DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
B.Tech (R21 Regulation) COURSE STRUCTURE

IV YEAR I- SEMESTER

S.No.	Course Code	Course Title	Category	L	T	P	C
1	21CS4111	Data Warehousing and Data Mining	PC	3	-	-	3
2	21CS4112	Digital Forensics	PC	3	-	-	3
Professional Elective –III							
3	21CS4171	Deep Learning	PE	3	-	-	3
	21CS4172	Soft Computing	PE				
	21CS4173	Advanced Algorithms	PE				
	21CS4174	Cloud Computing	PE				
Professional Elective – IV							
4	21CS4175	Real Time Operating System	PE	3	-	-	3
	21CS4176	Ad-Hoc and Sensor Networks	PE				
	21CS4177	High Performance Computing	PE				
	21CS4178	Information Storage Management	PE				
5	**Open Elective III**		OE	3	-	-	3
PRACTICAL							
6	21CS4151	Data Warehousing and Data Mining Lab	PC	-	-	3	1.5
	21CS4152	Digital Forensics Lab	PC			3	1.5
7	21CS4181	Mini Project	PW	-	-	4	2
Total Credits				**15**	**0**	**10**	**20**

*__Note:__ Mini Project should be carried out during summer break after III year II semester

IV YEAR II-SEMESTER

S.No.	Course Code	Course Title	Category	L	T	P	C
1	21MB4211	Fundamentals of Management and Organizational Behavior	HS	3	-	-	3
Professional Elective – V							
2	21CS4271	Computer Vision	PE	3	-	-	3
	21CS4272	Blockchain Technology	PE				
	21CS4273	Internet of Things	PE				
	21CS4274	Software Testing Methodologies	PE				
Professional Elective - VI							
3	21CS4275	Big Data Management	PE	3	-	-	3
	21CS4276	Natural Language Processing	PE				
	21CS4277	Robotic Process Automation	PE				
	21CS4278	Security Analysis	PE				
Practical							
4	21CS4281	Major Project	PW	-	-	20	10
Total Credits				**9**		**20**	**19**

IV YEAR – I SEM

21CS4111: DATA WAREHOUSING AND DATA MINING

B.Tech. IV Year I Sem.

L	T	P	C
3	0	-	3

Prerequisites:

- Database Management Systems

Course Objectives:

- Understand data warehouse concepts, architecture, business analysis and tools.
- Understand various data pre-processing and data visualization techniques
- Understand various algorithms for finding hidden and interesting patterns in data
- Apply various classification and clustering techniques using tools.
- To make use of cluster Analysis.

Course Outcomes: Upon completion of the course, the students will be able to

- Demonstrate data mart to perform business analysis with OLAP tools.
- Analyse suitable pre-processing techniques for data analysis
- Apply association rule mining techniques for data analysis & find frequent patterns
- Apply and Analyse various classification techniques for data analysis
- Apply and Analyse various suitable clustering techniques for data analysis

UNIT-I:
DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP)

Data Warehousing and Business Analysis: - Data warehousing Components –Building a Data warehouse –Data Warehouse Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) –Typical OLAP Operations, OLAP and OLTP.

UNIT-II:
DATA MINING – INTRODUCTION

Introduction to Data Mining Systems, Knowledge Discovery Process, Data Mining Functionalities – Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures. - Architecture Of A Typical Data Mining Systems- Classification Of Data Mining Systems.

UNIT-III:
FREQUENT PATTERN ANALYSIS

Mining Frequent Patterns, Associations and Correlations, Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

UNIT-IV:
CLASSIFICATION- Issues Regarding Classification and Prediction, Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation –

Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy.

UNIT-V:

CLUSTERING

Cluster analysis- Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods- Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods –Outlier analysis-outlier detection methods.

TEXT BOOKS:

1. Jiawei Han and Micheline Kamber, ―Data Mining Concepts and Techniques‖, Third Edition, Elsevier, 2012.
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression,2014.
3. H.Dunham,"Data Mining:Introductory and Advanced Topics" Pearson Education.
4. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World : A Practical Guide for Building Decision Support Systems, Pearson Education.

REFERENCES:

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

21CS4112: DIGITAL FORENSICS

B.Tech. IV Year I Sem.

L	T	P	C
3	-	-	3

Prerequisites:

- Cyber security
- Applied Mathematics
- Information Technology

Course Objectives:

- To understand the basic digital forensics.
- To understand the basic techniques for conducting the forensic examination on different digital devices.
- To understand how to examine digital evidences such as the data acquisition, identification analysis.
- To understand how to examine Processing crimes and incident scenes.
- To Gain knowledge about Current computer forensics tools.

Course Outcomes: Upon completion of the course, the students will be able to

- Apply forensic analysis tools to recover important evidence for identifying computer crime.
- Apply To be well-trained as next-generation computer crime investigators.
- Analyze on Forensics acquisition tools.
- Analyze on Processing crimes and Scenes.
- Apply on validating and testing forensic software's.

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.

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 and Investigations, 2nd ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5.

REFERENCES:

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

21CS4171: DEEP LEARNING

(Professional Elective – III)

B.Tech IV Year I Sem

L	T	P	C
3	-	-	3

Prerequisites:

- Artificial Intelligence.
- Discreate Mathematics.

Course Objectives:

- To introduce the foundations of Artificial Neural Networks.
- To acquire the knowledge on Deep Learning Concepts.
- To learn various types of Artificial Neural Networks.
- To gain knowledge to apply optimization strategies.
- To gain knowledge to apply Speech Recognition.

Course Outcomes: Upon completion of the course, the students will be able to

- Understand the concepts of Neural Networks.
- Select the Learning Networks in modeling real world systems.
- Understand Regularization for Deep Learning
- Use an efficient algorithm for Deep Models.
- Apply optimization strategies for large scale applications.

UNIT - I

Deep Feedforward Networks: Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms, Historical Notes

UNIT - II

Regularization for Deep Learning:

Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under- Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi- Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop, and Manifold Tangent Classifier.

UNIT - III

Optimization for Training Deep Models, How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta- Algorithms

UNIT - IV

Convolutional Networks:

The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely

Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuro-scientific Basis for Convolutional Networks, Convolutional Networks and the History of Deep Learning

UNIT - V

Applications:

Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications.

TEXT BOOKS:

1. Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning (Adaptive Computation and Machine Learning series), MIT Press.

REFERENCE BOOKS:

1. Li Deng and Dong Yu, Deep Learning Methods and Applications, Foundations and Trends® in Signal Processing Volume 7 Issues 3-4, ISSN: 1932-8346.
2. Dr. N.D. Lewis, Deep Learning Made Easy with R A Gentle Introduction for Data Science. Create Space Independent Publishing Platform (January 10, 2016).
3. François Chollet, JJ Allaire, MEAP Edition Manning Early Access Program Deep Learning with R Version 1, Copyright 2017 Manning Publications.

21CS4172: SOFT COMPUTING
(Professional Elective- III)

B.Tech. IV Year I Sem.

L	T	P	C
3	-	-	3

Prerequisites:
- Artificial Intelligence.
- Discreate Mathematics.

Course Objectives:
- Familiarize with soft computing concepts
- Introduce and use the idea of fuzzy logic and use of heuristics based on human experience
- Familiarize the Neuro-Fuzzy mode ling using Classification and Clustering techniques
- Learn the concepts of Genetic algorithm and its applications
- Acquire the knowledge of Rough Sets.

Course Outcomes: Upon completion of the course, the students will be able to
- Identify the difference between Conventional Artificial Intelligence to Computational Intelligence.
- Understand fuzzy logic and reasoning to handle and solve engineering problems
- Apply the Classification and clustering techniques on various applications.
- Understand the advanced neural networks and its applications
- Perform various operations of genetic algorithms and Rough Sets.
- Comprehend various techniques to build model for various applications

UNIT-I

Introduction to Soft Computing: Evolutionary Computing, "Soft" computing versus "Hard" computing, Soft Computing Methods, Recent Trends in Soft Computing, Characteristics of Soft computing, Applications of Soft Computing Techniques.

UNIT-II

Fuzzy Systems: Fuzzy Sets, Fuzzy Relations, Fuzzy Logic, Fuzzy Rule-Based Systems

UNIT-III

Fuzzy Decision Making, Particle Swarm Optimization

UNIT-IV

Genetic Algorithms: Basic Concepts, Basic Operators for Genetic Algorithms, Cross over and Mutation Properties, Genetic Algorithm Cycle, Fitness Function, Applications of Genetic Algorithm.

UNIT-V

Rough Sets, Rough Sets, Rule Induction, and Discernibility Matrix, Integration of Soft Computing Techniques.

TEXTBOOK:

1. Soft Computing–Advances and Applications an 2015 by B.K.Tripathy and J.Anuradha – Cengage Learning

REFERENCES:

1. N.Sivanandam & S.N.Deepa, "Principles of Soft Computing", 2ndedition,Wiley India,2008.
2. DavidE. Goldberg, "Genetic Algorithms- In Search, optimization and Machine learning", Pearson Education.
3. J.S.R.Jang,C.T.SunandE.Mizutani,"Neuro-Fuzzy and SoftComputing",Pearson Education,2004.
4. G.J.Klir&B.Yuan, "FuzzySets & Fuzzy Logic",PHI,1995.
5. Melanie Mitchell, "An Introduction to Genetic Algorithm",PHI,1998.
6. TimothyJ.Ross,"FuzzyLogic with Engineering Applications", McGraw- Hill International editions,1995.

21CS4173: ADVANCED ALGORITHMS

(Professional Elective- III)

B.Tech. IV Year I Sem.

L	T	P	C
3	-	-	3

Pre-requisites:

- A course on "Computer Programming & Data Structures"
- A course on "Advanced Data Structures & Algorithms"

Course Objectives:

- Relate the recurrence relations for analyzing the algorithms
- Summarize the graphs and their traversals.
- Apply various algorithmic techniques.
- Analyze how to evaluate and compare different algorithms using worst-case, average-case and best-case analysis.
- Introduce the Concept of NP-Completeness and Approximation Algorithms:

Course Outcomes: Upon completion of the course, the students will be able to

- Analyze the performance of algorithms
- Choose appropriate data structures and algorithm design methods for a specified application
- Understand how the choice of data structures and the algorithm design methods impact the performance of programs.
- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering.

UNIT-I

Introduction: Role of Algorithms in computing, Order Notation, Recurrences, Probabilistic Analysis and Randomized Algorithms. Sorting and Order Statistics: Heap sort, Quick sort and Sorting in Linear Time.

Advanced Design and Analysis Techniques: Dynamic Programming- Matrix chain Multiplication, Longest common Subsequence and optimal binary Search trees.

UNIT-II

Greedy Algorithms- Huffman Codes, Activity Selection Problem. Amortized Analysis.

Graph Algorithms: Topological Sorting, Minimum Spanning trees, Single Source Shortest Paths, Maximum Flow algorithms.

UNIT-III

Sorting Networks: Comparison Networks, Zero-one principle, bitonic Sorting Networks, Merging Network, and Sorting Network.

Matrix Operations- Strassen's Matrix Multiplication, Inverting matrices,
Solving system of linear Equations.

UNIT-IV

String Matching: Naive String Matching, Rabin-Karp algorithm, matching with finite Automata, Knuth-Morris-Pratt algorithm.

UNIT-V

NP-Completeness and Approximation Algorithms: Polynomial time, polynomial time verification, NP-Completeness and reducibility, NP-Complete problems. Approximation Algorithms- Vertex cover Problem, Travelling Salesperson problem.

TEXTBOOK:

1. Introduction to Algorithms, "T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein" ThirdEdition,PHI.

REFERENCES:

1. Fundamentals Of Computer Algorithms, EllisHorowitz, Satraj Sahniand Rajasekharam, Galgotia publications pvt.Ltd.
2. Design and Analysis Algorithms-ParagHimanshuDave, Himanshu Bhalchandra Dave Publisher:Pearson.
3. Algorithm Design: Foundations, Analysis and Internet examples, M.T.Good rich and R.Tomassia, JohnWileyand sons.
4. Data structures and Algorithm Analysis in C++, Allen Weiss, Second edition, Pearson education.

21CS4174: CLOUD COMPUTING
(Professional Elective - II)

B.Tech. IV Year I Sem.

L	T	P	C
3	-	-	3

Pre-requisites:
- A course on "Computer Networks"
- A course on "Operating Systems"
- Distributed System

Course Objectives:
- To explain the evolving computer model called cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.
- The course provides a unified and fundamental view of the broad field of computer networks.
- To understand and extremely relevant world of Computer Net working is introduced in a top down Approach.

Course Outcomes: Upon completion of the course, the students will be able to

- Understand various service delivery models of a cloud computing architecture.
- Understand the virtualization and cloud computing concepts.
- Able to understand cloud computing architecture and managing cloud infrastructure and its applications.
- Acquire knowledge on cloud service models.
- Acquire knowledge on cloud service providers.

UNIT-I

Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano Computing.

UNIT-II

Cloud Computing Fundamentals: Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud Computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, and Four Cloud Deployment Models.

UNIT-III

Cloud Computing Architecture and Management: Cloud Architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications, on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure Managing the Cloud Application, Migrating Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.

UNIT-IV

Cloud Service Models: Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of

PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers, Other Cloud Service Models.

UNIT-V

Cloud Service Providers: EMC, EMC IT, Captiva Cloud Toolkit, Google, Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue ,Service, Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM, Cloud Models, IBM Smart Cloud, SAP Labs, SAP HANA Cloud Platform, Virtualization Services Provided by SAP, Sales force, Sales Cloud, Service Cloud: Knowledge as a Service, Rack space, VMware, Manjrasoft, Aneka Platform.

TEXT BOOKS:

1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014 .

REFERENCES:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej , M.Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD,rp2011.

21CS4175: REAL TIME OPERATING SYSTEMS

(Professional Elective- IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	-	-	3

Pre-requisites:

- A course on "Operating Systems"
- Distributed System

Course Objectives:

- To develop an understanding of various Real time system applications
- To introduce the principles shared by many real-time operating systems
- To obtain a broad understanding of the technologies and applications
- To design embedded multitasking application software
- To understand the architecture of real time operating systems

Course Outcomes: Upon completion of the course, the students will be able to

- Understand the fundamentalconcepts of real-time operating systems.
- Apply the concepts of real time applications
- Apply the concepts of pipes memory system
- Understand the various real time operating systems
- Analyze the concept of thread synchronization

UNIT-I
INTRODUCTION:
Introduction to Operating System: Computer Hardware Organization, BIOS and Boot Process, Multi-threading concepts, Processes, Threads,Scheduling

UNIT-II
BASICS OF REAL-TIME CONCEPTS:
Terminology: RTOS concepts and definitions, real-time design issues, examples, Hardware Considerations: logic states, CPU, memory, I/O, Architectures, RTOS building blocks, Real-Time Kernel

UNIT-III
PROCESS MANAGEMENT:
Concepts, scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, scheduling algorithms Threads: Multi-threading models, threading issues, thread libraries, synchronization Mutex: creating, deleting, prioritizing mutex, mutex internals

UNIT-IV
INTER-PROCESS COMMUNICATION:
Messages, Buffers, mailboxes, queues, semaphores, deadlock, priorityinversion,
PIPES MEMORYMANAGEMENT:-
Process stack management, run-time buffer size, swapping, overlays, block/page management, replacement algorithms, real-time garbagecollection

UNIT-V
CASE STUDIES:
Case study Linux POSIX system, RTLinux / RTAI, Windows system, Vxworks, uItron Kernel Design Issues: structure, process states, datastructures, inter-task communication mechanism, Linux Scheduling

TEXT BOOKS:

1. J. J Labrosse, "MicroC/OS-II: The Real –Time Kernel",Newnes, 2002.
2. Jane W. S. Liu, "Real-time systems", Prentice Hall, 2000.

REFERENCES:

1. W. Richard Stevens, "Advanced Programming in the UNIX®Environment", 2nd Edition, Pearson Education India, 2011.
2. Philips A. Laplante, "Real-Time System Design and Analysis",3rd Edition, John Wley& Sons, 2004
3. Doug Abbott, "Linux for Embedded and Real-Time Applications", Newnes, 2nd Edition, 2011.

21CS4176: AD-HOC AND SENSOR NETWORKS

(Professional Elective - IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	-	-	3

Prerequisites:

- A course on "Computer Networks"
- A course on "Mobile Computing"

Course Objectives:

- To understand the basic WSN Technology and supporting protocols.
- To understand the MAC protocols and address physical layer can errors.
- To understand the security of sensor networks
- To understand the applications of ad hoc and sensor networks
- To Understand the transport layer and security issues possible in Ad hoc and Sensor networks

Course Outcomes: Upon completion of the course, the students will be able to

- Understand the state-of-the-art research in the emerging subject of Ad Hoc and Wireless Sensor Networks
- Solve the issues in real-time application development based on ASN.
- Conduct further research in the domain of ASN
- Understand the transport layer and security issues possible in Ad hoc and sensor networks.
- Understand dynamic nature of WSN.

UNIT - I

Introduction to Ad Hoc Networks - Characteristics of MANETs, Applications of MANETs and challenges of MANETs. Routing in MANETs - Criteria for classification, Taxonomy of MANET routing algorithms, Topology based routing algorithms-Proactive: DSDV; Reactive: DSR, AODV; Hybrid: ZRP; Position-based routing algorithms-Location Services-DREAM, Quorum-based; Forwarding Strategies: Greedy Packet, Restricted Directional Flooding-DREAM, LAR.

UNIT - II

Data Transmission - Broadcast Storm Problem, Rebroadcasting Schemes-Simple-flooding, Probability-based Methods, Area-based Methods, Neighbor Knowledge-based: SBA, Multipoint Relaying, AHBP. **Multicasting:** Tree-based: AMRIS, MAODV; Mesh-based: ODMRP, CAMP;Hybrid: AMRoute, MCEDAR.

UNIT - III

Geocasting: Data-transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR.TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc.

UNIT - IV

Basics of Wireless, Sensors and Lower Layer Issues: Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer, Routing Layer.

UNIT - V

Upper Layer Issues of WSN: Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots.

TEXT BOOKS:

1. Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P. Aggarwal, World Scientific Publications, March 2006, ISBN – 981–256–681–3.
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Eseview Science, ISBN – 978-1-55860-914-3 (Morgan Kauffman).

21CS4177: HIGH PERFORMANCE COMPUTING

(Professional Elective- IV)

B.Tech. IV Year I Sem. **L T P C**
3 - - 3

Prerequisites:

- Computer networks
- Distributed System

Course Objectives:

- Knowledge on parallel programming paradigms.
- To understand the HPC platforms with particular reference to Cluster system.
- Analyze the performance of HPC applications.
- To Understand SPMD Programming.
- Knowledge on Partitioning applications for heterogeneous resources,

Course Outcomes: Upon completion of the course, the students will be able to

- Understand the role of HPC in science and engineering.
- Apply HPC platforms and parallel programming models.
- Analyze and assess the performance of HPC applications and their supporting hardware.
- Apply administration, scheduling, code portability and data management in an HPC environment, with particular reference to Grid Computing.
- Analyze the suitability of different HPC solutions to common problems found in Computational Science.

UNIT-I

Introduction: Characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies (drawn from multi scale, multi-discipline applications).

UNIT -II

High-End Computer Systems: Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared-memory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Peta scale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purpose-built.

UNIT -III

Parallel Algorithms: Parallel models: ideal and real frameworks, Basic Techniques: Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Trees, Graphs, Randomi.

UNIT -IV

Parallel Programming: Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, Star-P, Matlab MPI), Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays

UNIT -V

Performance: Measuring performance, Identifying performance bottlenecks, restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, using existing libraries, tools, and frameworks.

TEXT BOOKS:

1. Contemporary High Performance Computing by Jeffrey S. Vetter ,Released November 2017, Publisher(s): Chapman and Hall/CRC , ISBN: 9781466568358.

REFERENCES:

1. High Performance Computing by Charles Severance & Kevin Dowd, Copyright Year: 2010 , Last Update: 2021 ,Publisher: OpenStax CNX.

21CS4178: INFORMATION STORAGE MANAGEMENT

(Professional Elective- IV)

B.Tech. IV Year I Sem. **L T P C**
3 - - 3

Prerequisites:

- Computer networks

Course Objectives:

- To understand the basic components of Storage System Environment.
- To understand the Storage Area Network Characteristics and Components.
- To examine emerging technologies including IP-SAN.
- To describe the different backup and recovery topologies and their role in providing disaster recovery and business continuity capabilities.
- To understand the local and remote replication technologies.

Course Outcomes: Upon completion of the course, the students will be able to

- To Understand the Concept of Information Storage and Data centre Environment.
- Apply knowledge about Data Protection.
- To Know and understand Intelligent Storage System.
- To understand Data centre Environment, Data Protection, Fibre Channel SAN
- To Know the Backup and Archive Technologies.

UNIT I :
STORAGE SYSTEMS

Introduction to Information Storage and Management: Information Storage, Evolution of Storage Technology and Architecture, Data Center Infrastructure, Key Challenges in Managing Information, Information Lifecycle. Storage System Environment: Components of the Host. RAID: Implementation of RAID, RAID Array Components, RAID Levels, RAID Comparison, RAID Impact on Disk Performance, Hot Spares. Intelligent Storage System: Components, Intelligent Storage Array.

UNIT II :
STORAGE NETWORKING TECHNOLOGIES

Direct-Attached Storage and Introduction to SCSI: Types of DAS, DAS Benefits and Limitations, Disk Drive Interfaces, Introduction to Parallel SCSI, SCSI Command Model. Storage Area Networks: Fiber Channel, SAN Evolution, SAN Components, Fiber Channel Connectivity, Fiber Channel Ports, Fiber Channel Architecture, Zoning, Fiber Channel Login Types, Fiber Channel Topologies. Network Attached Storage: Benefits of NAS, NAS File I/Components of NAS, NAS Implementations, NAS-Implementations, NAS File Sharing Protocols, NAS I/O Operations.

UNIT III :
ADVANCED STORAGE NETWORKING AND VIRTUALIZATION

IP SAN: iSCSI, FCIP. Content-Addressed Storage: Fixed Content and Archives, Types of Archives, Features and Benefits of CAS, CAS Architecture, Object Storage and Retrieval in CAS, CAS Examples. Storage Virtualization: Forms of Virtualization, NIA Storage

Virtualization Taxonomy, Storage Virtualization Configurations, Storage Virtualization Challenges, Types of Storage Virtualization.

UNIT IV :
BUSINESS CONTINUITY

Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. Backup and Recovery: Backup Purpose, Considerations, Granularity, Recovery Considerations, Backup Methods and Process, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments, Backup Technologies.

UNIT V :
REPLICATION

Local Replication: Source and Target, Uses of Local Replicas, Data Consistency, Local Replication Technologies, Restore and Restart Considerations, Creating Multiple Replicas, Management Interface. Remote Replication: Modes of Remote Replication and its Technologies, Network Infrastructure.

TEXT BOOK:

1. EMC Corporation, Information Storage and Management, Wiley, India.

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 Networks Fundamentals, Pearson Education Limited, 2002.

21CS4151:DATA WAREHOUSING AND DATA MINING LAB

B.Tech. IV Year I Sem **L T P C**

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Prerequisites:

- Data Base Management System

Course Objectives:

- Understand how to build a data warehouse and query it (using open source tools like Pentaho Data Integration Tool, Pentaho Business Analytics).
- Understand how to perform data mining tasks using a data mining toolkit (such as open source WEKA).
- Understand the data sets and data preprocessing.
- Understand data mining tasks such as association rule mining, classification, clustering and regression.
- Exercise the data mining techniques with varied input values for different parameters.
- To Gain Practical Experience Working with all real data sets.

Course Outcomes: Upon completion of the course, the students will be able to

- Understand the various kinds of tools for data mining.
- Find unseen pattern in large volume of historical data that helps to manage an organization efficiently.
- Demonstrate the working of algorithms for data mining tasks such association rule mining, classification, clustering in large data sets.
- Apply mining techniques for realistic data.
- Improve hands-on experience working with all real data sets

LIST OF EXPERIMENTS:

1. A**. Build Data Warehouse**
   i. Identify source tables and populate sample data.
   ii. Design multi-dimensional data models namely Star, Snowflake and Fact
   iii. Constellation schemas for any one enterprise (ex. Banking, Insurance, Finance, Healthcare, manufacturing, Automobiles, sales etc).
   iv. Write ETL scripts and implement using data warehouse tools.
   v. Perform Various OLAP operations such slice, dice, roll up, drill up and pivot
   vi. Explore visualization features of the tool for analysis like identifying trends etc.

   B. . **Installation of WEKA Tool** - Explore WEKA Data Mining/Machine Learning Toolkit
   i. Understand the features of WEKA tool kit such as Explorer, Knowledge flow interface, Experimenter, command-line interface.
   ii. Navigate the options available in the WEKA(ex. select attributes panel, preprocess panel, classify panel, cluster panel, associate panel and visualize)
2. Listing applications for mining
3. Creating new Arff File
4. conversion of various data files
5. Pre-Processes Techniques on Data Set
6. Pre-process a given dataset based on Handling Missing Values
7. Training the given dataset for an application-classification
8. Testing the given dataset for an application-classification
9. Generating accurate models-classification
10. Data Pre-Processing – Data Filters

11. Feature selection-classification
12. Web Mining-Clustering Techniques
13. Text Mining-Association Analysis.

TEXT BOOKS :

1. Data Mining – Concepts and Techniques - JIAWEI HAN & MICHELINE KAMBER Harcourt India.
2. Data Mining Techniques – Arun K pujari, Universities Press.

REFERENCE BOOKS :

1. Data Mining Introductory and advanced topics –MARGARET H DUNHAM, PEARSON EDUCATION
2. Data Mining Techniques – ARUN K PUJARI, University Press.
3. Data Warehousing in the Real World – SAM ANAHORY & DENNIS MURRAY. Pearson Edn Asia.
4. Data Warehousing Fundamentals – PAULRAJ PONNAIAH WILEY STUDENT EDITION.
5. The Data Warehouse Life cycle Tool kit – RALPH KIMBALL WILEY STUDENT EDITION.

21CS4152: DIGITAL FORENSICS LAB

B.Tech. IV Year I Sem.

L	T	P	C
-	-	3	1.5

Course Objectives:

- To understand a comprehensive overview of collecting, investigating, preserving.
- To presenting evidence of cybercrime left in digital storage devices, emails, browsers, mobile devices using different Forensics tools.
- To Understand file system basics and where hidden files may lie on the disk, as well as how to extract the data and preserve it for analysis.
- To understand some of the tools of e-discovery.
- To understand the network analysis, Registry analysis and analyze attacks using different forensics tools.

Course Outcomes: Upon completion of the course, the students will be able to

- Understand the importance of a systematic procedure for investigation of data found on digital storage media that might provide evidence of wrong-doing.
- Understand the file system storage mechanisms and retrieve files in hidden format.
- Apply the use of computer forensics tools used in data analysis.
- Analyze how to find data that may be clear or hidden on a computer disk, find out the open ports for the attackers through network analysis, Registry analysis.
- Apply on validating and testing forensic software's

List of Experiments

1. Perform email analysis using the tools like Exchange EDB viewer, MBOX viewer and View user mailboxes and public folders, Filter the mailbox data based on various criteria, Search for particular items in user mailboxes and public folders.
2. Perform Browser history analysis and get the downloaded content, history, saved logins, searches, websites visited etc using Foxton Forensics tool, Dumpzilla.
3. Perform mobile analysis in the form of retrieving call logs, SMS log, all contacts list using the forensics tool like SAFT.
4. Perform Registry analysis and get boot time logging using process monitor tool.
5. Perform Disk imaging and cloning the using the X-way Forensics tools.
6. Perform Data Analysis i.e History about open file and folder, and view folder actions using Last view activity tool.
7. Perform Network analysis using the Network Miner tool.
8. Perform information for incident response using the crowd Response tool.
9. Perform File type detection using Autopsy tool.
10. Perform Memory capture and analysis using the Live RAM capture or any forensic tool.

TEXT BOOKS:

1. Real Digital Forensics for Handheld Devices, E. P. Dorothy, Auerback Publications, 2013.
2. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics, J. Sammons, Syngress Publishing, 2012.

REFERENCE BOOKS:

1. Handbook of Digital Forensics and Investigation, E. Casey, Academic Press, 2010.
2. Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides, C. H. Malin, E. Casey and J. M. Aquilina, Syngress, 2012.
3. The Best Damn Cybercrime and Digital Forensics Book Period, J. Wiles and A.Reyes, Syngress, 2007.

21CS4181: MINI PROJECT

B.Tech. IV Year I Sem.

L	T	P	C
-	-	4	2

IV YEAR – II SEM

21MB4211: FUNDAMENTALS OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR

B.Tech. IV Year II Sem.

L	T	P	C
3	-	-	3

Course Objective:

- To understand the fundamentals of management, history and evolution of management theories
- To analyze various dimensions of organizational planning and organizing.
- To understand the functions of staffing, Directing and controlling.
- To understand the fundamental concepts of Organizational Behaviour.
- To analyze and evaluate the various dimensions of Cognitive process and Stress related issues in Organizational Behaviour.

Course Outcomes: After the completion of the course, student should be able to

- Understand the fundamentals of management and contribution of management thinkers.
- Analyze the relevance and importance of planning and organizing.
- Understand the importance of organizing, types of organizational structures and various function of human resource management
- Understand fundamental concepts of organizational behaviour
- Analyze and evaluate the various dimensions of cognitive process and stress related issues in organizational behaviour.

UNIT- I

Introduction to Management: Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of Management.

Approaches- Classical Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach.

UNIT – II

Planning and Organizing: General Framework for Planning - Planning Process, Types of Plans, Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization, Recentralization.

UNIT- III

Staffing: Functions of HRM.

Leadership: Leadership Styles; Leadership theories.

Motivation - Types of Motivation; Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X, Theory Y and Theory Z.

Communication: Types of communication, Importance, Communication Process and communication Barriers.

Controlling: Process of controlling, Types of Control

UNIT- IV

Introduction to OB - Definition, Nature and Scope –Environmental and organizational context – Impact of IT, globalization, Diversity, Ethics, culture, reward systems and organizational design on Organizational Behaviour. Cognitive Processes-I : Perception and Attribution: Nature and importance of Perception – Perceptual selectivity and organization -Social perception – Attribution Theories.

UNIT- V

Cognitive Processes-II: Personality and Attitudes - Personality as a continuum – Meaning of personality - Johari Window and Transactional Analysis - Nature and Dimension of Attitudes- Stress and Conflict: Meaning and types of stress –Meaning and types of conflict - Effect of stress and intra-individual conflict - strategies to cope with stress and conflict.

TEXT BOOKS:

1. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.
2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009
3. Principles and Practice of Management, L. M. Prasad, S. Chand, 2019, New Delhi.
4. Robbins, P. Stephen, Timothy A. Judge: Organisational Behaviour, 12/e, PHI/Pearson, NewDelhi, 2009.

REFERENCES:

1. Newstrom W. John & Davis Keith, Organisational Behaviour-- Human Behaviour at Work, 12/e,TMH, New Delhi, 2009.
2. Luthans, Fred: Organizational Behaviour 10/e, McGraw-Hill, 2009.

21CS4271: COMPUTER VISION

(Professional Elective - V)

B.Tech. IV Year II Sem.

L	T	P	C
3	-	-	3

Prerequisites:

- Programming and Mathematics course.

Course Objectives:

- Recognize and describe both the theoretical and practical aspects of computing with images. Connect issues from Computer Vision to Human Vision.
- Describe the foundation of image formation and image analysis. Understand the basics of 2D and 3D Computer Vision.
- Become familiar with the major technical approaches involved in computer vision. Describe various methods used for registration, alignment, and matching in images.
- Get an exposure to advanced concepts leading to object categorization and segmentation in images.
- Build computer vision applications.

Course Outcomes: Upon completion of the course, the students will be able to

- Implement fundamental image processing techniques required for computer vision.
- Understand Image formation process.
- Extract features from Images and do analysis of Images.
- Generate 3D model from images and to develop applications using computer vision techniques.
- Understand video processing, motion computation and 3D vision and geometry.

UNIT I

Introduction: Image Processing, Computer Vision and Computer Graphics, What is Computer Vision - Low - level, Mid-level, High-level.

Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality

UNIT II

Image Formation Models: Monocular imaging system, Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, BRDF, color etc., Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading, Construction of 3D model from image.

Image Processing and Feature Extraction: Image preprocessing, Image representations (continuous and discrete), Edge detection.

UNIT III

Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.

Shape Representation and Segmentation: Contour based representation, Region based representation, Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi resolution analysis.

UNIT IV

Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal Component analysis, Shape priors for recognition. Image Understanding: Pattern recognition methods, HMM, GMM and EM.

UNIT V

Applications: Photo album - Face detection – Face recognition - Eigen faces - Active appearance and 3D shape models of faces Application: Surveillance - foreground-background separation - particle filters - Chamfer matching, tracking, and occlusion - combining views from multiple cameras - human gait analysis Application: In-vehicle vision system: locating roadway - road markings - identifying road signs - locating pedestrians.

TEXT BOOKS:

1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.
3. Multiple View Geometry in Computer Vision Second Edition, Richard Hartley and Andrew Zisserman, Cambridge University Press, March 2004.

REFERENCE BOOKS:

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992. Wiley Dreamtech.
2. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982. Java Script, D. Flanagan, O'Reilly, SPD.
3. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010.
4. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.
5. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.

21CS4272: BLOCK CHAIN TECHNOLOGY

(Professional Elective –V)

B.Tech. IV Year II Sem.

L	T	P	C
3	-	-	3

Prerequisites

- Knowledge in security and applied cryptography;
- Knowledge in distributed databases

Course Objectives

- To Introduce block chain technology and Crypto currency
- Make use of Digital Identity verification.
- To explore the Concept of Bit coin MOOCs
- Analyze the Demurrage currency
- Analyze the Business model challenges

Course Outcomes: Upon completion of the course, the students will be able to

- Understand basics of Block Chain Technology and Cryptocurrency
- Apply to Get Exposure on Block chain Environment and Digital Identity Verification
- Understand Block Chain Science.
- Summarize Types of Cryptocurrency.
- Analyze about research advances related to one of the most popular technological areas today.

UNIT- I

Introduction: Block chain or distributed trust, Protocol, Currency, Crypto currency, How a Crypto currency works, Crowd funding

UNIT- II

Extensibility of Block chain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Block chain Environment

UNIT- III

Block chain Science: Grid coin, Folding coin, Block chain Genomics, Bit coin MOOCs

UNIT - IV

Currency, Token, Tokenizing, Campus coin, Coindrop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency

UNIT - V

Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations

TEXTBOOK:

1. Blockchain Blue print for Economy by Melanie Swan.

REFERENCES:

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps 1st Edition, by Daniel Drescher.

21CS4273: INTERNET OF THINGS
(Professional Elective - V)

B.Tech. IV Year II Sem.

L	T	P	C
3	-	-	3

Prerequisites
- Knowledge in security and Embedded Hardware
- Knowledge in Networking
- Knowledge in Cloud Computing

Course Objectives:
- To introduce the terminology, technology and its applications
- To introduce the concept of M2M (machine to machine) with necessary protocols
- To introduce the Python Scripting Language which is used in many IoT devices
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of web-based services on IoT devices

Course Outcomes: Upon completion of the course, the students will be able to
- Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- Compare and contrast the deployment of smart objects and the technologies to connect them to network.
- Appraise the role of IoT protocols for efficient network communication.
- Elaborate the need for Data Analytics and Security in IoT.
- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

UNIT - I
Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

UNIT - II
IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

UNIT - III
Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

UNIT - IV
IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

UNIT - V

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

REFERENCES:

1. The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press –2012
2. Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison; Florian Michahelles-(Eds.) – Springer – 2011
3. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press - 2010
4. The Internet of Things: Applications to the Smart Grid and Building Automation by – Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley -2012
5. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012

21CS4274: SOFTWARE TESTING METHODOLOGIES

(Professional Elective-V)

B.Tech. IV Year II Sem. **L T P C**
3 - - 3

Prerequisites:

- A course on "Software Engineering".

Course Objectives:

- To provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies.
- To develop skills in performing manual testing.
- To develop skills in software test automation and management using latest tools.
- To provide knowledge in taking decision of when to use automation testing and manual testing
- To provide knowledge in taking decision of when to use Test Metrics and Measurements.

Course Outcomes: Upon completion of the course, the students will be able to

- Acquire knowledge on STLC phases and consequences of bugs.
- Analyze to perform various testing techniques.
- Analyze on logic based testing and regular expressions.
- Evaluate the test planning and management.
- Analyze to develop skills in software test automation and management using latest tools.

UNIT- I

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs, STLC (software testing life cycle) phases.
Flow graphs and Path testing: -Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT - II

Integration Testing: Integration Testing as a Type of Testing, Integration Testing as a Phase of Testing, Scenario Testing, Defect Bash.
System and Acceptance Testing: Overview, Functional Versus Non-Functional, Functional System Testing & Non-Functional, Acceptance Testing.
Dataflow Testing:- Basics of data flow testing, strategies in data flow testing, application of dataflow testing.
Regression Testing: Introduction, Types, When to do Regression testing, how to do Regression Testing, Best Practices in Regression Testing.

UNIT- III

White Box Testing: Static Testing, Structural Testing, Challenges, **Black Box Testing, and Logic Based Testing:** Overview, decision tables, path expressions, kv charts, specifications.
Paths, Path products and Regular expressions: Path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

UNIT-IV

State, State Graphs and Transition testing: State graphs, good & bad state graphs, state testing, Testability tips, Automation Testing versus Manual Flow Testing.

Test Planning, Management, Execution and Reporting: Introduction, Planning, Management, Process, and Reporting, Best Practices.

UNIT - V

Software Test Automation: Terms used in Automation, Skills needed for Automation, What to Automate, Scope of Automation, Design and Architecture for Automation, Generic Requirements for Test Tools, Process Model for Automation, Selecting a Test Tool, Automation for Extreme Programming Model, Challenges.

Test Metrics and Measurements: Metrics & Measurements, Types, Project, Progress, Productivity, Release

TEXT BOOKS:

1. Software Testing techniques - BarisBeizer, Dreamtech, second edition.
2. Software Testing Tools – Dr.K.V.K.K.Prasad, Dreamtech.
3. Srinivasa Desikan & Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2007.

REFERENCES:

1. The craft of software testing - Brian Marick, Pearson Education.
2. Software Testing Techniques – SPD(Oreille)
3. Software Testing in the Real World – Edward Kit, Pearson.
4. Effective methods of Software Testing, Perry, John Wiley.
5. Art of Software Testing – Meyers, John Wiley.
6. "Software Testing – Effective Methods, Tools and Techniques", RenuRajani, Pradeep Oak, TMK.
7. Effective methods of Software Testing, Perry, John Wiley.
8. Art of Software Testing – Meyers, John Wiley.

21CS4275: BIG DATA MANAGEMENT

(Professional Elective- VI)

B.Tech. IV Year II Sem.

L	T	P	C
3	-	-	3

Prerequisites:

- A course on "Data Base Management System".

Course Objectives:

- To introduce the concepts of Big Data Analytics.
- To introduce the concept of Big Data Architecture
- To introduce tools/algorithms that are available for a variety of analytics.
- To learn Data Analysis with Spark.
- To introduce the Database for Modern Web.

Course Outcomes: Upon completion of the course, the students will be able to

- Analyze sources of Big Data and Analyzing Tools.
- Apply Map statistical methods to analyze huge data.
- Apply the frameworks in Distributed File Systems.
- Create cluster in Hadoop distributed file system.
- Apply Map Reduction in HDFS.

UNIT – I

INTRODUCTION TO BIG DATA: Introduction –distributed file system –Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce.

UNIT – II

INTRODUCTION TO HADOOP AND HADOOP ARCHITECTURE: Big Data – Apache Hadoop & Hadoop EcoSystem, Moving Data in and out of Hadoop –Understanding inputs and outputs of MapReduce - Data Serialization.

UNIT – III

HDFS, HIVE AND HIVEQL, HBASE HDFS: Overview, Installation and Shell, Java API; Hive Architecture and Installation, Comparison with Traditional Database, HiveQL, Querying Data, Sorting And Aggregating, Map Reduce Scripts, Joins & Sub queries, HBase concepts, Advanced Usage, Schema Design, Advance Indexing, PIG, Zookeeper , how it helps in monitoring a cluster, how to Build Applications with Zookeeper.

UNIT –IV

SPARK: Introduction to Data Analysis with Spark, Downloading Spark and Getting Started, Programming with RDDs, Machine Learning with MLlib. **NoSQL** What is it?, Where It is Used, Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vs NoSQL, NewSQL.

UNIT –V

DATA BASE FOR THE MODERN WEB: Introduction to MongoDB key features, Core Server tools, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document-Oriented data, principles of schema design, Constructing queries on Databases, collections and Documents, MongoDB Query Language.

TEXT BOOKS:

1. Boris lublinsky, Kevin t. Smith, AlexeyYakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 19788126551071, 2015.
2. Chris Eaton, Dirk derooset al. , "Understanding Big data", McGraw Hill, 2012.
3. BIG Data and Analytics , Sima Acharya, Subhashini Chhellappan, Willey
4. MongoDB in Action, Kyle Banker,Piter Bakkum , Shaun Verch, Dream tech Press
5. Tom White , "HADOOP: The definitive Guide", O Reilly 2012.
6. VigneshPrajapati, "Big Data Analytics with R and Hadoop", Packet Publishing 2013.http://www.bigdatauniversity.com/
7. Learning Spark: Lightning Fast Big Data Analysis Paperback by Holden Karau

REFERENCES:

1. Michael Minelli, Michele Chambers, Ambiga Dhiraj, JimStogdill, "BigData BigAnalytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", 1stEdition,Wiley Publications,2013.
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012 3. PeteWarden, "Big Data Glossary", O'Reilly, 2011..

21CS4276: NATURAL LANGUAGE PROCESSING

(Professional Elective - VI)

B.Tech. IV Year II Sem. **L T P C**
3 - - 3

Prerequisites:

- Data structures, finite automata and probability theory

Course Objectives:

- Solve the problems and solutions of NLP
- Solve the relation to linguistics and statistics.
- Importance of Representation of Syntactic Structure. And Parsing Algorithms
- To introduce Semantic Interpretation.
- Make use of Multilingual and Cross lingual Language Modeling.

Course Outcomes: Upon completion of the course, the students will be able to

- Understand linguistic phenomena and an ability to model them with formal grammars.
- Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
- Apply manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
- Design, implement, and analyze NLP algorithms
- Design different language modeling Techniques.

UNIT – I

Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models.

Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, and Performances of the Approaches.

UNIT - II

Syntax Analysis: Parsing Natural Language, Tree banks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues.

UNIT - III

Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

UNIT - IV

Predicate-Argument Structure, Meaning Representation Systems, Software.

UNIT - V

Discourse Processing: Cohesion, Reference Resolution, Discourse Cohesion and Structure

Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross lingual Language Modeling.

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory toPractice– Daniel M. Bikel and Imed Zitouni, Pearson Publication.
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S.Tiwary

REFERENCE BOOK:

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications.

21CS4277: ROBOTIC PROCESS AUTOMATION

(Professional Elective- VI)

B.Tech. IV Year II Sem. **L T P C**
3 - - 3

Prerequisites:

- Programming Concepts Basics ,Understanding the application,
- Basic Web Concepts, Protocols, Email Clients, Data Structures

Course Objectives:

- To understand the Basics of Robotic Process Automation
- Identify the intensity of Design Robotic Process Automation
- To comprehend the installation process of RPA Tools
- To understand the control structure to design RPA Application
- To know the way of interaction of Robotic Process Automation with external Applications
- To understand the Exception Handling Mechanism in RPA

Course Outcomes: Upon completion of the course, the students will be able to

- Understand on Robotic Process Automation
- Compare RPA with Non-Automation process
- Design RPA with Internal interactions
- Design RPA with External Application interaction
- Implement RPA using Exception Handling mechanism

UNIT - I

Processes, Software Design, SDL C: Programming Concepts Basics – 2 : Scripting, .Net Framework, .Net ,Fundamentals, Control structures and functions, XML, HTML, CSS, Varibles & Arguments.

RPA Basics: History of Automation, What is RPA,RPA vs Automation, Processes & Flowcharts, Programming Constructs in RPA, What Processes can be Automated, Types of Bots, Workloads, which can be automated.

UNIT - II

RPA Advanced Concepts: Standardization of processes, RPA Development methodologies, Difference from SDLC, Robotic control flow architecture, RPA business case, RPA Team. Process Design Document/Solution Design Document, Industries best suited for RPA, Risks, & Challenges with RPA, RPA and emerging ecosystem.

Installation: Installing Studio community edition, The User Interface, Keyboard Shortcuts, About Updating, About Automation Projects, Introduction to Automation Debugging, Managing Activation Packages, Reusing Automations Library, Installing the Chrome Extension, Installing the Firefox Extension, Connecting your project to a source control system, Activities Guide.

Variables : Managing Variables, Naming Best Practices, The Variables Panel, Generic Value Variables, Text Variables, True or False Variables, Number Variables, Array Variables ,Date and Time Variables, Data Table Variables, Managing Arguments, Naming Best Practices, The Arguments Panel, Using Arguments, About Imported Namespaces, Importing New Namespaces.

UNIT - III

Control Flow: Control Flow Introduction, If Else Statements, Loops, Advanced Control Flow, Sequences, Flowcharts, About Control Flow, Control Flow Activities, The Assign Activity, The Delay Activity, The Do While Activity, The If Activity, The Switch Activity, The While Activity, The For Each Activity, The Break Activity.

Data Manipulation :Data Manipulation Introduction, Scalar variables, collections and Tables, Text Manipulation, Data Manipulation, Gathering and Assembling Data.
Recording and Advanced UI Interaction :Recording Introduction, Basic and Desktop Recording, Web Recording, Input / Output Methods, Screen Scraping, Data Scraping, Scraping advanced techniques.
Selectors :Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors, RPA Challenge.

UNIT- IV
Advanced Automation concepts and techniques: Image, Text & Advanced Citrix Automation :Introduction to Image & Text , Automation, Image based automation, Keyboard based automation, Information Retrieval, Advanced Citrix Automation challenges, Best Practices, Using tab for Images, Starting Apps.
Excel Data Tables & PDF : Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, Extracting a single piece of data, Anchors, Using anchors in PDF.
Email Automation :Email Automation, Incoming Email automation, Sending Email automation.

UNIT- V
Exceptional Handling & Best Practice : Debugging and Exception Handling : Debugging Tools, Strategies for solving issues, Catching errors.
Introduction to Orchestrator Orchestrator: Tenants, Authentication, Users, Roles, Robots, Environments, Queues & Transactions, Schedules.
Emerging and Future Trends in IT: Emerging and Future Trends in IT : Artificial Intelligence, Machine Learning, Agent awareness, Natural Language Processing, Computer Vision.

TEXT BOOKS:

1. Learning Robotic Process Automation by Alok Mani Tripathi, Published by Packt Publishing Ltd.
2. Robotic Process Automation Succinctly By Ed Freitas Foreword by Daniel Jebara
3. Robotic Process Automation by Nividous

REFERENCE BOOK:

1. Robotic Process Automation NICE Special Edition by NICE RPA team with Steve Kaelble,Published by: John Wiley & Sons, Ltd., The Atrium, Southern Gate.

21CS4278: SECURITY ANALYSIS

(Professional Elective - VI)

B.Tech. IV Year II Sem. **L T P C**
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Prerequisites:

- Should have basic knowledge of computer networks and information security.

Course Objectives:

- To introduce the information security terminology, technology and its applications
- To introduce data leakage threats and its solutions
- To give guidelines for implementing security policies in the organization
- To make familiar with the roles and responsibilities in security domain
- To make familiar with the roles information security vulnerabilities and threats

Course Outcomes: Upon completion of the course, the students will be able to

- Classify various security attacks and issues.
- Classify types of data leakage threats and prevention techniques.
- List the information security policies and procedures
- Differentiate various information security management roles and responsibilities
- Compose various threats, vulnerabilities and appropriate vulnerability management and assessment solutions

UNIT-I

Information Security Management: Information Security Overview, Threats and Attack Vectors, Types of Attacks, Common Vulnerabilities, and Exposures (CVE), Security Attacks, Fundamentals of Information Security, Computer Security Concerns, Information Security Measures etc.

UNIT-II

Fundamentals of Information Security: Key Elements of Networks, Logical Elements of Network, Critical Information Characteristics, Information States etc.

Data Leakage: What is Data Leakage and statistics, Data Leakage Threats, Reducing the Risk of Data Loss, Key Performance Indicators (KPI), Database Security etc.

UNIT-III

Information Security Policies, Procedures, and Audits: Information Security Policies necessity-key elements & characteristics, Security Policy Implementation, Configuration, Security Standards-Guidelines & Frameworks etc.

UNIT-IV

Information Security Management – Roles and Responsibilities: Security Roles & Responsibilities, Accountability, Roles, and Responsibilities of Information Security Management, team-responding to emergency situation-risk analysis process etc.

UNIT-V

Information Security Vulnerabilities-Threats and vulnerabilities, human and computer based social engineering, social media countermeasures, vulnerability management-vulnerability scanning, testing, threat management, remediation etc. Vulnerability assessment, classification, vulnerability assessment phases, characteristics of a good vulnerability

assessment solutions, vulnerability assessment reports-tools, information security risk assessment, risk treatment, residual risk, risk acceptance, risk management feedback Loops etc.

TEXT BOOKS:

1. Information Security Management – A student's Hand Book – NASCOMM
2. Management of Information Security by Michael E. Whitman and Herbert J. Mattord
3. Assessing Information Security (strategies, tactics, logic and framework) by A Vladimirov, K.Gavrilenko, and A.Michajlowski.

REFERENCES:

1. Information Security Management Handbook, Fourth Edition, Volume I-TIPTON HAROLD F.
2. http://www.iso.org/iso/home/standards/management-standards/iso27001.htm2
3. http://csrc.nist.gov/publications/nistpubs/800-55-Rev1/SP800-55-rev1.pdf
4. CISSP (ISC)2 Certified Information Systems Security Professional Official Study Guide Paperback – Import, 8 Oct 2015 by James M. Stewart (Author), Mikehapple(Author), Darril Gibson (Author)
5. The Art of Computer Virus Research and Defense by Peter Szor.

MAJOR PROJECT

B.Tech. IV Year II Sem.

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