010
3. Watts S Humphrey, "A Discipline for Software Engineering", Pearson Education, 2001.
4. Boriz and Beizer, "Software Testing Techniques", DreamTech, 2nd Edition, 2000.
5. "Software Engineering", Ian Sommer Ville, Pearson Education, Nineth Edition, 2011.

	Unit 1	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**
Bloom's Taxonomy	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	✓				✓
K2: Understanding	✓	✓		✓	✓
K3: Applying	✓	✓	✓	✓	✓
K4: Analyzing		✓	✓	✓	✓
K5: Evaluating		✓	✓		✓
K6: Creating		✓	✓		