M.Tech.(CSE), R17 Course Structure (Choice Based Credit System)

I SEMESTER

S. No	Course Code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	17CO01	Android Technologies	3	-	-	3	3	40	60	100
2	17CO02	Fundamentals of Data Science	3	-	-	3	3	40	60	100
3	17CO03	Machine Learning	3	-	-	3	3	40	60	100
4	PE-I	Programme Elective-I	3	-	-	3	3	40	60	100
5	PE-II	Programme Elective-II	3	-	-	3	3	40	60	100
6	17CO60	Android Technologies Lab	-	-	2	2	1	40	60	100
7	17CO61	Fundamentals of Data Science Lab	-	-	2	2	1	40	60	100
8	17CO50	Technical Seminar	-	-	2	2	1	100	--	100
10	17CO90	**Add-on-Course-1** High Performance Computing	3	-	-	3	3	40	60	100
		Total	**15/ 18**	**-**	**6**	**21/24 ***	**18/21***	**380/ 420***	**420/ 480***	**800/ 900***

***With inclusion of Add on course**

II SEMESTER

S. No	Course Code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	17CO10	Big Data Analytics	3	-	-	3	3	40	60	100
2	17CO11	Internet of Things	3	-	-	3	3	40	60	100
3	17CO12	Cryptography and Network Security	3	-	-	3	3	40	60	100
4	PE-III	Programme Elective-III	3	-	-	3	3	40	60	100
5	PE-IV	Programme Elective-IV	3	-	-	3	3	40	60	100
6	17CO62	Big Data Analytics Lab	-	-	2	2	1	40	60	100
7	17CO63	Internet of Things Lab	-	-	2	2	1	40	60	100
8	17CO51	Mini Project	-	-	2	2	1	100	--	100
10	17CO91	**Add-on-Course-2** Information Retrieval Systems	3	-	-	3	3	40	60	100
		Total	**15/ 18***	**-**	**6**	**21/ 24***	**18/ 21***	**380/ 420***	**420/ 480***	**800/ 900***

***With inclusion of Add on course**

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III SEMESTER

S. No	Course Code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	PE-V	Programme Elective -V	3	-	-	3	3	40	60	100
2	PE-VI	Programme Elective -VI	3	-	-	3	3	40	60	100
3	17CO52	Internship	-	-	-	-	2	100	--	100
4	17CO53	Project Work (Phase-I)	-	-	20	20	10	40	60	100
		Total	**6**	**-**	**20**	**26**	**12/15/18**	**220**	**180**	**400**

IV SEMESTER

S. No	Course Code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	17CO54	Project Work (Phase-II)	-	-	32	32	16	40	60	100
2	17CO55	Comprehensive Viva Voce	-	-	4	4	2	100	--	100
		Total	**-**	**-**	**36**	**36**	**18**	**140**	**60**	**200**

LIST OF COURSES FOR PROGRAMME ELECTIVE- I & II

S.No	Course Code	Course Title
1	17CO04	Advanced Algorithm Design
2	17CO05	Ad-hoc Networks
3	17CO06	Object Oriented Software Engineering
4	17CO07	Image Processing
5	17CO08	Cloud Computing
6	17CO09	Parallel Algorithms

Note: Students are required to choose any two courses as Programme Elective- I & II

List of courses for Programme Elective- III& IV

S.No	Course Code	Course Title
1	17CO13	Advanced Data Mining
2	17CO14	TCP/IP Networking
3	17CO15	Software Testing and Quality Assurance
4	17CO16	Neural Networks
5	17CO17	Web and Database Security
6	17CO18	Graph Analytics

Note: Students are required to choose any two courses as Programme Elective- III & IV.

List of courses for Programme Elective-V & VI

S.No	Course Code	Course Title
1	17CO19	Web Mining
2	17CO20	Storage Area Networks
3	17CO21	Software Project Management
4	17CO22	Pattern Recognition
5	17CO23	Computer Forensics
6	17CO24	Deep Learning

Note: Students are required to choose two/one courses as Programme Elective- III & IV , depending on the add-on-courses opted in Semester I & II.

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M.Tech. (I Sem.) **17CO01 - ANDROID TECHNOLOGIES**

L	T	P	Cr.
3	-	-	3

Prerequisites: Fundamentals of Java programming and Linux

Course Objectives:

- To demonstrate their understanding of the fundamentals of Android operating systems
- To demonstrate their skills of using Android software development tools
- To demonstrate their ability to develop software with reasonable complexity on mobile platform
- To demonstrate their ability to deploy software to mobile devices
- To demonstrate their ability to debug programs running on mobile devices

Course Outcomes:

CO1 To express their understanding of the fundamentals of Android Platform

CO2 To apply their skills of User Interface Components to develop basic UI for Android Apps

CO3 To distinguish important components of Android Platform

CO4 To develop android applications that interacts with SQLite Database

CO5 To understand the advanced concepts in Android Platform

UNIT - I

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Eclipse platform, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc., Resources for different devices and languages, Runtime Configuration Changes Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

UNIT - II

Android User Interface: Measurements – Device and pixel density independent measuring units Layouts –Linear, Relative, Grid and Table LayoutsUser Interface (UI) Components – Editable and non-editableText Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickersEvent Handling – Handling clicks or changes of various UI componentsFragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities

UNIT - III

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMSBroadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an ActivityNotifications – Creating and Displaying notifications, Displaying Toasts.

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UNIT - IV

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared PreferenceDatabase – Introduction to SQLite database, creating and opening a database, creating tables, inserting, retrieving and deleting data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

UNIT - V

Advanced Topics: Alarms – Creating and using alarmsUsing Internet Resources – Connecting to internet resource, using download manager, Location Based Services – Finding Current Location and showing location on the Map, updating location

TEXT BOOKS

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

REFERENCE

Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

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M.Tech. (I Sem.) **17CO02 - FUNDAMENTALS OF DATA SCIENCE**

L	T	P	Cr.
3	-	-	3

Prerequisites: Fundamentals of statistics and probability

Course Outcomes

CO1: Students will apply data science concepts and methods to solve problems in real world contexts.

CO2: Students will demonstrate proficiency with statistical analysis of data.

CO3: Students will demonstrate skill in Data Modeling.

CO4: Students will have a good understanding of the relationship between a specific problem and the methods used to solve the problem.

CO5: Students will demonstrate the ability to translate time series data into clear, actionable insights.

UNIT-I

Introduction: What is Data Science? What roles exist in Data Science? Current landscape of perspectives. Define the workflow, tools and approaches data scientists use to analyze data. Define a problem and identify appropriate data sets using the data science workflow. Walk through the data science workflow using a case study.

UNIT-II

Statistics Fundamentals: Exploratory Data Analysis and the Data Science Process -analyze datasets using basic summary statistics: mean, median, mode, max, min, quartile, inter-quartile, range, variance, standard deviation and correlation. Data Visualization – scatter plots, scatter matrix, line graph, box blots, and histograms. Identify a normal distribution within a dataset using summary statistics and visualization. Causation Vs Correlation. Test a hypothesis within a sample case study. Validate your findings using statistical analysis.

UNIT-III

Foundations of Data Modelling: Introduction Regression – data modelling and linear regression. Categorical variables versus Continuous variables. Build the linear regression/logistic regression model using a dataset. Fit model – regularization, bias and error metrics. Evaluate model fit using loss functions – MSE(Mean Square Error), RMSE (Root MSE), Mean Absolute Error(MAE). Apply different regression models based on fit and complexity. Evaluate model using metrics such as accuracy/error, Confusion matrix, ROC curve and Cross Validation.

UNIT-IV

Data Science in the real world

Dimensionality Reduction – perform dimensionality reduction using topic models such as PCA and SVD. Refine and extract data/information from sample datasets. Introduction to Classification - define classification model, apply k-NN, Naïve Classifier and Decision trees. Build the classification model using a dataset and evaluate.

UNIT - V

Working with Time Series Data – Introduction, observations, sub setting data and selecting observations, Time series periodicity and Time Intervals, Plotting Time series,

TEXT BOOKS

1. The Art of Data Science: A Guide for Anyone Who Works with Data, Roger D.Peng, Elizabeth Matsui, Lean Pub, 2015.
2. Doing Data Science, Straight Talk from The Frontline, Cathy O'Neil and Rachel Schutt. O'Reilly. 2014.
3. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking, Foster Provost and Tom Fawcett. 2013
4. Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman, Springer, 2009.

REFERENCES

1. Mining of Massive Datasets,JureLeskovek, AnandRajaraman and Jeffrey Ullman. , Cambridge University Press. 2014.
2. Machine Learning: A Probabilistic Perspective.Kevin P. Murphy, MIT Press, 2013.
3. Avrim Blum, John Hopcroft and RavindranKannan. Foundations of Data Science.
4. Data Mining and Analysis: Fundamental Concepts and Algorithms, Mohammed J. Zaki and Wagner Miera Jr., Cambridge University Press. 2014.
5. R Programming for Data Science, Roger D. Peng, LeanPub, 2015.
6. Python for Data Science for Dummies, Luca Massaron and John Paul Mueller, John Wiley and Sons, 2015.

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M.Tech. (I Sem.) **17CO03 - MACHINE LEARNING**

L	T	P	Cr.
3	-	-	3

Prerequisites: Fundamentals of Data Mining

Course Objectives

- To understand the basic concepts of learning and decision trees.
- To understand the neural networks and genetic algorithms.
- To understand the Bayesian techniques.
- To understand the instant based learning.
- To understand the analytical learning and reinforced learning.

Course Outcomes:

CO1: Identify various approaches in learning like concept learning and decision tree learning etc.

CO2: Analyse different types of neural networks as multi-layer and back propagation networks and genetic algorithms

CO3: Identify different topic s in Bayesian and computational learning as Bayes theorem, Gibbs algorithm and Bayesian belief networks

CO4: Analyse different types of learning and learning set of rules such as case based reasoning and learning first order rules

CO5: Summarize various concepts of analytical learning and reinforcement learning in terms of FOCL algorithm and Q learning

UNIT - I

INTRODUCTION, CONCEPT LEARNING AND DECISION TREES Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning.

UNIT - II

NEURAL NETWORKS AND GENETIC ALGORITHMS Neural Network Representation – Problems – Perceptron's – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming.

UNIT - III

BAYESIAN AND COMPUTATIONAL LEARNING Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm.

UNIT - IV

INSTANT BASED LEARNING AND LEARNING SET OF RULES K- Nearest Neighbour Learning – Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules.

UNIT - V

ANALYTICAL LEARNING AND REINFORCED LEARNING Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning.

TEXT BOOK

Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013.

REFERENCES

1. EthemAlpaydin, "Introduction to Machine Learning", 2nd Ed., PHI Learning Pvt. Ltd., 2013.
2. T. Hastie, R. Tibshirani, J. H. Friedman, "The Elements of Statistical Learning", Springer; 1st edition, 2001.

M.Tech. (I Sem.) **17CO04 - ADVANCED ALGORITHM DESIGN**

L	T	P	Cr.
3	-	-	3

Prerequisites: Foundations in design and analysis of algorithms and data structures

Course Objectives: Upon completion of this course, students will be able to do the following:

- Analyze the asymptotic performance of algorithms.
- Ability to analyze asymptotic runtime complexity of algorithms including formulating recurrence relations.
- Ability to understand and design algorithms using greedy strategy, divide and conquer approach, dynamic programming, Demonstrate a familiarity with major algorithms and data structures.

Course Outcomes

CO1: Graduates will be able to evaluate and analyze complexity of algorithm

CO2: Graduates will be able to understand divide and conquer techniques of algorithm design

CO3: Graduates will be able to understand greedy and dynamic programming in algorithm design

CO4: Graduates will be able to understand how backtracking and branch and bound technique can be used in algorithms

CO5: Graduates will be able to adopt best algorithm design techniques to solve the given problem

UNIT - 1

Introduction: Notion of an Algorithm–Fundamentals of Algorithmic Problem Solving–Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework –Asymptotic Notations and Basic efficiency classes.

UNIT - II

Divide and Conquer Method: General Method, Applications: Binary search, Quick sort, Merge sort and Analysis of divide and conquer runtime recurrence relations.

UNIT - III

Greedy Method: General method, Applications: Minimum cost spanning tree (Prim's and Kruskal's algorithm), Dijkstra's algorithm.

UNIT - IV

Dynamic programming: General Method, Applications: Floyd's algorithm, Optimal Binary Search Tree, 0/1 knapsack problem

UNIT - V

Back tracking: General Method, Applications: Sum of Subsets, Hamiltonian Cycles. **Branch and bound**: The Method–Assignment problem, Travelling Salesman Problem - Introduction to NP-Hard and NP-Complete Problems.

TEXT BOOK

Introduction to the Design & Analysis of Algorithms, AnanyLevitin, 2nd Edition, Pearson Education 2007.

REFERENCES

1. "Introduction to Algorithms", 3rd Ed., T. H. Cormen, C. E. Leiserson, R. L. Rivest, Clifford Stein, PHI.
2. "Computer Algorithms", Ellis Horowitz and SartajSahni, Silicon press, 2008.

M.Tech. (I Sem.) **17CO05 - AD-HOC NETWORKS**

L	T	P	Cr.
3	-	-	3

Prerequisites: Fundamentals of computer networks

Course Objectives:

- To enable student to understand fundamentals of networks, types and challenges of adhoc networks.
- To understand various adhoc routing protocols
- To understand multicast routing in adhoc networks
- To understand the transport layer issues and security protocols
- To understand issues in providing QoS.

Course Outcomes:

CO1: To understand the state-of-the-art in network protocols, architectures and applications

CO2: Analyze existing network protocols and networks.

CO3: Develop new protocols in networking

CO4: To understand how networking research is done

CO5: To investigate novel ideas in the area of Networking via term-long research projects

UNIT - I
FUNDAMENTALS

Introduction – Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio Propagation Mechanisms – Characteristics of the Wireless Channel – IEEE 802.11a–b Standard – Origin of Ad hoc Packet Radio Networks – Technical Challenges – Architecture of PRNETs – Components of Packet Radios – Ad hoc Wireless Networks – What is an Ad Hoc Network? Heterogeneity in Mobile Devices – Wireless Sensor Networks – Traffic Profiles – Types of Ad hoc Mobile Communications – Types of Mobile Host Movements – Challenges Facing Ad hoc Mobile Networks – Ad hoc wireless Internet.

UNIT - II
ADHOCROUTINGPROTOCOLS

Introduction – Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks – Classifications of Routing Protocols – Table–Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV) – Wireless Routing Protocol (WRP) – Cluster Switch Gateway Routing (CSGR) – Source–Initiated On–Demand Approaches – Ad hoc On–Demand Distance Vector Routing (AODV) – Dynamic Source Routing (DSR) –Temporally Ordered Routing Algorithm (TORA) – Signal Stability Routing (SSR) –Location–Aided Routing (LAR) – Power–Aware Routing (PAR) – Zone Routing Protocol (ZRP).

UNIT - III
MULTICASTROUTING IN ADHOC NETWORKS

Introduction – Issues in Designing a Multicast Routing Protocol – Operation of Multicast Routing Protocols – An Architecture Reference Model for Multicast Routing Protocols – Classifications of Multicast Routing Protocols – Tree–Based Multicast Routing Protocols– Mesh–Based Multicast Routing Protocols – Summary of Tree and Mesh based Protocols – Energy–Efficient Multicasting – Multicasting with Quality of Service Guarantees – Application – Dependent Multicast Routing – Comparisons of Multicast Routing Protocols.

UNIT - IV

TRANSPORT LAYER– SECURITY PROTOCOLS

Introduction – Issues in Designing a Transport Layer Protocol for Ad hoc Wireless Networks – Design Goals of a Transport Layer Protocol for Ad hoc Wireless Networks –Classification of Transport Layer Solutions – TCP over Ad hoc Wireless Networks – Other Transport Layer Protocols for Ad hoc Wireless Networks – Security in Ad Hoc Wireless Networks – Network Security Requirements – Issues and Challenges in Security Provisioning – Network Security Attacks – Key Management – Secure Routing in Ad hoc Wireless Networks.

UNIT - V

QoS AND ENERGY MANAGEMENT

Introduction – Issues and Challenges in Providing QoS in Ad hoc Wireless Networks – Classifications of QoS Solutions – MAC Layer Solutions – Network Layer Solutions – QoS Frameworks for Ad hoc Wireless Networks Energy Management in Ad hoc Wireless Networks – Introduction – Need for Energy Management in Ad hoc Wireless Networks – Classification of Energy Management Schemes – Battery Management Schemes – Transmission Power Management Schemes – System Power Management Schemes.

TEXTBOOK

C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols", Prentice Hall, PTR, 2004.

REFERENCES

1. C. K. Toh, "Ad Hoc Mobile Wireless Networks Protocols and Systems", Prentice Hall, PTR, 2001.
2. Charles E. Perkins, "Ad Hoc Networking", Addison Wesley, 2000

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M.Tech. (I Sem.)	17CO06 - OBJECT ORIENTED SOFTWARE ENGINEERING	L	T	P	Cr.
		3	-	-	3

Prerequisites: Software Engineering, Fundamental concepts of OOAD

Course Objectives

1. As Software development is the expensive process, proper measures are required
2. So that the resources can be used efficiently and effectively.
3. Thus this course is to provide the students with the concepts of organized methodology for implementing medium-large software systems like Team programming, Common design and coding methodologies, including Object-Oriented Design (OOD).
4. Design Patterns, Refactoring, and the Unified Modeling Language (UML) and standard software Engineering tools.

Course Outcomes:

CO1	To learn the fundamentals of OO Software Engineering
CO2	To learn about software prototyping, analysis and design
CO3	To learn the various OO Design models
CO4	Understand the object-oriented process from requirements through testing
CO5	Case studies to apply the principles

UNIT - I
INTRODUCTION

Software Engineering Paradigms-Software Development process models-Project & Process-Project management–Process & Project metrics-Object Oriented concepts & Principles.

UNIT - II
PLANNING & SCHEDULING

Software prototyping-Software project planning–Scope–Resources-Software Estimation-Empirical Estimation Models-Planning-Risk Management-Software Project Scheduling–Object Oriented Estimation & Scheduling.

UNIT - III
ANALYSIS & DESIGN

Analysis Modeling-Data Modeling-Functional Modeling& Information Flow-BehavioralModeling-Structured Analysis-Object Oriented Analysis-Domain Analysis-Object Oriented Analysis process-Object Relationship Model-ObjectBehavior Model. Design Concepts & Principles-Design Process-DesignConcepts-Modular Design–Design Effective Modularity-Introduction to Software Architecture-Data Design–Transform Mapping–Transaction Mapping–OOD-Design System design process-Object design process-Design Patterns.

UNIT - IV
IMPLEMENTATION & TESTING

Top-Down, Bottom-Up, object oriented product Implementation & Integration. Software testing methods-White Box, Basis Path-Control Structure–Black Box-Unit Testing-Integration testing-Validation & System testing. Testing OOA &OODmodels-Object oriented testing strategies.

UNIT - V

MAINTENANCE

Maintenance process-System documentation-program evolution dynamics-Maintenance costs-Maintainability measurement–Case studies

TEXTBOOK

Bernd Bruegge and Alan H Dutoit, "Object-Oriented Software Engineering", 2nd edition, Pearson Education.

REFERENCE

"Object Oriented and Classical software Engineering", 7/e StephenR.Schach,TMH

M.Tech. (I Sem.) **17CO07 - IMAGE PROCESSING**

L	T	P	Cr.
3	-	-	3

Prerequisites: Concepts of Computer Graphics

Course Objectives

- To introduce basic principles of digital image processing.
- To provide knowledge on Image data structures
- To demonstrate different image encoding techniques.
- To explain segmentation and restoration techniques.

Course Outcomes:

CO1: To study the image fundamentals and mathematical transforms necessary for image processing

CO2: To study the image enhancement techniques

CO3: To study Color Image Processing procedures

CO4: To study the image compression procedures

CO5: To study the image segmentation and representation techniques

UNIT-I

Introduction: Examples of fields that use digital image processing, fundamental steps in digital image processing, components of image processing system. Digital Image Fundamentals: A simple image formation model, image sampling and quantization, basic relationships between pixels

UNIT-II

Image enhancement in the spatial domain: Basic gray-level transformation, histogram processing, enhancement using arithmetic and logic operators, basic spatial filtering, smoothing and sharpening spatial filters, combining the spatial enhancement methods

UNIT-III

Color Image Processing: Color fundamentals, color models, pseudo color image processing, basics of full–color image processing, color transforms, smoothing and sharpening, color segmentation

UNIT-IV

Image Compression: Fundamentals, image compression models, error-free compression, lossy predictive coding, image compression standards.

UNIT-V

Image Segmentation: Detection of discontinuous, edge linking and boundary detection, thresholding, region–based segmentation

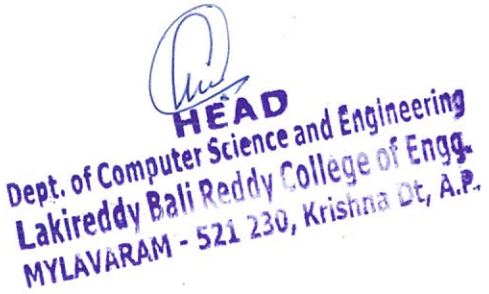
Morphological Image Processing: Preliminaries, dilation, erosion, open and closing, hit or miss transformation, basic morphologic algorithms

TEXT BOOK

Digital Image Processing, Rafeal C. Gonzalez, Richard E.Woods, Second Edition, Pearson Education/PHI.

REFERENCES

1. Image Processing, Analysis, and Machine Vision, Milan Sonka, Vaclav Hlavac and Roger Boyle, Second Edition, Thomson Learning.
2. Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson Course Technology
3. Digital Image Processing and Analysis, B. Chanda, D. DattaMajumder, Prentice Hall of India, 2003
4. Computer Vision and Image Processing, Adrian Low, Second Edition, B.S.Publications
5. Digital Image Processing using Matlab, Rafeal C. Gonzalez, Richard E.Woods, Steven L. Eddins, Pearson Education.



M.Tech. (I Sem.) **17CO08 - CLOUD COMPUTING**

L	T	P	Cr.
3	-	-	3

Prerequisites: Foundations of Computer Networks and Mobile Computing

Course Objectives

- To provide knowledge on Cloud Computing concepts, technologies and architecture.
- To introduce the concepts of Cloud Computing fundamentals, applications and implementations.
- To identify various areas of information systems in managing the cloud environment.

Course Outcomes:

CO1 Analyze various delivery and deployment models.
CO2 Analyze the virtual machine provisioning and virtualized storage strategies.
CO3 Explore the PAAS and SAAS Services.
CO4 Identify the issues in monitoring and management in cloud environment for achiving Quality of Service (QOS).
CO5 Identify the components necessary for deployment of applications on the cloud.

UNIT -I

Introduction to cloud computing- Cloud computing in a Nutshell, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks.

UNIT –II

Enriching the „Integration as a Service" Paradigm for the Cloud Era--The Onset of Knowledge Era, The Evolution of SaaS, The Challenges of SaaS Paradigm, SaaS Integration Services and products, SaaS Integration Appliances.The Enterprise Cloud Computing Paradigm - Background, Enterprise Cloud Technology and Market Evolution.

UNIT -III

INFRASTRUCTURE AS A SERVICE (IAAS):Virtual Machines Provisioning and Migration Services- Background and Related Work, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services ,VM Provisioning and Migration in Action, Provisioning in the Cloud Context. On the Management of Virtual Machines for Cloud Infrastructures- The Anatomy of Cloud Infrastructures, Distributed Management of Virtual Infrastructures.

UNIT- IV

Understanding Scientific Applications for Cloud Environments: A Classification of Scientific Applications and Services in the Cloud , SAGA-based Scientific Applications that Utilize Clouds. The MapReduce Programming Model and Implementations: MapReduce Programming Model, Major MapReduce Implementations for the Cloud, MapReduce Impacts and Research Directions.

UNIT- V

Managing the Cloud: Administrating the cloud, Management Responsibilities, life cycle management, cloud management products, Standards. Cloud Security: Securing the cloud, boundary, mapping, -brokered cloud storage access, storage location and tenancy, Encryption. Introducing service oriented architecture.

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TEXT BOOKS

1. RajkumarBuyya ,JamesBroberg, AndrzejGoscinski, CLOUD COMPUTING Principles and Paradigms , Wiley Publishing inc.
2. Barrie Sosinsky Cloud Computing Bible, Wiley Publishing inc.

REFERENCES

1. Michael Miller, Cloud Computing Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.
2. Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper Cloud Computing for Dummies. Wiley publishing inc.
3. Cloud Application Architecture- George Reese.
4. Haley Beard Cloud computing best practices

e-Learning Resources:

1. http://www.slideshare.net/himanshuawasthi2109/cloud-computing-ppt-16240131
2. http://nptel.ac.in/courses/106105033/41
3. https://www.youtube.com/watch?v=r8Lu_BjxlZc
4. http://video.mit.edu/watch/mitef-nyc-cloud-computing-8347/

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M.Tech. (I Sem.) **17CO09 - PARALLEL ALGORITHMS**

L	T	P	Cr.
3	-	-	3

Prerequisites: Foundations of design and analysis of algorithms

Course Objectives

- To Understand parallel processing terminology, organizational features of processor Arrays and mapping & scheduling aspects of algorithms.
- To Study and analyse the parallel algorithms on SIMD and MIMD models. Implement fastFourier transform algorithms on Hyper-Cube architectures.
- To Study parallel sorting methods such as Odd Even transposition and bitonic merge sort on various types of processor arrays and multiprocessors.
- To know about parallel search operations like Ellis algorithms and Manber& Ladner's algorithms for dictionary operations.
- To examine parallel algorithms developed to solve problems in graph theory which are related to search graph and finding connected components, minimum spanning trees and shortest paths in graphs.

Course Outcomes:

CO1 Know the concept of parallel processing in terms of its background, models, performance and analysis.

CO2 Compare balanced trees, pointer jumping, divide and conquer methods and study parallel RAM models.

CO3 Analyse parallel sorting algorithms for processor arrays and multiprocessors includes odd-even transposition sort for linear arrays ,merge sort for mesh, cube connected and perfect shuffle networks

CO4 Solve the problems in graph theory related to searching graphs, minimum cost spanning tree using parallel algorithms.

CO5 Classify realistic models of parallel computation methods includes bulk synchronous parallel, LogP and shared memory

UNIT - I

Introduction – Computational demand in various application areas, Advent of parallel processing, Terminology – Pipelining, Data parallelism and control parallelism – Amdhal's Law. Organizational features of processor arrays, Multiprocessor s and Multi computers. Mapping and scheduling aspects of algorithms. Mapping into meshes and Hypercubes – Load balancing – List scheduling algorithm and Coffman – Graham scheduling algorithm for parallel processors.

UNIT - II

Elementary parallel algorithms on SIMD and MIMD machines, Analysis of these algorithms, Matrix multiplication algorithms on SIMD and MIMD models. Fast Fourier Transform algorithms – Implementation on Hyper-Cube architectures, solving linear system of equations, parallelizing aspects of sequential methods of back substitution and Tridiagonal.

UNIT - III

Parallel sorting methods – Odd Even Transposition sorting on processor arrays. Bitonic –Merge sort on Shuffle-Exchange 1D-Array Processor, 2D-Mesh Processors and Hypercube processor array.

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UNIT - IV

Parallel Quick-sort on Multiprocessors - Hyper Quick sort on Hyper Cube Multicomputers.Parallel search operations - Ellis algorithm and Manber& Ladner's algorithms for dictionary operations.

UNIT - V

Parallel algorithms for graph searching – P-Depth search, Breadth-Depth search and Breadth-First search. All pairs of shortest paths and Minimum Cost Spanning tree. Parallelization aspects of combinatorial search algorithm with focus on branch and bound methods and Alpha-Beta search methods.

TEXT BOOK

Michael J.Quinn, "Parallel Computing Theory & Practice", second edition,Tata McGraw-Hill Edition 2002 .

REFERENCES

1. Joseph, "Introduction to Parallel Algorithms", Pearson Edition Wesley
2. David Culler and J.P.Singh with Anoop Gupta, "Parallel Computing Architecture: A Hardware/Software Approach", Morgan Kaufmann publishers.

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M.Tech. (I Sem.) **17CO60 - ANDROID TECHNOLOGIES LAB**

L	T	P	Cr.
-	-	2	1

Prerequisites: Java Programming Skills

Course Objectives:

- Know the components and structure of mobile application development frameworks for Android
- Understand how to work with various mobile application development frameworks.
- Learn the basic and important design concepts and issues of development of mobile applications.
- Understand the capabilities and limitations of mobile devices.

Course Outcomes:

CO1 To develop basic android applications
CO2 To develop moderate android applications
CO3 To develop android applications that interact with SQLite database

LIST OF EXPERIMENTS:

1. Develop an application that uses GUI components, Font and Colours.
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi-threading.
8. Develop a native application that uses GPS location information.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.
11. Write a mobile application that creates alarm clock

M.Tech. (I Sem.)	17CO61 - FUNDAMENTALS OF DATA SCIENCE LAB	L	T	P	Cr.
		-	-	2	1

Prerequisites: Fundamentals of statistics

Course Outcomes:

CO1 Students will develop relevant programming abilities

CO2 Students will develop the ability to build and assess data-based models

CO3 Students will apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

Experiment – I: Introduction to R

Purpose: This Cycle introduces you to the use of the R statistical package within the Data Science and Big Data Analytics environment. After completing the tasks in This Cycle you should able to:

a. Read data sets into R, save them, and examine the contents

Tasks you will complete in This Cycle include:

a. Invoke the R environment and examine the R workspace

b. Created table and data sets in R

c. Examine, manipulate and save data sets

d. Exit the R environment

Experiment – II: Basic Statistics and Visualization

Purpose: This Cycle introduces you to the analysis of data using the R statistical package within the Data Science and Big Data Analytics environment. After completing the tasks in This Cycle you should able to:

a. Perform summary (descriptive) statistics on the data sets

b. Create basic visualizations using R both to support investigation of the data as well as exploration of the data

c. Create plot visualizations of the data using a graphics package

Tasks you will complete in This Cycle include:

a. Reload data sets into the R statistical package

b. Perform summary statistics on the data

c. Remove outliers from the data

d. Plot the data using R

e. Plot the data using lattice and ggplot

Experiment - III: K-means Clustering

Purpose: This Cycle is designed to investigate and practice K-means Clustering. After completing the tasks in This Cycle you should able to:

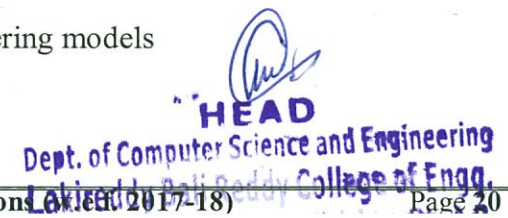
a. Use R functions to create K-means Clustering models

b. Use ODBC connection to the database and execute SQL statements and load datasets from the database in an R environment

c. Visualize the effectiveness of the K-means Clustering algorithm using graphic capabilities in R

Tasks you will complete in This Cycle include:

a. Use the R -Studio environment to code K-means Clustering models



b. Use the ODBC connection in the R environment to create the average household income from the census database as test data for K-means Clustering
c. Use R graphics functions to visualize the effectiveness of the K-means Clustering algorithm

Experiment - IV: Association Rules

Purpose: This Cycle is designed to investigate and practice Association Rules. After completing the tasks in This Cycle you should able to:
a. Use R functions for Association Rule based models
Tasks you will complete in This Cycle include:
a. Use the R -Studio environment to code Association Rule models
b. Apply constraints in the Market Basket Analysis methods such as minimum thresholds on support and confidence measures that can be used to select interesting rules from the set of all possible rules
c.Use R graphics "arules" to execute and inspect the models and the effect of the various thresholds

Experiment - V: Linear Regression

Purpose: This Cycle is designed to investigate and practice the Linear Regression method. After completing the tasks in This Cycle you should able to:
a. Use R functions for Linear Regression (Ordinary Least Squares - OLS)
b. Predict the dependent variables based on the model
c. Investigate different statistical parameter tests that measure the effectiveness of the model
Tasks you will complete in This Cycle include:
a. Use the R -Studio environment to code OLS models
b. Review the methodology to validate the model and predict the dependent variable for a set of given independent variables
c. Use R graphics functions to visualize the results generated with the mode

Experiment - VI: Logistic Regression

Purpose: This Cycle is designed to investigate and practice the Logistic Regression method. After completing the tasks in This Cycle you should able to:
a. Use R functions for Logistic Regression-also known as Logit)
b. Predict the dependent variables based on the model
c. Investigate different statistical parameter tests that measure the effectiveness of the mode
Tasks you will complete in This Cycle include:
a. Use R -Studio environment to code Logit models
b. Review the methodology to validate the model and predict the dependent variable for a set of given independent variables
c. Use R graphics functions to visualize the results generated with the model

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Experiment – VII : Naive Bayesian Classifier

Purpose: This Cycle is designed to investigate and practice the Naïve Bayesian Classifier analytic technique. After completing the tasks in This Cycle you should be able to:
a. Use R functions for Naïve Bayesian Classification
b. Apply the requirements for generating appropriate training data
c. Validate the effectiveness of the Naïve Bayesian Classifier with the big data
Tasks you will complete in This Cycle include:
a. Use R-Studio environment to code the Naïve Bayesian Classifier
b. Use the ODBC connection to the "census" database to create a training data set for Naïve Bayesian Classifier from the big data
c. Use the Naïve Bayesian Classifier program and evaluate how well it predicts the results using the training data and then compare the results with original data

Experiment - VIII: Decision Trees

Purpose: This Cycle is designed to investigate and practice Decision Tree (DT) models covered in the course work. After completing the tasks in This Cycle you should able to:
a. Use R functions for Decision Tree models
b. Predict the outcome of an attribute based on the model
Tasks you will complete in This Cycle include:
a. Use the R -Studio environment to code Decision Tree Models
b. Build a Decision Tree Model based on data whose schema is composed of attributes
c. Predict the outcome of one attribute based on the model

Experiment -IX :
Simulate Principal component analysis

Experiment -X
Simulate Singular Value Decomposition

REFERENCES
1. "Big Data Analytics with R and Hadoop" -Vignesh Prajapati-2013 Packet Publishing
2. "R and Data Mining: Examples and Case Studies" -Yanchang Zhao- 2012 Elsevier

M.Tech. (I Sem.) **17CO90 - HIGH PERFORMANCE COMPUTING**

L	T	P	Cr.
3	-	-	3

Prerequisites: Fundamentals of Data Mining

Course Objectives:

- To introduce students to high performance computing systems in science and engineering
- Expose students to the features of modern processors that affect performance and be able to use these features in the design and optimization of high-performance software.
- To utilize techniques to automatically implement, optimize, and adapt programs to different platforms.
- To provide the concepts of parallel processing and develop the skills required to implement high performance software
- Learn techniques for analyzing the performance of programs and their interaction with the underlying hardware.

Course Outcomes:

CO1 Demonstrate memory hierarchies, processor types and techniques in high performance computing

CO2 Analyze the execution of parallel programs on high performance computing resources using parallel programming paradigms such as MPI

CO3 Outline the fundamentals of Internet of Things (IoT), Big Data and Analytics and the High Performance approaches like Cluster computing, Grid computing, Cloud computing and Heterogeneous computing

CO4 Design the network infrastructure for High-Performance Big Data Analytics Storage and Storage Area Networks

CO5 Analyze the techniques for Real-time Analytics, General Parallel File System (GPFS) and High-performance Computing (HPC) Paradigms

UNIT - 1

Modern Processors: Stored-program computer architecture, General-purpose cache-based microprocessor architecture, Memory hierarchies, Multicore processors, multithreaded processors, Vector processors. Basic Optimization Techniques for Serial Code: Scalar profiling, Common sense optimizations, Simple measures, large impact, the role of compilers C++ optimizations Data Access Optimization: Balance analysis and light-speed estimates.

UNIT - II

Parallel Computers: Taxonomy of parallel computing paradigms, Shared-memory Computers, Distributed-memory computers, Hierarchical (hybrid) systems Networks Basics of arallelization: Why parallelize? Parallelism, Parallel scalability Shared-Memory Parallel Programming with OpenMP: Short introduction to OpenMP.

UNIT - III

The brewing trends and transformations in the IT landscape: Introduction, The Emerging IT Trends, , The Internet of Things (IoT)/Internet of Everything (IoE), Apache Hadoop for Big Data and Analytics, Big Data into Big Insights and Actions, Conclusions. The high performance Technologies: Introduction, The Emergence of Big Data Analytics(BDA) Discipline, The Strategic Implications of Big Data, The Big Data Analytics Challenges, The high-Performance Computing(HPC)Paradigms for fast and BDA, The High Performance Approaches Through parallelism, Cluster computing, Grid computing, Cloud computing, Heterogeneous computing, Main Frames for High-performance Computing, Supercomputing for Big data Analytics.

UNIT - IV

Network infrastructure for High –Performance: Introduction, Network Infrastructure for High performance Computing, Limitations of Present-Day Networks, Approaches for the Design of Network Infrastructure for High-Performance Big Data Analytics Storage Infrastructure for High-Performance Big Data Analytics: Introduction, Storage Area Networks, Storage Infrastructure for storing big data.

UNIT - V

Real –Time Analytics Using High-Performance Computing: Introduction, Technologies That support Real-time Analytics, Processing in Memory(PIM), In-Database Analytics, MOA: Massive Online Analysis, General Parallel File System(GPFS) High-performance Computing (HPC) Paradigms: Introduction, need of Mainframes, Cost-An Important Factor for HPC, Cloud Computing Centralized HPC.

TEXT BOOKS

1. "Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall/CRC Computational Science 2010 by Georg Hager, Gerhard Wellein
2. Pethuru Raj, Anupama Raman, DhivyaNagaraj, "High-Performance Big Data Analysis: Computing Systems and Approches", 1st ed. 2015, Springer.

REFERENCE BOOKS:

1. CUDA by Example, "An Introduction to General-Purpose GPU Programming "
2. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2003.
3. Kaihwang and NareshJotwani, "Advanced Computer Architecture" 2nd edition Tata McGrawHill

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M.Tech. (II Sem.) **17CO10 - BIG DATA ANALYTICS**

L	T	P	Cr.
3	-	-	3

Prerequisites: Fundamentals of Cloud Computing, Data Mining

Course Objectives:

- To understand big data analytics as the next wave for businesses looking for competitive advantage
- To understand the financial value of big data analytics
- To explore tools and practices for working with big data
- To understand how big data analytics can leverage into a key component
- To understand how to mine the data
- To learn about stream computing
- To know about the research that requires the integration of large amount of data.

Course Outcomes:

CO1	Analyze the big data for useful business applications
CO2	To impart theoretical knowledge related to Data Analytics
CO3	To impart theoretical knowledge related to Stream Computing
CO4	Students will apply data science concepts and methods to solve problems in Predictive Analytics
CO5	Learn to build and maintain reliable, scalable, distributed systems with Apache Hadoop

UNIT - I

-INTRODUCTION TO BIG DATA Analytics – Nuances of big data – Value – Issues – Case for Big data – Big data options Team challenge – Big data sources – Acquisition – Nuts and Bolts of Big data. Features of Big Data - Security, Compliance, auditing and protection - Evolution of Big data – Best Practices for Big data Analytics - Big data characteristics.

UNIT - II

DATA ANALYSIS Evolution of analytic scalability – Convergence – parallel processing systems – Cloud computing – grid computing – map reduce – enterprise analytic sand box – analytic data sets – Analytic methods.

UNIT - III

STREAM COMPUTING Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window.

UNIT - IV

PREDICTIVE ANALYTICS AND VISUALIZATION 9Predictive Analytics – Supervised – Unsupervised learning – Neural networks – Kohonen models – Normal – Deviations from normal patterns - Mining Frequent item sets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm –Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data Visualizations - Visual data analysis techniques.

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UNIT - V

FRAMEWORKS AND APPLICATIONS 9 IBM for Big Data – Map Reduce Framework - Hadoop – Hive - – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Hbase – Impala – Analysing big data with twitter – Big data for E-commerce .

TEXT BOOKS

1. Frank J Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley and SAS Business Series, 2012.
2. Colleen Mccue, "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis", Elsevier, 2007
3. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007. 4. AnandRajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.

REFERENCES

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with
2. Analytics", Wiley and SAS Business Series, 2012.
3. Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill, 2011.
4. Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch , James Giles, David Corrigan, "Harness the Power of Big data – The big data platform", McGraw Hill, 2012. 8. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007 9. Pete Warden, Big Data Glossary, O'Reilly, 2011. 10. Jiawei Han, MichelineKamber "Data Mining Concepts and Techniques", Second Edition,

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M.Tech. (II Sem.) **17CO11 - INTERNET OF THINGS**

L	T	P	Cr.
3	-	-	3

Prerequisites: Fundamentals of ad-hoc networks and computer networks

Course Objectives:

- Understand the vision of IoT from a global context.
- Understand the application of IoT.
- Determine the Market perspective of IoT.
- Use of Devices, Gateways and Data Management in IoT.
- Building state of the art architecture in IoT.
- Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.

Course Outcomes:

CO1: Vision and Introduction to IoT

CO2: Understand IoT Market perspective

CO3: Understand State of the Art – IoT Architecture.

CO4: Data and Knowledge Management and use of Devices in IoT Technology

CO5: Real World IoT Design with Privacy and Security

UNIT - I

IoT& Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Security, Privacy & Trust, Device Level Energy Issues.

UNIT - II

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, M2M to IoT-An Architectural Overview– Building an architecture, Main design principles, An IoT architecture outline, standards considerations.

UNIT - III

IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

UNIT - IV

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

UNIT - V

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie , Security.

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TEXT BOOKS

1. VijayMadisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1 st Edition, VPT, 2014.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013.

REFERENCE

CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493

M.Tech. (II Sem.)	17CO12 - CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	Cr.
		3	-	-	3

Prerequisites: Fundamentals of Information Security

Course Objectives:

- Understand OSI security architecture and classical encryption techniques.
- Acquire fundamental knowledge on the concepts of finite fields and number theory. Understand various block cipher and stream cipher models.
- Describe the principles of public key cryptosystems, hash functions and digital signature.

Course Outcomes:

CO1 Analyze the basic concepts of cryptography and network security and classify attacks on a network

CO2 Analyze the different process for hiding the information with conventional cryptographic algorithms

CO3 Understand the working of various block cipher cryptosystems

CO4 Analyze public cryptosystems and disseminate from conventional systems for the security

CO5 Apply authentication techniques to provide secure communication.

UNIT I

Introduction: Confidentiality -- Data Integrity -- Authentication -- Non-Repudiation. -- Overview of Issues involved. Classical Encryption Techniques: Mono alphabetic, Substitution Methods, Polyalphabetic Substation Methods -- Permutation Methods – Cryptanalysis of these Methods.

UNIT II

Modern Encryption Techniques: Simplified DES -- DES -- Triple DES -- Block Cipher, Design Principles -- Block Cipher Modes of Operation. IDEA -- Security Issues Involved with these methods. Confidentiality Using Conventional Encryption: Placement of Encryption -- Traffic Confidentiality -- Key Distribution -- Random Number Generation.

UNIT III

Introduction to Number Theory :(Basics Pertaining to Security Related Algorithms). Public Key Cryptography: Principles -- RSA Algorithm.

UNIT IV

Message Authentication and Hash Functions -- Hash an MAC Algorithms. Digital Signatures and Authentication Protocols -- Authentication Applications.

UNIT V

Basic Overview of Electronic Mail Security -- IP Security -- WEB Security.
System Security: Intruders, Viruses and Worms – Firewalls.

TEXT BOOK

Cryptography and Network Security, William Stallings. (Second Edition) Pearson Education, Asia.

REFERENCE:

Network Security: The Complete Reference.by Roberta Bragg, Mark Phodes-Ousley, Keith. Strassberg Tata Mcgraw-Hill.

M.Tech. (II Sem.) **17CO13 - ADVANCED DATA MINING**

L	T	P	Cr.
3	-	-	3

Prerequisites: Fundamentals of Data mining

Course Objectives:

- To develop the abilities of critical analysis to data mining systems and applications.
- To implement practical and theoretical understanding of the technologies for data mining
- To understand the strengths and limitations of various data mining models.

Course Outcomes:

CO1	To introduce students to the basic concepts and techniques of Data Mining
CO2	Understand the Advance Classification techniques
CO3	Analyze advance clustering methods
CO4	Understand Web and Text Mining
CO5	Learn Temporal and Spatial Data Mining

UNIT - I

Data mining Overview and Advanced Pattern Mining Data mining tasks – mining frequent patterns, associations and correlations, classification and regression for predictive analysis, cluster analysis , outlier analysis; advanced pattern mining in multilevel, multidimensional space – mining multilevel associations, mining multidimensional associations, mining quantitative association rules, mining rare patterns and negative patterns.

UNIT - II

Advance Classification Classification by back propagation, support vector machines, classification using frequent patterns, other classification methods – genetic algorithms, roughest approach, fuzz>set approach;

UNIT -III

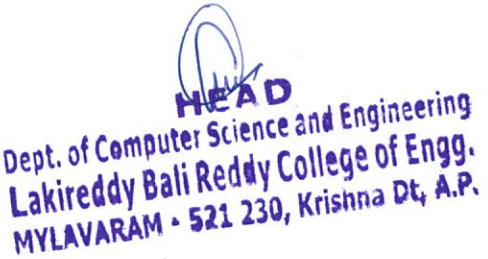
Advance Clustering Density - based methods –DBSCAN, OPTICS, DENCLUE; Grid-Based methods – STING, CLIQUE; Exception – maximization algorithm; clustering High-Dimensional Data; Clustering Graph and Network Data.

UNIT - IV

Web and Text Mining Introduction, web mining, web content mining, web structure mining, we usage mining, Text mining – unstructured text, episode rule discovery for texts, hierarchy of categories, text clustering.

UNIT - V

Temporal and Spatial Data Mining Introduction; Temporal Data Mining – Temporal Association Rules, Sequence Mining, GSP algorithm, SPADE, SPIRIT Episode Discovery, Time Series Analysis, Spatial Mining – Spatial Mining Tasks, Spatial Clustering. Data Mining Applications.



TEXT BOOKS

1. Data Mining Concepts and Techniques, Jiawei Hang MichelineKamber, Jianpei, Morgan Kaufmannn.
2. Data Mining Techniques – Arun K pujari, Universities Press.

REFERENCES

1. Introduction to Data Mining – Pang-Ning Tan, Vipinkumar, Michael Steinbach, Pearson.
2. Data Mining Principles & Applications – T.V Sveresh Kumar, B.Esware Reddy, JagadishSKalimani, Elsevier.

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M.Tech. (II Sem.)	17CO14 - TCP/IP NETWORKING	L	T	P	Cr.
		3	-	-	3

Prerequisites: Fundamentals of Networks

Course Objectives:

- TCP/IP is arguably the single most important computer networking technology.
- The Internet and most home networks support TCP/IP as communication protocol.
- This course provides a foundation to understand various principles, protocols and design aspects of Computer Network and also helps to achieve the fundamental purpose of computer networks in the form of providing access to shared resources.

Course Outcomes:

CO1 Will have knowledge and understanding of TCP/IP, OSI
CO2 Will develop their skills Network Layer Protocols
CO3 Understand Transport Layer Protocols
CO4 Learn Concurrent Processing in Client-Server environment
CO5 To impart theoretical knowledge Next Generation Internet Protocol

UNIT I
INTRODUCTION TO COMPUTER NETWORKS
Introduction to Layered Architecture (TCP/IP, OSI), Networking Devices, IP addressing, Subnetting, VLSM, CIDR.

UNIT II
NETWORK LAYER PROTOCOLS
Router IOS- Static and Default Routing-Interior Gateway Routing Protocols: RIPV1&V2, OSPF, EIGRP- Exterior Gateway Routing Protocol: BGP

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UNIT III
TRANSPORT LAYER PROTOCOLS
TCP & UDP datagram and its characteristics, RTP, Flow Control and Error Control Mechanisms, Silly Window Syndrome - Clark's and Nagle Algorithm - Congestion Control Mechanisms - Token Bucket and Leaky Bucket.

UNIT IV
SOCKET PROGRAMMING
Introduction to socket programming- Concurrent Processing in Client-Server Software-Byte ordering and address conversion functions – Socket Interface - System calls used with sockets - Iterative server and concurrent server- Multi protocol and Multi service server- TCP/UDP Client server programs – Thread Creation and Termination – TCP Echo Server using threads- Remote Procedure Call.

UNIT V
NEXT GENERATION INTERNET PROTOCOL
Introduction to IPv6 – IPv6 Advanced Features –V4 and V6 header comparison – V6 Address types –Stateless auto configuration – IPv6 routing protocols – IPv4-V6 Tunneling and Translation Techniques.

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TEXT BOOK

Behrouz A. Forouzan, "Data Communications and Networking", McGraw-Hill, 5thedition, ISBN- 10: 0073376221, ISBN-13: 978-0073376226, 2012.

REFERENCE

Douglas E. Comer,"Internetworking with TCP/IP, Principles, Protocols, and Architecture", Addison-Wesley, 5thedition, Vol 1, ISBN-10: 0131876716 | ISBN-13: 978-0131876712, 2005.

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M.Tech. (II Sem.)	17CO15 - SOFTWARE TESTING AND QUALITY ASSURANCE	L	T	P	Cr.
		3	-	-	3

Prerequisites: Fundamentals of Software Engineering

Course Objectives:

- To understand software quality assurance framework and standards.
- To understand various software quality assurance metrics and measurements.
- To apply software quality assurance metrics.
- To understand software testing environment.
- To understand various software testing techniques.

Course Outcomes:

CO1 An ability to understand the quality management in software

CO2 To analyse the different types of models for quality assurance

CO3 To measure various business process reengineering

CO4 To know how to prevent the defects

CO5 To Learn risk management in software process

UNIT I

Software Quality Assurance Framework and Standards SQA Framework: What is Quality? Software Quality Assurance, Components of Software Quality Assurance – Software Quality Assurance Plan: Steps to develop and implement a Software Quality Assurance Plan – Quality Standards: ISO 9000 and Companion ISO Standards, CMM, CMMI, PCMM, MalcomBalridge, 3 Sigma, 6 Sigma

UNIT II

Software Quality Assurance Metrics and Measurement Software Quality Metrics: Product Quality metrics, In-Process Quality Metrics, Metrics for Software Maintenance, Examples of Metric Programs.

UNIT III

Software Quality metrics methodology: Establish quality requirements, Identify Software quality metrics, Implement the software quality metrics, analyse software metrics results, validate the software quality metrics – Software quality indicators – Fundamentals in Measurement theory.

UNIT IV

Software Testing Strategy and Environment: Establishing testing policy, structured approach to testing, test factors, Economics of System Development Life Cycle (SDLC) Testing, Software Testing Methodology- Defects hard to find, verification and validation, functional and structural testing, workbench concept, eight considerations in developing testing methodologies, testing tactics checklist.

UNIT V

Software Testing Techniques

Black-Box, Boundary value, Bottom-up, Branch coverage, Cause-Effect graphing, CRUD, Database, Exception, Gray-Box, Histograms, Inspections, JADs, Pareto Analysis, Prototyping, Random Testing, Risk-based Testing, Regression Testing, Structured Walkthroughs, Thread Testing, Performance Testing, White-Box Testing

TEXT BOOKS

1. Effective Methods for Software Testing, 2nd Edition, William E. Perry, Second Edition, Wiley India, 2006.
2. Software Quality, Mordechai Ben-Menachem/Garry S. Marliss, Thomson Learning Publication, 1997.

REFERENCES

1. Testing and Quality Assurance for Component-based Software, by Gao, Tsao and Wu, Artech House Publishers
2. Software Testing Techniques, by BoriesBeizer, Second Edition, Dreamtech Press
3. Managing the Testing Process, by Rex Black, Wiley
4. Handbook of Software Quality Assurance, by G. Gordon Schulmeyer, James I.McManus, Second Edition, International Thomson Computer Press
5. Software Testing and continuous Quality Improvement, by William E.Lewis, GunasekaranVeerapillai, Second Edition, Auerbach Publications

M.Tech. (II Sem.) **17CO16 - NEURAL NETWORKS**

L	T	P	Cr.
3	-	-	3

Prerequisites: Fundamentals of artificial intelligence

COURSE OBJECTIVES:

- To understand the basic concepts of neurons, perceptron's and back propagation networks.
- To understand feed forward and recurrent networks.
- To understand Support Vector Machines and Linear regression.
- To understand different types of unsupervised neural networks.
- To understand adaptive resonance theory and its applications.

Course Outcomes:

CO1: Describe models of the brain and neuron function with mathematical methods.

CO2: Design and develop artificial neural networks in software.

CO3: Describe more complex neural networks and the training methods for the same.

CO4: The Student Learn Unsupervised Learning Networks

CO5: The student will have a broad knowledge in developing the different algorithms for neural networks

UNIT I

Biological Neural Networks - Artificial Neuron- Activation Functions, Learning rules, Hebb Network- Perceptron Networks- Adaline- Madaline-Back propagation networks, Learning factors- Linear Separability.

UNIT II

Single Layer Feedback Networks- Hopfield Network-Associative Memories- Recurrent auto association memory –Bidirectional Associative memory-Boltzmann machine.

UNIT III

Support Vector Machines Optimal Hyper plane for Linearly Separable Patterns and Non separable Patterns – Support Vector Machine for Pattern Recognition – XOR Problem – Support Vector Machines for Nonlinear Regression.

UNIT IV

Unsupervised Learning Networks Neural Network based on competition - Maxnet -Hamming Network- Self-Organizing feature Maps- Learning Vector Quantization Adaptive Resonance Theory.

UNIT V

Building Blocks of Adaptive Resonance – Substrate of Resonance Structural Details of Resonance Model – Adaptive Resonance Theory – Applications.

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TEXT BOOKS

1. LaureneFausette, "Fundamentals of Neural Networks", Pearson Education, New Delhi, 2004.
2. Satish Kumar, "Neural Networks: A Classroom Approach", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2004.
3. Simon Haykin, "Neural Networks: A Comprehensive Foundation", 2ed.,Addison Wesley Longman (Singapore) Private Limited, Delhi, 2001.

REFERENCES

1. Limin Fu, "Neural Networks in Computer Intelligence" Tata McGraw Hill Publishing Company, New Delhi, 2006.
2. Sivanandam S N and Paul raj M, "Introduction to Artificial Neural Networks", Vikas Publishing House Private Limited, New Delhi, 2003.
3. Rajasekaran S and VijayalakshmiPai G A, "Neural Networks, Fuzzy Systems and Genetic Algorithms", Prentice Hall of India, New Delhi, 2003.
4. Haykins, "Neural Networks – A Comprehensive foundation", Prentice Hall of India, New Delhi, Second Edition 2003.
5. Zimmermann H J, "Fuzzy set theory and its Applications", Allied Publishers Ltd, New Delhi, 1999.

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M.Tech. (II Sem.) **17CO17 - WEB AND DATABASE SECURITY**

L	T	P	Cr.
3	-	-	3

Prerequisites: Web technologies and Information security

Course Objective:

- To have a wide understanding of the various threats in the internet.
- To gain knowledge about security threats at user and sever level, transaction level.
- To know about commerce and legal issues in the web.

Course Outcomes:

CO1: Understand security-related issues in Web-based systems and applications
CO2: Be able to evaluate a Web-based system with respect to its security requirements
CO3: Understand the fundamental mechanisms of securing a Web-based system
CO4: Be able to implement security mechanisms to secure a Web-based application
CO5: Understand security issues and common controls in electronic commerce systems

UNIT I

Introduction to web security: World Wide Web Architecture, Threats, Landscape, User Security, Server Security, Data Security, Cryptography

UNIT II

Web-User level security: Privacy-protection Techniques and Technologies, Backup and Antitheft, Plugins, JavaScript, Flash, Digital Certificates – Server and Client, Code Signing-Server level security: Physical security, Host security, SSL certificates,

UNIT III

Web Service Security, Web Application Security, and Secure Programming-Transaction level security

UNIT IV

Security infrastructure: SSL/TLS protocol, Secure Authentication and Messaging, Public Key Infrastructure, Firewall solutions, Intrusion Detection System, Disaster Recovery and Backups-Commerce

UNIT V

Digital Payments, Blocking Software and Censorship Technologies, Legal issues: Civil and Criminal, Intellectual Property and Actionable Content.

TEXT BOOKS

Simpson Garfinkel, Gene Spafford, Web Security, Privacy and Commerce, O'Reilly, Second Edition, 2002. ISBN: 978-0-596-00045-5.

REFERENCES

1. ShwetaBhasin, Web Security Basics, Premier Press, 2003. ISBN: 1-59200-006-1.
2. Simpson Garfinkel, Eugene H. Spafford, Web Security and Commerce, O'Reilly, First Edition. ISBN: 1-56592-269-7.

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M.Tech. (II Sem.) **17CO18 - GRAPH ANALYTICS**

L	T	P	Cr.
3	-	-	3

Prerequisites: Fundamentals Data Mining, Data Structures

Course Objectives

1. To understand Matching concepts and algorithms relevant to that.
2. Able to solve extremal problems and chromatic numbers.
3. To identify different models of directed and random graphs.
4. To understand Hamiltonian paths and cycles.

Course Outcomes

CO1: Explore the graph analytic techniques and its applications

CO2: Model a problem into a graph database and perform analytical tasks over the graph in a scalable manner

CO3: Understand the External problems in graph theory

CO4: Learn the fundamentals of Directed Graphs

CO5: To impart theoretical knowledge of Random graphs

UNIT I

Review of basics- Graphs and digraphs, incidence and adjacency matrices, isomorphism. Trees: Equivalent definitions of trees, minimum spanning trees. Cut vertices, cut edges, Paths and Cycles: Euler tours, Hamilton paths and cycles.

UNIT II

Matchings-Matchings: Berge's Theorem, perfect matchings, Hall's theorem, Tutte's theorem, Konig's theorem, algorithms for matching and weighted matching (in both bipartitie and general graphs), factors of graphs (decompositions of the complete graph).

UNIT III

Extremal problems- Independent sets and covering numbers, Turan's theorem, Ramsey theorems; Colorings: Brooks theorem, the greedy algorithm, the Welsh-Powell bound, critical graphs, chromatic polynomials, girth and chromatic number.

UNITIV

Directed Graphs - Tournaments, directed paths and cycles, connectivity and strongly connected digraphs, branching.

UNIT V

Random Graphs:-The basic models - use of expectations, simple properties of almost all graphs, almost determined variables – use of variance, Hamiltonian cycles, the phase transition.

TEXT BOOKS

1. Douglas B. West, Introduction to Graph Theory, Prentice Hall of India. 2002.
2. NarsinghDeo, Graph Theory with Applications to Engineering and Computer Science. Prentice-Hall. 2004.
3. Frank Harary, Graph Theory, Narosa. 2000.
4. R. Ahuja, T. Magnanti, and J. Orlin, Network Flows: Theory, Algorithms, and Applications, Prentice-Hall.

REERENCES

1 Bollobas, Bela, Modern Graph Theory, Springer.
2 Diestel, R. Graph Theory, Springer.

M.Tech. (II Sem.) **17CO62 - BIG DATA ANALYTIC LAB**

L	T	P	Cr.
-	-	2	1

Prerequisites: Programming Fundamentals Java and R

Course Outcomes:

CO1 Set up single and multi-node Hadoop Clusters

CO2 Apply Map Reduce algorithms for various algorithms

CO3 Design new algorithms that uses Map Reduce to apply on Unstructured and structured data

Week 1

- **Downloading and installing Hadoop**
- **Understanding different Hadoop modes**
- **Startup scripts & Configuration files**

Week: 2

- Setting up Hadoop pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux.

Week: 3

- **After successful installation on one node, configuration of a multi-node Hadoopcluster(one master and multiple slaves)**

Week: 4

Implement the following file management tasks in Hadoop:

- Adding files and directories
- Retrieving files & Deleting files

Week:5

- Implement Matrix Multiplication with Hadoop Map Reduce

Week:6

- Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

Week:7

- Running Word Counting on a Remote Cluster

Week:8

- K-means clustering using map reduce

Week 8

- Understanding Hive
- Installing Hive & Setting up Hive configurations
- Practice Hive with example

Week 9:

- Installing HBase & thrift
- Practice HBase with example

Week 10:

- Practice Importing and Exporting Data from Various DBs

Reference text

Big Data Analytics with R and Hadoop--VigneshPrajapati--2013 Packt Publishing

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L	T	P	Cr.
-	-	2	1

M.Tech. (II Sem.) **17CO63 - INTERNET OF THINGS LAB**

Prerequisites: Programming Skills of Java

Course Objectives

- Understand the Eclipse IoT Project.
- Understand the architecture of IoT Toolkit
- Understand the gateway-as-a-service deployment in IoT toolkit
- Understand the working principle of Raspberry Pi
- Understand the API gateway service reference implementation in IoT toolkit.

Course Outcomes

CO1: Set up eclipse IoT Project

CO2: Design projects on Raspberry Pi

CO3: Implement API gateway service on IoT Tool Kit

Syllabus:

1. Exercise on Eclipse IoT Project.
2. Experiments on few Eclipse IoT Projects.
3. Any experiment of architecture of IoT Toolkit.
4. Exercise on smart object API gateway service reference implementation in IoT toolkit.
5. Experiment on HTTP- to-CoAP semantic mapping proxy in IoT toolkit.
6. Experiment on gateway-as-a-service deployment in IoT toolkit.
7. Experiment on application framework and embedded software agents for IoT toolkit.
8. Exercise on working principle of Raspberry Pi.
9. Experiment on Connectivity of Raspberry Pi with existing system components.

REFERENCES

1. https://github.com/connectIOT/iottoolkit .
2. https://www.arduino.cc/
3. http://www.zettajs.org/
4. Contiki (Open source IoT operating system) .
5. Arduino (open source IoT project).
6. IoT Toolkit (smart object API gateway service reference implementation) .
7. Zetta (Based on Node.js, Zetta can create IoT servers that link to various devices and Sensors)

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M.Tech. (II Sem.) **17CO91 - INFORMATION RETRIEVAL SYSTEMS**

L	T	P	Cr.
3	-	-	3

Prerequisites: Fundamentals databases

Course Objectives:

- To use different information retrieval techniques in various application areas
- To apply IR principles to locate relevant information large collections of data
- To analyze performance of retrieval systems when dealing with unmanaged data sources
- To implement retrieval systems for web search tasks.

Course Outcomes:

CO1: Understand the underlined problems related to IR

CO2: Learn vector space model

CO3: Understand XML retrieval systems

CO4: Understand and deploy efficient techniques for the indexing of document objects that are to be retrieved

CO5: Implement features of retrieval systems for web-based and other search tasks

UNIT I

Boolean retrieval. The term vocabulary and postings lists. Dictionaries and tolerant retrieval. Index construction. Index compression.

UNIT II

Scoring, term weighting and the vector space model. Computing scores in a complete search system. Evaluation in information retrieval. Relevance feedback and query expansion.

UNIT III

XML retrieval. Probabilistic information retrieval. Language models for information retrieval. Text classification. Vector space classification.

UNIT IV

Support vector machines and machine learning on documents, Flat clustering, Hierarchical clustering, Matrix decompositions and latent semantic indexing.

UNIT V

Web search basics. Web crawling and indexes, Link analysis.

TEXT BOOK

Introduction to Information Retrieval , Christopher D. Manning and PrabhakarRaghavan and HinrichSchütze, Cambridge University Press, 2008.

REFERENCES

1. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark T Maybury, Springer.
2. Modern Information Retrieval, Ricardo Baeza-Yates, Pearson Education, 2007.
3. Information Retrieval: Algorithms and Heuristics, David A Grossman and OphirFrieder, 2nd Edition, Springer, 2004.
4. Information Retrieval Data Structures and Algorithms, William B Frakes, Ricardo BaezaYates, Pearson Education, 1992.
5. Information Storage &Retieval, Robert Korfhage, John Wiley & Sons.

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M.Tech. (III Sem.)	17CO19 - WEB MINING	L	T	P	Cr.
		3	-	-	3

Prerequisites: Fundamentals of Data Mining

Course Objective

- To understand the characteristics of the Internet and data mining
- To know about the web crawling algorithm implementation
- To study the web data collection and analysis of web data for new patterns

Course Outcomes:

CO1: Build a sample search engine using available open source tools
CO2: Analyze social media data using appropriate data/web mining techniques
CO3: Understand Structured Data Extraction
CO4: Design a system to harvest information available on the web to build recommender systems
CO5: Identify the different components of a web page that can be used for mining

UNIT I

INTRODUCTION: World Wide Web, History of the Web and the Internet, What is Data Mining? What is Web Mining? Introduction to Association Rule Mining, Supervised Learning & Unsupervised Learning. Information Retrieval and Web Search: Basic Concepts of Information Retrieval, Information Retrieval Models, Relevance Feedback, Evaluation Measures, Text and Web Page Pre-Processing, Inverted Index and Its Compression, Latent Semantic Indexing, Web Search, Meta-Search: Combining Multiple Rankings, Web Spamming.

UNIT II

Social Network Analysis: Introduction, Co-Citation and Bibliographic Coupling, PageRank, HITS Algorithm, Community Discovery. Web Crawling: A Basic Crawler Algorithm, Implementation Issues, Universal Crawlers, Focused Crawlers, Topical Crawlers, Evaluation, Crawler Ethics and Conflicts.

UNIT III

Structured Data Extraction: Wrapper Generation, Preliminaries, Wrapper Induction, Instance-Based Wrapper Learning, And Automatic Wrapper Generation: Problems, String Matching and Tree Matching, Building DOM Trees, Extraction Based on a Single List Page, Extraction Based on Multiple Pages.

UNIT IV

Information Integration: Introduction to Schema Matching, Pre-Processing for Schema Matching, Schema -Level Matching, Domain and Instance-Level Matching, Combining Similarities, 1: m Match, Integration of Web Query Interfaces, Constructing a Unified Global Query Interface. Opinion Mining and Sentiment Analysis: The Problem of Opinion Mining, Document Sentiment Classification, Sentence Subjectivity and Sentiment Classification, Opinion Lexicon Expansion, Aspect-Based Opinion Mining, Opinion Search and Retrieval, Opinion Spam Detection.

UNIT V

Web Usage Mining: Data Collection and Pre-Processing, Data Modeling for Web Usage Mining, Discovery and Analysis of Web Usage Patterns, Recommender Systems and Collaborative Filtering, Query Log Mining, Computational Advertising.

TEXT BOOK

Wilbert Liu, Bing," Web Data Mining", 2nd Edition.Elseiver, 2011.

REFERENCE

SoumenChakrabarti, "Mining the Web", Morgan-Kaufmann Publishers, Elseiver, 2002.

M.Tech. (III Sem.)	17CO20 - STORAGE AREA NETWORKS	L	T	P	Cr.
		3	-	-	3

Prerequisites: Fundamentals of Networks

Course Objectives

- To understand Storage Area Networks characteristics and components.
- To become familiar with the SAN vendors and their products
- To learn Fibre Channel protocols and how SAN components use them to communicate with each other
- To become familiar with Cisco MDS 9000 Multilayer Directors and Fabric Switches Thoroughly learn Cisco SAN-OS features.
- To understand the use of all SAN-OS commands. Practice variations of SANOS features

Course Outcomes:

CO1 Identify and describe the functions to build data center networking for switch network
CO2 Describe the different types of RAID implementations and their benefits.
CO3 Describe the benefits of the different network storage options for different application environments
CO4 Identify single points of failure in a storage infrastructure and list solutions.
CO5 Identify and analyzes the common threats in each domain.

UNIT I

Introduction to Storage Technology, Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data centre infrastructure, role of each element in supporting business activities

UNIT II

Storage Systems Architecture Hardware and software components of the host environment, Key protocols and concepts used by each component ,Physical and logical components of a connectivity environment ,Major physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics, and performance Implications, Concept of RAID and its components , Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Compare and contrast integrated and modular storage systems ,High-level architecture and working of an intelligent storage system

UNIT III

Introduction to Networked Storage Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IPSAN, Benefits of the different networked storage options, understand the need for long-term archiving solutions and describe how CAS fulfils the need, understand the appropriateness of the different networked storage options for different application environments

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UNIT IV

Information Availability & Monitoring & Managing Data centre , List reasons for planned/unplanned outages and the impact of downtime, Impact of downtime, Differentiate between business continuity (BC) and disaster recovery (DR) ,RTO and RPO, Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures , Architecture of backup/recovery and the different backup/recovery topologies , replication technologies and their role in ensuring information availability and business continuity, Remote replication technologies and their role in providing disaster recovery and business continuity capabilities Identify key areas to monitor in a data centre, Industry standards for data centre monitoring and management, Key metrics to monitor for different components in a storage infrastructure, Key management tasks in a data centre.

UNIT V

Securing Storage and Storage Virtualization Information security, Critical security attributes for information systems, Storage security domains, List and analyses the common threats in each domain, Virtualization technologies, block-level and file level virtualization technologies and processes.

TEXT BOOK

EMC Corporation, Information Storage and Management, Wiley

REFERENCES

1. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 2003.
2. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne, 2001.
3. Meeta Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002.

M.Tech. (III Sem.) **17CO21 - SOFTWARE PROJECT MANAGEMENT**

L	T	P	Cr.
3	-	-	3

Prerequisites: Fundamentals of Software Engineering

Course Objectives

- To develop skills in software project management
- The topics include-software economics; software development life cycle; artifacts of the process; workflows; checkpoints; project organization and responsibilities; project control and process instrumentation;

Course Outcomes:

CO1: Identify the basic concepts and issues of software project management, Parameters to be considered to improve the software economics.

CO2: Apply SDLC methodology for development and identification of artifacts for each lifecycle phases.

CO3: Apply activities necessary to successfully complete and close the software projects using all the checkpoints in development process.

CO4: Apply the metrics for assessing the quality and cost; Acquire knowledge about automation building blocks and organization structure.

CO5: Identify the elements of tailoring process and future software project management along with case study (CCPDS).

UNIT I

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software costestimation.

UNIT II

Improving Software Economics: Reducing Software product size, improving softwareprocesses, improving team effectiveness, improving automation, Achieving required quality, Peer inspections. The old way and the new: The principles of conventional softwareEngineering, principles of modern software management, transitioning to an iterativeprocess.

UNIT III

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts,programmaticartifacts. Model based software architectures: A Management perspectiveand technical perspective. Work Flows of the process: Software process workflows,Iteration workflows.

UNIT IV

Checkpoints of the process: Major mile stones, Minor Milestones, Periodic status assessments. Iterative Process Planning: work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

Project Organizations and Responsibilities: Line-of-Business Organizations, ProjectOrganizations, evolution of Organizations. Process Automation: Automation Building blocks,The Project Environment.

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UNIT V

Project Control and Process instrumentation: The seven core Metrics, Management Indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics Automation. Tailoring the Process: Process discriminates.

Future Software Project Management: modern Project Profiles, Next generation Software Economics, modern process transitions.

Case Study: The command Centre Processing and Display system- Replacement (CCPDSR).

TEXT BOOK

Software Project Management, Walker Royce: Pearson Education, 2005.

REFERENCES

1. Software Project Management, Bob Hughes and Mike Cotterell: Tata McGraw-Hill Edition.
2. Software Project Management, Joel Henry, Pearson Education.
3. Software Project Management in practice, PankajJalote, Pearson Education.2005.

M.Tech. (III Sem.) **17CO22 - PATTERN RECOGNITION**

L	T	P	Cr.
3	-	-	3

Prerequisites: Fundamentals of Image Processing

Course Objectives:

- Understand the concept of patterns and the basic approach to the development of pattern recognition algorithms.
- Understand and apply methods for data pre-processing, feature extraction, and feature selection to multivariate data.
- Understand and apply supervised and unsupervised classification methods to detect and characterize patterns in real-world data.
- To develop prototype for pattern recognition algorithms that can be used to study.

Course Outcomes:

CO1 Understand and apply various algorithms for pattern recognition

CO2 Bring out structural pattern recognition and feature extraction techniques

CO3 Learn about Supervised and unsupervised Learning.

CO4 Realize the clustering concepts and algorithms

CO5 Understand the process of Hidden Morkov Models

UNIT I

Introduction: Machine perception, pattern recognition example, pattern recognition systems, the design cycle, learning and adaptation.

Bayesian Decision Theory: Introduction, continuous features – two categories classifications, minimum error-rate classification- zero–one loss function, classifiers, discriminant functions, and decision surfaces.

UNIT II

Normal density: Univar ate and multivariate density, discriminant functions for the normal density different cases, Bayes decision theory – discrete features, compound Bayesian decision theory and context.

Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case.

UNIT III

Un-supervised learning and clustering: Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Date description and clustering.

UNIT IV

Similarity measures, criteria function for clustering. Component analyses: Principal component analysis, non-linear component analysis; Low dimensional representations and multi-dimensional scaling.

UNIT V

Discrete Hidden MorkovModels: Introduction, Discrete–time markov process, extensions to hidden Markov models, three basic problems for HMMs

Continuous hidden Markov models: Observation densities, training and testing with continuous HMMs, types of HMMs.

TEXT BOOKS

1. Richard O. Duda, Peter E. Hart and David G. *Stroke Pattern Classifications.* 2 ed Wiley Student Edition
2. LawerenceRabiner and Biing Hwang, *Fundamentals of Speech Recognition.* Pearson Education.

REFERENCE

Earl Gose, Richard John Baugh and Steve Jost, *Pattern Recognition and Image Analysis.* PHI, 2004.

M.Tech. (III Sem.) **17CO23 - COMPUTER FORENSICS**

L	T	P	Cr.
3	-	-	3

Prerequisites: Foundations of Information Security

Course objectives

- To get the Knowledge on basic digital forensics and techniques for conducting the forensic examination on different digital devices.
- To identify the procedure for High tech Investigations, data recovery workstations.
- To examine digital evidences such as the data acquisition, identification analysis.
- To apply forensic analysis tools to recover important evidence for identifying computer crime.
- Used for well-trained as next-generation computer crime investigators.

Course Outcomes:

CO1 Understand the definition of computer forensics fundamentals

CO2 Describe the types of computer forensics technology

CO3 Analyze various computer forensics systems.

CO4 Illustrate the methods for data recovery, evidence collection and data seizure.

CO5 Summarize duplication and preservation of digital evidence.

Prerequisites: Foundations of Information Security

UNIT I

Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

UNIT II

Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

UNIT III

Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

UNIT IV

Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case

.

UNIT V

Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

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TEXT BOOKS

1. Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, 2002.
2. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Guide to Computer Forensics andInvestigations, 2 ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5.

REFERENCE

Vacca, J, *Computer Forensics, Computer Crime Scene Investigation*, 2Ed, Charles River Media, 2005, ISBN: 1-58450-389.

M.Tech. (III Sem.) **17CO24 - DEEP LEARNING**

L	T	P	Cr.
3	-	-	3

Prerequisites: Foundations Neural Networks

Course Objectives

- Used to formalize tasks in terms of computational Complexity via Deep Learning Architectures.
- Used to design deep learning models via Statistical approaches to solve data-rich tasks
- Helpful to Build datasets, tune and train deep learning models with advanced deep learning libraries
- To understand the inner mechanisms of Deep learning Neural techniques during training
- To analyze the performance of Optimization techniques on tasks of interest

Course Outcomes:

CO1: Design deep architectures and algorithms for pattern recognition
CO2: Analyse classification problems probabilistically and estimate classifier performance
CO3: Explore the essentials of Deep Learning and Deep Network architectures
CO4: Define, train and use a Deep Neural Network for solving real world problems that require artificial Intelligence based solutions
CO5: Explore the essentials of Optimization for Training Deep Models

UNIT-I

Introduction: How do we train Deep Architectures, Intermediate Representations: Sharing Features and Abstractions Across Tasks, Desiderata for Learning AI, Computational Complexity, Local vs Non-Local Generalization.

UNIT-II

Probability and Information Theory: Why Probability, Random Variables, Probability Distributions, Conditional Probability, Independence and Conditional Independence, Expectation, Variance and Covariance, Information Theory, Common Probability Distributions.

UNIT-III

Neural Networks for Deep Architectures: Learning Algorithms, Generalization, Capacity, over fitting and under fitting, Generalization Error, Estimators, Bias and variance, Maximum Likelihood Estimation. Learning Mechanisms: Supervised Vs Unsupervised Learning,

UNIT -IV

Feed forward Deep learning Neural Networks: Introduction, Formalizing and Generalizing Neural Networks, Multi-Layer Neural Networks, The Challenge of Training Deep Neural Networks, Unsupervised Learning for Deep Architectures, Deep Generative Architectures, Convolutional Neural Networks, Auto-Encoders.

UNIT-V

Optimization for Training Deep Models: Optimization for Model Training: Empirical Risk minimization, generalization, Data parallelism.

Challenges in Optimization: Local Minima, III- Conditions, Plateaus, Saddle Points and Other flat regions.

Optimization Algorithms: Gradient Descent, Stochastic Gradient Descent, Momentum.

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TEXT BOOKS

1. Learning Deep Architectures for AI", Foundations and Trends® in Machine Learning, YoshuaBengio, 2009, Now Publishers
2. Deep Learning, YoshuaBengio Ian J. Goodfellow Aaron Courville, MIT Press, 2015

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1. Deep Learning in Python Prerequisites The LazyProgrammer(http://lazyprogrammer.me).
2. Deep Learning and Neural Networks, Jeff Heaton, Heaton Research, Inc 2015 Statistical Language Learning, Charniack, Eugene,MIT Press, 1993.