(w.e.f 2015-2016)

Jawaharlal Nehru Technological University Anantapur
College OF Engineering Anantapur (Autonomous)
Course Structure for Master of Technology (Computer Science)
(w.e.f 2015-16)

I Year I Semester

Code	Subject	L	T/P/D	C
15D51101	Advanced Data Structures	4	0	4
15D51102	Advanced Data Bases	4	0	4
15D51103	Advances in Software Engineering	4	0	4
15D51104	Advanced Network Technologies	4	0	4
	Elective –I	4	0	4
15D51105	1. Distributed and Cloud Computing			
15D51106	2. Distributed Operating Systems			
15D51107	3. Parallel Computing			
	Elective –II	4	0	4
15D51108	1**.** 3D Technologies			
15D51109	2. Computer Vision			
15D51110	3. Computational Intelligence			
15D51111	Data Structures & Data Bases Lab	0	4	2
	Total	**24**	**4**	**26**

I Year II Semester

Code	Subject	L	T/P/D	C
15D51201	Service Oriented Architecture	4	0	4
15D51202	Natural Language Processing	4	0	4
15D51203	Software Quality Assurance and Testing	4	0	4
15D51204	Advanced Data Mining	4	0	4
	Elective –III	4	0	4
15D51205	1. Cyber Security			
15D51206	2. Soft Computing			
15D51207	3. Information Retrieval Systems			
	Elective –IV	4	0	4
15D51208	1.Big Data Analytics			
15D51209	2. Digital Image Processing			
15D51210	3.. Pattern Recognition			
15D54201	Research Methodology (Audit Course)			
15D51211	Service Oriented Architecture & Software Testing La	0	4	2
	Total	**24**	**4**	**26**

III & IV Semester

Code	Subject	L	P	C
15D51301	**III Semester Seminar - I**	0	4	2
15D51401	**IV Semester Seminar - II**	0	4	2
15D51302	**III & IV Semester Project Work**	--	--	44
	Total	**0**	**8**	**48**

Note: All End Examinations (Theory and Practical) are of three hours duration.

T- Tutorial L- Theory P- Practical/Drawing C - Credits

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Department of Computer Science & Engineering

M.Tech. I– ISem (CS)	T	P	C
	4	0	4

15D51101: Advanced Data Structures

Objectives:

- To Strengthen the ability to identify and apply the suitable data structure for the given real world problem
- To develop a base for advanced computer science study.
- Study the advanced data structures & know the application areas
- To get acquaintance with some of the advanced algorithms.

UNIT-I

Introduction: Algorithm, Algorithm Specification, Performance Analysis, Randomized Algorithms,

Divide- And- Conquer: General Method, Binary search, Finding the Maximum and Minimum, Merge sort, Quick Sort, Selection.

UNIT-II:

Stacks and Queues: Templates in C++, The Stack Abstract Data type, The Queue Abstract Data Type, Evaluation of Expressions.

Linken Lists: Singly Linked Lists, Representing Lists in C++, Circular Lists, Linked Stacks and Queues.

UNIT-III:

HEAP STRUCTURES: Min/Max Heap, Binary Heap, Applications of Priority Queue, d- Heap, Leftist Heap, Skew Heap, Binomial Queues,

UNIT IV:

Trees: Preliminaries, Binary Trees, Search Tree ADT- Binary Search Trees, AVL Trees, Splay Trees, Trees Traversals, B- Tree.

UNIT-V:

Graphs: The Graphs Abdtract Data Types, Elementary Graph Operations: Depth First Search, Breadth Components, Spanning Trees. Minimum Cost Spanning Trees.

NP- Hard and NP- Complete Problems: Basic Concepts, Cooks Theorem, NP-Hard Graph Problems, NP- Hard Scheduling Problem, NP-Hard CODE generation problem.

Text Books:

1. Computer Algorithms, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, GALGOTIA.
2. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson.
3. Fundamentals of Data structures in C++ Sahni, Horowitz,Mehta, Universities Press, 2nd Edition.

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15D51102: Advanced Databases

Objectives:

- Understand and describe current and emerging database models and technologies.
- Study the concepts of parallel and distributed databases
- Able to describe object and object relational databases
- Explore the databases for XML, Mobile and multimedia

UNIT I: PARALLEL AND DISTRIBUTED DATABASES

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Three Tier Client Server Architecture-Case Studies.

UNIT II: OBJECT AND OBJECT RELATIONAL DATABASES

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL/Oracle – Case Studies.

UNIT III: XML DATABASES

XML Databases: XML Data Model – DTD - XML Schema - XML Querying – Web Databases – JDBC – Information Retrieval – Data Warehousing – Data Mining

UNIT IV: MOBILE DATABASES

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols- Mobile Database Recovery Schemes

UNIT V: MULTIMEDIA DATABASES

Multidimensional Data Structures – Image Databases – Text/Document Databases- Video Databases – Audio Databases – Multimedia Database Design.

Text Books

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson Education/Addison Wesley, 2007.
2.Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Fifth Edition, McGraw Hill, 2006

3. V.S.Subramanian, “Principles of Multimedia Database Systems”, Harcourt India Pvt Ltd., 2001.
4. Vijay Kumar, “ Mobile Database Systems”, John Wiley & Sons, 2006

References:

1. Thomas Cannolly and Carolyn Begg, “ Database Systems, A Practical Approach to Design, Implementation and Management”, Third Edition, Pearson Education, 2007.
2. C.J.Date, A.Kannan and S.Swamynathan,”An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

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	4	0	4

15D51103: Advances in Software Engineering

Objectives:

The course should enable the student

- a broad and critical understanding of all the processes for engineering high quality software and the principles, concepts and techniques associated with software development
- an ability to analyze and evaluate problems and draw on the theoretical and technical knowledge to develop solutions and systems
- a range of skills focused on the analysis of requirements, design and implementation of
  reliable and maintainable software, with strong emphasis on engineering principles applied over the whole development lifecycle
- an awareness of current research in software development, the analytical skills and research techniques for their critical and independent evaluation and their application to new problems.

Unit - I :

Software and Software Engineering: The Nature of Software, The Unique Nature of WebApps, Software Engineering, Software Process, Software Engineering Practice, Software Myths.

Process Models: A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Terminology, Product and Process.

Unit – II:

Understanding Requirements: Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements.

Requirements Modeling: Requirements Analysis, Scenario-Based Modeling, UML Models That Supplement the Use Case, Data Modeling Concepts, Class-Based Modeling.

Unit – III :

Design Concepts: Design within the Context of Software Engineering, Design Process, Design Concepts, The Design Model.

Architectural Design: Software Architecture, Architectural Genres, Architectural Styles, Architectural Design, Assessing Alternative Architectural Designs, Architectural Mapping Using Data Flow.

Component-Level Design: What is a Component, Designing Class-Based Components, Conducting Component-Level Design, Component-Level Design for WebApps, Designing Traditional Components, Component-Based Development.

Unit – IV :

User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

Coding and Testing: Coding, Code Review, Software Documentation, Testing, Testing in the Large versus Testing in the Small, Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Program Analysis Tools, Integration Testing, Testing Object-Oriented Programs, System Testing, Some General Issues Associated with Testing.

Unit – V :

Verification and Validation: Planning Verification and Validation, Software Inspections, Automated Static Analysis, Verification and Formal Methods.

Software Maintenance: Characteristics of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models, Estimation of Maintenance cost.

Text Books :

1. Software Engineering A Practitioner's Approach, Roger S. Pressman, Seventh Edition McGrawHill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, Third Edition, PHI.

Reference Books :

1. Software Engineering, Ian Sommerville, Eighth Edition, Pearson education.
2. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
3. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
4. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
5. Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition, 2006.
6. Software Engineering2: Specification of systems and languages, Diner Bjorner, Springer
   International edition , 2006.
7. Software Engineering Foundations, Yingxu Wang, Auerbach Publications,2008.
8. Software Engineering Principles and Practice, Hans Van Vliet,3rd edition, John Wiley &Sons Ltd.
9. Software Engineering 3:Domains,Requirements,and Software Design, D.Bjorner, Springer
   International Edition.
10. Introduction to Software Engineering, R.J.Leach, CRC Press.

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M.Tech. I– ISem (CS)	T	P	C
	4	0	4

15D51104: Advanced Network Technologies

Objectives:

- To understand the concepts and techniques that have been used to design and implement the TCP/IP Internet
- To understand the issues that are driving the development of new protocols to broaden and enhance the operation of the Internet
- Understand the architecture of the Internet protocols as a layered model
- Describe the functions implemented by each protocol, the design of the protocol and the characteristics of typical implementations
- Analyze the relationships and dependencies between the protocols
- Measure and characterize the behavior of the protocols in the operating environment seen on the Internet

Outcomes:

- Acquire Knowledge on TCP/IP architecture and layers and their comparison with the OSI layers
- Ability to analyze requirements of IP routing and choose appropriate routing methods
- Ability demonstrate how internetworking devices obtain their network configuration
- Ability to identify the purpose, features and functions of current common network hardware and OSI layer with which each is associated.

Unit I:

The OSI Model and the TCP/IP Protocols suite: Protocol layer, The OSI model, TCP/IP protocol suite, Addressing

Underlying Technologies: Wired local area networks, Wireless LANs, Point to point WANs, Switched WANs.

Introduction to Network Layer: Switching, Packet switching at network layer, Network layer services and issues.

Unit II:

Delivery and Forwarding of IP Packets: Delivery, Forwarding, Structure of a router

Internet Protocol Version 4(IPv4): Datagrams, IP over ATM, Security, IP Package

Internet Protocol Version 6(IPv6): Packet format, Transition from IPv4 to IPv6

Address Resolution Protocol: Address mapping, ATM layer, ARP packages

ICMPv4 and Mobile IP: debugging tools and packages, Addressing, Agents, Three Phases, Inefficiency in mobile IP

UNIT-III: UNICAST AND MULTICAST ROUTING PROTOCOLS

Intra-and-Inter Domain Routing, Distance Vector Routing, RIP (Routing Information Protocol), Link State Routing, OSPF (Open Shortest Path First) protocol, BGP (Border Gateway Protocol), Difference between unicast, multicast and broadcast, Multicast Applications, Multicast Routing, Multicast Link State Routing (MOSPF), Multicast Distance Vector (DVMRP).

UNIT-IV: TRANSPORT LAYER PROTOCOLS

User datagram protocol (UDP)-Process-to-Process communication, User datagram, Checksum, UDP operation, Use of UDP, Package.

Transmission Control Protocol (TCP) -TCP services, Features, Segment, Connection, Flow and Error Control, Congestion Control, TCP timers, Options, TCP package, Stream Control Transmission Protocol (SCTP) Services, Features, Packet format

Unit V- IEEE 802.15 WPAN STANDARDS

Standards Organizations for Information Networking: Evolution of Local & Personal Area Networks - IEEE 802.15 Wireless Personal-Area Network Standardization Series - IEEE 802.15.1 Bluetooth Overall Architecture - Protocol Stack Physical & MAC Mechanism - Frame Formats - Connection Management & Security. Interference between Bluetooth and 802.11.

TEXT BOOKS:

1. TCP/IP Protocol Suite, Behrouz A. Forouzan, TMH

2. KavehPahlavan and Prashant Krishnamurthy, "Networking Fundamentals: Wide, Local and Personal Area Communications", John Wiley & Sons, 2009.

REFERENCES:

1. TCP/IP, Tittel Chappell, Cengage Learning.

2. TCP/IP Illustrated, Volume,1the Protocols, W. Richard Stevens, G. Gabrani, Pearson.

3. TCP/IP Application Layer Protocols for Embedded Systems, M.Tim Jones, Networking Series

4. Ramjee Prasad and Luis Munoz, "WLANs and WPANs towards 4G Wireless", Artech House, 2003.

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	4	0	4

15D51105: Distributed and Cloud Computing
(Elective- I)

Objectives:

- Understand the cloud computing paradigm and recognize its various forms
- Gain an appreciation on the challenges and opportunities faced by cloud computing environments
- Able to implement some cloud computing features

Unit - I :

Distributed System Models and Enabling Technologies: Scalable Computing Service over the Internet; The Age of Internet Computing, Computing Trends and New Paradigms, Internet of Things and Cyber-Physical Systems. System Models for Distributed and Cloud Computing; Clusters of Cooperative Computers, Grid Computing Infrastructures, Peer-to-Peer Network Families, Cloud Computing over the Internet. Software Environments for Distributed Systems and Clouds; Service-Oriented Architecture (SOA), Distributed Operating Systems and Software Tools, Parallel/Distributed Programming Models. Performance, Security, and Energy-Efficiency: Performance Metrics and Scalability Analysis, Fault-Tolerance and System Availability, Network Threats and Data Integrity, Energy-Efficiency in Distributed Computing.

Unit – II:

Design of Cloud Computing Platforms: Cloud Computing and Service Models; Public, Private, and Hybrid Clouds, Cloud Ecosystem and Enabling Technologies, Infrastructure-as-a-Service (IaaS) Model, Platform- and Software-as-a-Service (Paas, SaaS). Architecture Design of Compute and Storage Clouds: A Generic Cloud Architecture Design, Layered Cloud Architectural development, Virtualization Support and Disaster Recovery, Architectural Design Challenges. Public Cloud Platforms: GAE, AWS and Windows Azure; Public Clouds and Service Offerings, Google Application Engine (GAE), Amazon Web Service (AWS), Microsoft Windows Azure. Inter- cloud Resource Management: Extended Cloud Computing Services, Resource Provisioning and Platform Deployment, Virtual Machine Creation and Management, Global Exchange of Cloud Resources. Cloud Security and Trust Management: Cloud Security Defense Strategies, Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques, Reputation-Guided Protection of Datacenters.

Unit – III :

Service Oriented Architectures: Services and Service Oriented Architectures: REST and Systems of Systems, Services and Web Services, Enterprise Multi-tier Architecture, Grid

Services and OGSA, Other Service Oriented Architectures and Systems. Message-Oriented Middleware: Enterprise Bus, Publish-Subscribe Model and Notification, Queuing and Messaging Systems, Cloud and Grid Middleware applications. Discovery, Registries, Metadata, and Databases: UDDI and Service Registries, Databases and Publish-Subscribe, Metadata catalogues, Semantic Web and Grid, Job Execution Environments and Monitoring. Workflow in Service-Oriented Architectures: Basic Concepts of Workflow, Workflow Standards, Workflow Architecture and Specification, Workflow Execution Engine

Unit – IV :

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms; Cloud Capabilities and Platform Features, Traditional Features Common To Grids and Clouds, Data Features and Databases, Programming and Runtime Features. Parallel and Distributed Programming Paradigms; Parallel Computing and Programming Paradigms, MapReduce, Twister and Iterative MapReduce, Hadoop Library from Apache, Mapping Applications to Parallel and Distributed Systems. Programming Support of Google App Engine: Programming the Google App Engine, Google File System (GFS), Bigtable, Google's NOSQL system, Chubby, Google's Distributed Lock service. Programming on Amazon AWS and Microsoft Azure: Programming on Amazon EC2, Amazon Simple Storage Service S3, Amazon Elastic Block Store EBS and SimpleDB, Microsoft Azure programming support. Emerging Cloud Software Environments: Open Source Eucalyptus and Nimbus, OpenNebula, Sector/Sphere, and OpenStack, Manjrasoft Aneka Cloud and Appliances.

Unit – V :

Grid Computing Systems and Resource Management: Grid Architecture and Service Modeling; Grid History and service families, CPU Scavenging and Virtual super computers, OGSA, Data intensive Grid service models. Grid Resource Management and Brokering: Resource Management and Job Scheduling, Grid Resource Monitoring with CGSP, Service Accounting and Economy Model, Grid Resource Brokering with Gridbus. Software and Grid Computing; Open-Source Grid Middleware Packages, The Globus Toolkit Architecture (GT4), Containers and Resource/Data Management. Grid Application Trends and security measures; Trust models for grid security enforcement, Authentication and Authorization methods, GSI. On-Line Social and Professional Networking; Online Social Network Characteristics, Graph-Theoretic Analysis of Social networks, Communities and Applications of Social Networks, Facebook: The World's Largest Content-Sharing Network, Twitter for Microblogging, News and Alert Services.

Text Books :

1. Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Kai Hwang, Jack Dongarra, Geoffrey Fox. MK Publishers
2. Mastering Cloud Computing, Rajakumar Buyya, Christian Vecchiola, S.Thamarai Selvi, TMH

Reference Books :

1. Grid Computing – Joshy Joseph, Craig Fellenstein, IBM Press, 2007.
2. Grid and Cluster Compting – Prabhu, Prentice-Hall of India, 2007.
3. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter: Cloud Computing, A Practical Approach, McGraw Fill, 2010
4. Cloud Computing Concepts , Technology & Architecture, Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Pearson Education
5. To the Cloud – Cloud Powering an Enterprise, Pankaj Arora, Raj Biyani, Salil Dave, TMH
6. Cloud Computing – A Practical Approch, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, TMH
7. Cloud Computing Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej Goscinski, Wiley
8. Enterprise Cloud Computing-Technology, Architecture, Applications, Gautam Shroff, Cambridge

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	4	0	4

15D51106: DISTRIBUTED OPERATING SYSTEMS
(Elective- I)

Objectives:

- To learn the fundamentals of Distributed Systems.
- To gain knowledge on Distributed operating system concepts that includes architecture and Communication, process, synchronization, consistency and replication, and fault tolerance.
- To design and implement sample distributed file systems.

Outcomes:

- Students will identify the core concepts of distributed systems: the way in which several machines orchestrate to correctly solve problems in an efficient, reliable and scalable way.
- Students will examine how existing systems have applied the concepts of distributed systems in designing large systems, and will additionally apply these concepts to develop sample systems.

UNIT-I

Introduction of Distributed System & Communication: Goals, Hardware Concepts, Software Concepts, the Client-Server Model, Remote Procedure Call, Remote Object Invocation, Message Oriented Communication, Stream-Oriented Communication.

UNIT-II

Processes & Synchronization: Threads, Clients, Servers, Code Migration, Software Agents, Clock Synchronization, Logical Clocks, Global State, Election Algorithms, Mutual Exclusion, Distributed Transactions.

UNIT-III

Consistency & Replication: Introduction, Data-Centric Consistency Models, Client Centric Consistency Models, Distribution Protocols, Consistency Protocols, Examples.

UNIT-IV

Fault Tolerance: Introduction to Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, Recovery.

UNIT-V

Distributed File Systems: SUN Network File System, The CODA File System, Other Distributed File Systems, Comparison of Distributed File Systems.

Text Books

Andrew S. Tanenbaum, Maarten Van Steen. Distributed Systems – Principles and Paradigms 2/e, PHI, 2004.

Reference Books

1. Pradeep K. Sinha, "Distributed Operating Systems Concepts and Design", PHI 2002.
2. Randy Chow Theodore Johnson, "Distributed Operating Systems and Algorithm Analysis", PEA, 2009.
3. George Couloris, Jean Dollimore, Tim Kind berg, "Distributed Systems Concepts and Design", 3/e, PEA, 2002.

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15D51107: Parallel Computing

(Elective- I)

Course Outcomes:

Acquire knowledge on large scale parallel system

Ability to implement parallel programs for large-scale parallel systems

Ability to design efficient parallel algorithms and applications

Ability to be conversant with performance to analyze and model parallel programs

UNIT I - Introduction to Parallel Computing

Motivating Parallelism-Scope of parallel computing-Parallel programming platforms-Implicit Parallelism- Limitations of Memory System Performance-Dichotomy of Parallel computing platforms-Physical organization of parallel platforms-Communication costs in parallel machines-Routing mechanisms for inter connection networks.

UNIT II - Principles of Parallel Algorithm Design

Preliminaries-Decomposition techniques-characteristics of tasks and interactions-mapping techniques for load balancing-methods for containing interaction overheads-parallel algorithm models.

UNIT III - Basic Communication Operations

One to all broadcast and all to one reduction-all to all broadcast and reduction -scatter and gather –sources of overhead in parallel programs-performance metrics for parallel systems-the effect of granularity on performance.

UNIT IV - Programming Using Message Passing Paradigm

Principles of message passing programming-Building blocks-Message passing interface-Topologies and embedding-Overlapping computation with communication-Collective communication and computation operation.

UNIT V - Programming Shared Address Space Platforms

Thread basics-Why threads?-POSIX thread-Thread basics-Synchronization primitives in Pthreads-controlling thread and synchronization attributes-Composite synchronization constructs-Case study:Implementation of Chat Server.

TEXT BOOKS

1. Ananth Grama ,Vipin Kumar,"*Introduction to parallel computing*",Second edition,2007
2. Cameron Hughes,Tracey Hughes,"*Parallel and Distributed Programming using C++*.Pearson education,2005

REFERENCES

1. Quinn, M. J., Parallel Computing: Theory and Practice (McGraw-Hill Inc.).
2. Bary Wilkinson and Michael Allen: Parallel Programming Techniques using Networked of workstations and Parallel Computers, Prentice Hall, 1999.
3. R. Buyya (ed.) High Performance Cluster Computing: Programming and Applications, Prentice Hall, 1999.

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	4	0	4

15D51108: 3D Technologies
(Elective II)

Objectives:

- Students should be able to learn the concepts of Animations, 2D Splines & Shapes & compound object, Animation Techniques.
- This course introduces fundamental 3D theories and principles of computer modeling and animation.

UNIT –I:

Computer-based Animation &Getting Started with Max Definition of Computer-based Animation, Basic Types of Animation: Real Time , Non-real-time, Definition of Modeling, Creation of 3D objects. Exploring the Max Interface, Controlling & Configuring the Viewports, Customizing the Max Interface & Setting Preferences, Working with Files, Importing & Exporting, Selecting Objects & Setting Object Properties, Duplicating Objects, Creating & Editing Standard Primitive & extended Primitives objects, Transforming objects, Pivoting, aligning etc.

Unit-II:

2D Splines & Shapes & compound object :Understanding 2D Splines& shape, Extrude & Bevel 2D object to 3D, Understanding Loft & terrain, Modeling simple 4 objects with splines, Understanding morph, scatter, conform, connect compound objects, blob mesh, Boolean ,Pro Boolean & procutter compound object.

Unit-III:

3DModelling: Modeling with Polygons, using the graphite, working with X Refs, Building simple scenes, Building complex scenes with X Refs, using assets tracking, deforming surfaces & using the mesh modifiers, modeling with patches & NURBS 8.

Unit-IV:

Key frame Animation Creating Key frames, Auto Key frames, Move & Scale Key frame on the timeline, Animating with constraints & simple controllers, animation Modifiers & complex controllers, function curves in the track view, motion mixer etc .

Unit –V:

Animation Techniques –Non Linear and Character Animation –Posing, Timing and Refining – Working with Poses.

Text Books:

1. Beginning Blender: Open Source 3D Modeling, Animation, and Game Design By Lance Flavell
2. Mastering 3D Animation , by Peter Ratner(Author) Autodesk Maya, 2011.
3. 3Ds Max 7 Fundamentals by Ted Boardman (Mar 26, 2005) - New Riders Publication.

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	4	0	4

15D51109: Computer Vision
(Elective II)

Objectives:

- The objective of this course is to understand the basic issues in computer vision and major approaches that address them.
- Students should be able to learn the Linear Filters, segmentation by clustering, Edge detection, Texture.

UNIT-I

LINEAR FILTERS: Introduction to Computer Vision, Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Technique: Normalized Correlation and Finding Patterns, Technique: Scale and Image Pyramids.

UNIT II

EDGE DETECTION: Noise- Additive Stationary Gaussian Noise, Why Finite Differences Respond to Noise, Estimating Derivatives - Derivative of Gaussian Filters, Why Smoothing Helps, Choosing a Smoothing Filter, Why Smooth with a Gaussian? Detecting Edges-Using the Laplacian to Detect Edges, Gradient-Based Edge Detectors, Technique: Orientation Representations and Corners.

UNIT-III

TEXTURE:

Representing Texture - Extracting Image Structure with Filter Banks, Representing Texture Using the Statistics of Filter Outputs, Analysis (and Synthesis) Using Oriented Pyramids -The Laplacian Pyramid, Filters in the Spatial Frequency Domain, Oriented Pyramids, Application: Synthesizing Textures for Rendering, Homogeneity, Synthesis by Sampling Local Models, Shape from Texture, Shape from Texture for Planes,

UNIT-IV

SEGMENTATION BY CLUSTERING: What is Segmentation, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering. The Hough Transform, Fitting Lines, Fitting Curves

UNIT-V

RECOGNIZATION BY RELATIONS BETWEEN TEMPLATES: Finding Objects by Voting on Relations between Templates, Relational Reasoning Using Probabilistic Models and Search, Using Classifiers to Prune Search, Hidden Markov Models, Application: HMM and Sign Language Understanding, Finding People with HMM.

TEXT BOOK:

1. David A.Forsyth, Jean Ponce, Computer Vision-A Modern Approach, PHI, 2003.

REFERENCE BOOKS:

1. Geometric Computing With Clifford Algebras: Theoretical Foundations and Applications in Computer Vision and Robotics, Springer; 1 edition,2001 by Sommer.
2. Digital Image Processing and Computer Vision, 1/e, by Sonka.
3. Computer Vision and Applications: Concise Edition (With CD) by Jack, Academy Press, 2000.

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15D51110: Computational Intelligence
(ELECTIVE-II)

Course Objectives:

- Computational Intelligence is the successor to Artificial Intelligence
- Offering special benefits in its applications in certain areas like Classification, Regression, Pattern Matching, Control, Robotics, Data Mining etc.
- To introduce the basic tools and techniques in Computational Intelligence such as Neural Networks and Genetic Algorithms from an application perspective to the students.

UNIT I

Introduction: Background and history of evolutionary computation, Behavioral Motivations for Fuzzy Logic, Myths and Applications areas of Computational Intelligence. Adaption, Self organization and Evolution, Historical Views of Computational Intelligence, Adaption and Self organization for Computational Intelligence, Ability to Generalize, Computational Intelligence and Soft Computing Vs Artificial Intelligence and Hard Computing.

UNIT II

Review of evolutionary computation theory and concepts: History of Evolutionary Computation, Evolution Computation Overview, Genetic algorithms, Evolutionary programming, Evolution strategies, genetic programming, and particle swarm optimization.

UNIT III

Review of basic neural network theory and concepts: Neural Network History, What Neural Networks are and Why they are useful, Neural Networks Components and Terminology, Neural Networks Topology, Neural Network Adaption, Comparing Neural Networks and Other information Processing Methods, Preprocessing and Post Processing.

UNIT IV:

Fuzzy Systems Concepts and Paradigms: Fuzzy sets and Fuzzy Logic, Theory of Fuzzy sets , Approximate Reasoning , Fuzzy Systems Implementations , Fuzzy Rule System Implementation.

UNIT V:

Computational Intelligence Implementations: Implementation Issues, Fuzzy Evolutionary Fuzzy Rule System Implementation, Best tools, Applying Computational Intelligence to Data Mining.

Performance Metrics: General Issues, Percent Correct, Average Sum-squared Error.

Textbooks:

1. Computational Intelligence - Concepts to Implementations by Eberhart & Shi

References:

1. Introduction to Genetic Algorithms by Melanie Mitchell
2. Handbook of Genetic Algorithms by Davis
3. Machine Learning by Tom Mitchell

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15D51111:Data Structures And Data Bases Lab

Objectives:

- The fundamental design, analysis, and implementation of basic data structures.
- Basic concepts in the specification and analysis of programs.
- Principles for good program design, especially the uses of data abstraction

1. Write a C++ program for sorting of array integers by using following techniques.
   a) Quick Sort, b) Merge Sort, c) Selection sort.
2. Write a C++ program to implement following using arrays.
   a) Stack b)queue c) circler Queue
3. Write a C++ program to implement following using Linked list
   a) Stack b)queue
4. Write a C++ program to implement ordered list using doubly linked list
5. Write C++ program for implementing Min/Max Heap.
6. Write a C++ program to implement binary search tree operation.
7. Write a C++ program to implement AVL Tree operations
8. Write a C++ program to implement Graph traverses by using following techniques
   a) DFS b) BFS
9. Write a SQL procedure that works with multimedia objects like images, audio, video and etc,.
10. Write DTD for XML representation of bank information.
11. Write a XML Schema for XML representation of bank information.
12. Using XPath perform the basic operations (Select query with where clause) on XML representation of bank information.
13. Using XQuery perform the grouping operation on XML representation of bank information.
14. Write a JSP program to retrieve bank information from XML file.

References

4. Fundamentals of Data structures in C++ Sahni, Horowitz,Mehta, Universities Press, 2nd Edition.
5. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson.
6. DataBase system concepts 5*th* edition by Silbersechatz, korath, Sudarshan.
7. Java Server Pages O'REILLY publications Hans Bergsten.

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15D51201: Service Oriented Architecture

Objectives:

The course should enable the student

- Understand SOA and evolution of SOA.
- Understand web services and primitive, contemporary SOA.
- Understand various service layers.
- Understand service-oriented analysis and design based on guidelines.

UNIT I

Introducing SOA: Fundamental SOA, Common Characteristics of Contemporary SOA, Common Tangible Benefits of SOA, Common Pitfalls of Adopting SOA.

The Evolution of SOA: An SOA Timeline, The Continuing Evolution of SOA, The Roots of SOA.

UNIT II

Web Services and Primitive SOA: The Web Services Frame Work, Services, Service Descriptions, Messaging.

Web Services and Contemporary SOA (Part I-Activity management and Composition): Message Exchange Patterns, Service Activity, Coordination, Atomic Transactions, Orchestration, Choreography.

Web Services and Contemporary SOA (Part-II-Advanced Messaging, Metadata and Security): Addressing, Reliable Messaging, Correlation, Policies, Metadata exchange, Security.

UNIT III

Principles of Service-Orientation: Service–Orientation and the Enterprise, Anatomy of SOA, Common Principles of Service–Orientation, Interrelation between Principles of Service-Orientation, Service Orientation and Object Orientation, Native Web Services Support for Principles of Service-Orientation.

Service Layers: Service-Orientation and Contemporary SOA, Service Layer abstraction, Application Service Layer, Business Service Layer, Orchestration Service Layer, Agnostic Services, Service Layer Configuration Scenarios.

UNIT IV

SOA Delivery Strategies: SOA Delivery Lifecycle Phases, The Top-Down Strategy, The Bottom-up Strategy, The Agile Strategy.

Service Oriented Analysis (Part I-Introduction): Introduction to Service Oriented Analysis, Benefits of a Business Centric SOA, Deriving Business Services.

Service Oriented Analysis (Part-II-Service Modelling): Service Modeling, Service Modelling Guidelines, Classifying Service Model Logic, Contrasting Service Modeling Approaches.

Service Oriented Design (Part I-Introduction): Introduction to Service-Oriented Design, WSDL Related XML Schema Language Basics, WSDL Language Basics, Service Interface Design Tools.

Service Oriented Design (Part II-SOA Composition Guidelines): SOA Composing Steps, Considerations for Choosing Service Layers, Considerations for Positioning Core SOA Standards, Considerations for Choosing SOA Extensions.

UNIT V

Service Oriented Design (Part III- Service Design): Service Design Overview, Entity-Centric Business Service Design, Application Service Design, Task-Centric Business Service Design, Service Design Guidelines.

Service Oriented Design (Part IV-Business Process Design): WS-BPEL Language Basics, WS- Coordination Overview, Service Oriented Business Process Design.

]TEXT BOOKS:

1. Service-Oriented Architecture-Concepts, Technology, and Design, Thomas Erl, Pearson Education.
2. Understanding SOA with Web Services, Eric Newcomer, Greg Lomow, Pearson Education.

REFERENCE BOOKS:

1. The Definitive guide to SOA, Jeff Davies & others, Apress, Dreamtech.
2. Java SOA Cook book, E.Hewitt, SPD.
3. SOA in Practice, N.M.Josuttis, SPD.
4. Applied SOA, M.Rosen and others, Wiley India pvt. Ltd.
5. Java Web Services Architecture, J.Mc Govern, and others, Morgan Kaufmann Publishers, Elsevier.
6. SOA for Enterprise Applications, Shankar.K, Wiley India Edition.
7. SOA-Based Enterprise Integration, W.Roshen, TMH.
8. SOA Security, K.Rama Rao, C.Prasad, dreamtech press.

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15D51202: Natural Language Processing

Objectives:

- able to explain and apply fundamental algorithms and techniques in the area of natural language processing (NLP)
- Understand approaches to syntax and semantics in NLP.
- Understand current methods for statistical approaches to machine translation.
- Understand language modeling.
- Understand machine learning techniques used in NLP.

UNIT I:

Introduction to Natural language

The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.

Unit II: Grammars and Parsing

Grammars and Parsing- Top- Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.

UNIT III: Grammars for Natural Language

Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.

UNIT IV:

Semantic Interpretation

Semantic & Logical form, Word senses & ambiguity, The basic logical form language, Encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts & embedded sentences, Defining semantics structure model theory.

Language Modeling

Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Crosslingual Language Modeling.

UNIT V:

Machine Translation

Survey: Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status.

Anusaraka or Language Accessor: Background, Cutting the Gordian Knot, The Problem,

Structure of Anusaraka System, User Interface, Linguistic Area, Giving up Agreement in Anusarsaka Output, Language Bridges.

Multilingual Information Retrieval

Introduction, Document Preprocessing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources.

Multilingual Automatic Summarization

Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets.

TEXT BOOKS:

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2.Multilingual Natural Language Processing Applications : From Theory To Practice-Daniel M.Bikel and Imed Zitouni , Pearson Publications.
3.Natural Language Processing, A paninian perspective, Akshar Bharathi,Vineet chaitanya,Prentice –Hall of India.

REFERENCES BOOKS:

1. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
2. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

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15D51203: Software Quality Assurance & Testing

Objectives:

The student should be able to:

- Understand software testing and quality assurance as a fundamental component of software life cycle
- Define the scope of software testing & quality assurance projects
- Efficiently perform testing & quality assurance activities using modern software tools
- Estimate cost of a testing & quality assurance project and manage budgets
- Prepare test plans and schedules for a testing & quality assurance project
- Develop testing & quality assurance project staffing requirements
- Effectively manage a testing & quality assurance project

UNIT I

Introduction to software quality, Challenges, Objectives, Quality Factors, Components of SQA, Contract review, Development and quality Plans, SQA Components in Project Life Cycle, SQA Defect Removal Policies, Reviews.

UNIT II

Software Testing Strategy and Environment: Minimizing Risks, Writing a Policy for Software Testing, Economics of Testing, Testing-an organizational issue, Management Support for Software Testing, Building a Structured Approach to Software Testing, Developing a Test Strategy.

Building Software Testing Process: Software Testing Guidelines, Workbench Concept, Customizing the Software Testing Process, Process Preparation Checklist.

UNIT III

Software Testing Techniques: Dynamic Testing – Black Box Testing Techniques, White Box Testing Techniques, Static Testing, Validation Activities, Regression Testing.

Software Testing Tools: Selecting and Installing Software Testing tools

Automation and Testing Tools: Load Runner, Win runner and Rational Testing Tools, Silk test, Java Testing Tools, JMetra, JUNIT and Cactus.

UNIT IV

Seven Step Testing Process–I: Overview of the Software Testing Process, Organizing of Testing, Developing the Test Plan, Verification Testing, Validation Testing.

UNIT V

Seven Step Testing Process-II: Analyzing and Reporting Test results, Acceptance and Operational Testing, Post-Implementation Analysis

Specialized Testing Responsibilities: Software Development Methodologies, Testing Client/Server Systems.

TEXT BOOKS:

1. Effective Methods for Software Testing, Third edition, William E. Perry, Wiley India, 2009
2. Software Testing – Principles and Practices, Naresh Chauhan, Oxford University Press, 2010.
3. Software Quality Assurance – From Theory to Implementation, Daniel Galin, Pearson Education, 2009.

Reference Books:

1. Testing Computer Software, Cem Kaner, Jack Falk, Hung Quoc Nguyen, Wiley India, rp2012.
2. Software Testing – Principles, Techniques and Tools, *M.G.Limaye*, Tata McGraw-Hill, 2009.
3. Software Testing - A Craftsman's approach, *Paul C. Jorgensen*, Third edition, Auerbach Publications, 2010.
4. Software Quality Assurance, *Milind Limaye*, Tata McGraw-Hill, 2011.

5. Software Quality – Theory and Management, *Alan C. Gillies*, Second edition, Cengage Learning,2009.

6. Software Quality – A Practitioner's approach, *Kamna Malik, Praveen Choudhary,* Tata McGraw-Hill, 2008.

7. Software Quality Models and Project Management in a Nutshell, *Shailesh Mehta*, Shroff Publishers and Distributors, 2010.

8. Software Quality Engineering – Testing, Quality Assurance and Quantifiable Improvement, *Jeff Tian*, Wiley India, 2006.

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15D51204: Advanced Data Mining

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.

UNIT-I

Introduction about data mining, Need of data mining, Business data mining, data mining tools, Data Mining Process: CRISP Data Mining, Business Understanding, data understanding and data preparation, modeling, evaluation and deployment, SEMMAS Process, Data mining applications, comparison of CRISP & SEMMA.

UNIT-II

Memory-Based Reasoning Methods, Matching ,Weighted Matching, Distance Minimization Data Mining Methods As Tools X Contents, Association Rules in Knowledge Discovery, Market-Basket Analysis, Market Basket Analysis Benefits Demonstration on Small Set of Data, Real Market Basket Data The Counting Method Without Software.

UNIT-III

Fuzzy Sets in Data Mining, Fuzzy Sets and Decision Trees, Fuzzy Sets and Ordinal Classification, Fuzzy Association Rules, Demonstration Model, Computational Results, Testing Inferences.

Rough Sets :Theory of Rough Sets , Information System, Decision Table, Applications of Rough Sets, Rough Sets Software Tools, The Process of Conducting Rough Sets Analysis, Data Pre-Processing, Data Partitioning, Discretization, Reduct Generation, Rule Generation and Rule Filtering, Apply the Discretization Cuts to Test Dataset, Score the Test Dataset on Generated Rule set , Deploying the Rules in a Production System.

UNIT-IV

Support Vector Machines, Formal Explanation of SVM, Primal Form, Dual Form, Soft Margin, Non-linear Classification, Regression, implementation, Kernel Trick.

Use of SVM–A Process-Based Approach, Support Vector Machines versus Artificial Neural Networks, Disadvantages of Support Vector Machines, Genetic Algorithm Support to Data Mining, Demonstration of Genetic Algorithm, Application of Genetic Algorithms in Data Mining

UNIT-V

Performance Evaluation for Predictive Modeling, Performance Metrics for Predictive Modeling ,Estimation Methodology for Classification Models, Simple Split, The *k*-Fold Cross Validation

Bootstrapping and Jackknifing, Area Under the ROC Curve.
Applications: Applications of Methods Memory-Based Application, Association Rule Application Fuzzy Data Mining, Rough Set Models, Support Vector Machine Application, Genetic Algorithm Applications-Product Quality Testing Design, Customer Targeting .

Text Book:

[1] Advanced Data Mining Techniques Authors: David L. Olson (Author), Dursun Delen.

References :

[1] Advances in data mining and modeling by Wai-Ki ChingMichael Kwok-Po Ng

[2] Advanced Techniques in Knowledge Discovery and Data Mining edited by Nikhil R. Pal, Lakhmi C Jain.

[3] Dynamic and Advanced Data Mining for Progressing Technological Development: Innovations and Systemic ApproachesA B M Shawkat Ali (Central Queensland University, Australia) and Yang Xiang (Central Queensland University, Australia)

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15D51205: Cyber Security
Elective –III

Objectives:

- Learn fundamentals of cryptography and its application to network security.
- Understand network security threats, security services, and countermeasures.
- Acquire background Knowledge on well known network security protocols such as Kerberos, IPSec and SSL.
- Understand software vulnerability and Access control in the OS
- Acquire background on hash functions, authentication, firewalls, intrusion detection techniques.
- Obtain background for original research in network security, especially wireless network and cell phone security.

UNIT-I

Introduction: Cyber attacks, Defense Strategies and Techniques

Mathematical background for Cryptography: Modulo arithmetic, The greatest common divisor, Useful Algebraic Structures, Chinese Remainder Theorem

Basics of Cryptography: Secret versus Public key Cryptography, Types of attacks, Elementary substitution Ciphers, Elementary Transposition Ciphers, Other Cipher Properties

Secrete Key Cryptography: Product Ciphers, DES Construction, Modes of Operation, MAC and other Applications, Attacks, Linear Crypt analysis.

UNIT-II

Public Key Cryptography: RSA Operations, Performance, Applications, Practical Issues

Cryptographic Hash: Properties, Construction, Applications and Performance

Discrete Logarithm and its applications: Diffie-Hellman Parameters, Other applications

Elliptic Curve Cryptography and Advanced Encryption Standard: Elliptic Curve Cryptography, Applications, Practical Considerations, Advanced Encryption Standard (AES).

UNIT-III

Key Management: Digital Certificates, Public key Infrastructure, Identity based Encryption,

Authentication-I: One-way Authentication, Mutual Authentication, Dictionary attacks,

Authentication-II: Centralized Authentication, The Needham-Schroeder Protocol, Kerberos, Biometrics

Security at the Network Layer: Security at Different Layers: Pros and Cons, IP Sec, Internet Key Exchange(IKE) protocol, Security policy and IPSec, Virtual Private Networks

Security at the Transport Layer: Introduction, SSL Handshake Protocol, SSL Record Layer Protocol, Open SSL.

UNIT-IV

Software Vulnerabilities: Phishing, Buffer Overflow, Format string attacks, Cross-site Scripting(XSS), SQL Injection, Virus and Worm Features, Internet scanning Worms, Topological Worms, Botnets,

Access Control in the Operating System: Preliminaries, Mandatory Access Control, Role-based Access control

Firewalls: Basics, Practical issues

Intrusion Prevention and Detection: Prevention Versus Detection, Types of Intrusion detection systems, DDoS attack prevention/detection, Malware Defense.

UNIT-V

WLAN Security: IEEE 802.11 Wireless LAN Security: Background, Authentication, Confidentiality and Integrity

Cell phone Security: Preliminaries, GSM (2G) Security, Security in UMTS (3G)

RFIDs and E-Passports: RFID basics, Applications, Security issues, Addressing RFID Privacy Concerns, Electronic Passports

Electronic Payment: Introduction, Enabling Technologies, Cardholder Present E-Transactions, Payment over the Internet, Mobile Payments, Electronic cash

TEXT BOOKS:

1. Network security and Cryptography by Bernard Menezes CENGAGE Learning Publications, 2010.

REFERENCES:

1. Wenbo Mao, “Modern Cryptography – Theory and Practice”, Pearson Education, New Delhi, 2006.
2. Jonathan Katz, Yehuda Lindell, “Introduction to Modern Cryptography”, Chapman & Hall/CRC, New York, 2007.
3. Bruce Schneier, “Applied Cryptography”, John Wiley & Sons, New York, 2004.
4. Charlie Kafuman, Radia Perlman, Mike Spenciner, Network Security Private Communication in Private world, Second Edition, Prentice Hall India 2002,ISBN:81-203-2213-4

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15D51206: Soft Computing
(Elective -III)

Course Objective
To give students knowledge of soft computing theories fundamentals, i.e. Fundamentals of artificial and neural networks, fuzzy sets and fuzzy logic and genetic algorithms

Course Outcomes
Learn the unified and exact mathematical basis as well as the general principles of various soft computing techniques

Unit - I :
Artificial Intelligence: AI Problems, Techniques, Problem Spaces, Pattern and Data
Search Techniques: Generate and Test, Hill Climbing, Best First Search Problem reduction. Knowledge Representation using Predicate Logic and Rules
Introduction: Hard Computing and Soft Computing.
Characteristics of Neural Networks: Biological Neural Networks and Features, Performance of Computer and Biological Neural Networks

Unit – II:
Artificial Neural Networks: Introduction, Basic models of ANN, important technologies Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back propagation Network, Associative Memory Networks, Training Algorithms for pattern association, BAM and Hopfield Networks

Unit – III :
Unsupervised Learning Network: Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohenen-Self-Organizing Featue Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks, Special Networks- Introduction o various networks

Unit – IV :
Introduction to Classical Sets (crisp sets) and Fuzzy Sets: operations and Fuzzy sets. Classical Relations and Fuzzy Relations-Cardinality, Operations, Properties and composition, Tolerance and equivalence relations.
Membership functions: Features, Fuzzifications, membership value assignments, Defuzzification

Unit – V :

Fuzzy arithmetic and Fuzzy Measures, Fuzzy Rule Base and Approximate Reasoning Fuzzy Decision making and Fuzzy Logic Control System.

Genetic Algorithm: Introduction and basic operators and terminology. Applications: Optimization of TSP, Internet Search Techniques

Text Books :

1. Principles of Soft Computing- S N Sivanandam, S N Deepa, Wiley, India, 2007.
2. Soft Computing and Intelligent System Design- Fakhreddine O Karry, Clarence D Silva, Pearson Edition, 2004.

Reference Books :

1. Artificial Intelligence and SoftComputing- Behavioural and Cognitive Modelling of the Human Brain- Amit Konar, CRC press, Taylor and Francis Group.
2. Artificial Intelligence – Elaine Rich and Kevin Knight, TMH, 1991, rp2008.
3. "Soft Computing" Sameer Roy, Pearson Education,2013.
4. A first course in Fuzzy Logic-Hung T Nguyen and Elbert A Walker, CRC. Press Taylor and Francis Group.
5. Artificial Intelligence and Intelligent Systems, N.P.Padhy, Oxford Univ. Press
6. "Artificial Intelligence and Neural Networks" Umarao, Pearson-Sangune

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15D51207: Information Retrieval Systems
(Elective III)

Course Objective

- To learn the different models for information storage and retrieval
- To learn about the various retrieval utilities
- To understand indexing and querying in information retrieval systems
- To expose the students to the notions of structured and semi structured data
- To learn about web search

Course Outcomes

- Ability to store and retrieve textual documents using appropriate models
- Ability to use the various retrieval utilities for improving search
- Ability to do indexing and compressing documents to improve space and time efficiency
- Ability to formulate SQL like queries for unstructured data

Unit - I :
Introduction to information retrieval
Retrieval Strategies: Vector space model, Probabilistic retrieval strategies: Simple term weights, Non binary independence model, Language Models

Unit – II:
Retrieval Utilities: Relevance feedback, Clustering, N-grams, Regression analysis, Thesauri.

Unit – III :
Retrieval Utilities: Semantic networks, Parsing.
Cross-Language Information Retrieval: Introduction, Crossing the language barrier.

Unit – IV :
Efficiency: Inverted index, Query processing, Signature files, Duplicate document detection

Unit – V :
Integrating Structured Data and Text: A Historical progression, Information retrieval as a relational application, Semi-structured search using a relational schema.
Distributed Information Retrieval: A Theoretical model of distributed retrieval, Web search

Text Books :

1. Information Retrieval – Algorithms and Heuristics, David A. Grossman, Ophir Frieder, 2nd Edition, 2012, Springer, (Distributed by Universities Press)

Reference Books :

1. "Modern Information Retrieval Systems", Yates, Pearson Education
2. "Information Storage and Retrieval Systems " Gerald J Kowalski, Mark T Maybury., Springer, 2000
3. "Mining the Web : Discovering Knowledge from Hypertext Data" Soumen Chakrabarti, , Morgan-Kaufmann Publishers, 2002
4. "An Introduction to Information Retrieval" Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, , Cambridge University Press, Cambridge, England, 2009

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15D51208: Big Data Analytics
(Elective IV)

Course Objectives:

- To understand Big Data Analytics for different systems like Hadoop.
- To learn the design of Hadoop File System.
- To learn how to analyze Big Data using different tools.
- To understand the importance of Big Data in comparison with traditional databases.

Course Outcomes:

- To gain knowledge about working of Hadoop File System.
- Ability to analyze Big Data using different tools.

UNIT- I

Introduction to Big Data. What is Big Data? Why Big Data is Important. Meet Hadoop Data, Data Storage and Analysis, Comparison with other systems, Grid Computing. A brief history of Hadoop. Apache hadoop and the Hadoop Ecosystem. Linux refresher, VMWare Installation of Hadoop.

UNIT-II

The design of HDFS. HDFS concepts. Command line interface to HDFS.Hadoop File systems. Interfaces. Java Interface to Hadoop. Anatomy of a file read. Anatomy of a file writes. Replica placement and Coherency Model. Parallel copying with distcp, keeping an HDFS cluster balanced.

UNIT-III

Introduction. Analyzing data with unix tools. Analyzing data with hadoop. Java MapReduce classes (new API). Data flow, combiner functions, Running a distributed MapReduce Job. Configuration API. Setting up the development environment. Managing configuration. Writing a unit test with MRUnit. Running a job in local job runner. Running on a cluster, Launching a job. The MapReduce WebUl.

UNIT-IV

Classic Mapreduce. Job submission. Job Initialization. Task Assignment. Task execution .Progress and status updates. Job Completion. Shuffle and sort on Map and reducer side.

Configuration tuning. Map Reduce Types. Input formats. Output cormats. Sorting. Map side and Reduce side joins.

UNIT-V

The Hive Shell. Hive services. Hive clients. The meta store. Comparison with traditional databases. Hive QI. Hbasics. Concepts. Implementation. Java and Map reduce clients. Loading data, web queries.

Text Books:

1. Tom White, Hadoop,"The Definitive Guide", 3rd Edition, O'Reilly Publications, 2012.

2. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch ,"Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", 1st Edition, TMH,2012.

References:

1. Big Data and Health Analytics Hardcover Katherine Marconi (Editor), Harold Lehmann (Editor)
2. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications by bart baesens, Wiley publications.

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15D51209: DIGITAL IMAGE PROCESSING

-(Elective IV)

Objectives:

- Develop an overview of the field of image processing.
- Understand the Image segmentation, enhancement, compression etc., approaches and how to implement them.
- Prepare to read the current image processing research literature.
- Gain experience in applying image processing algorithms to real problems
- Analyze general terminology of digital image processing.

Unit - I :

Digital Image Fundamentals: What is Digital Image Processing, examples of fields that use digital image processing, fundamental Steps in Digital Image Processing, Components of an Image processing system, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations.

Unit – II:

Image Enhancement: Image Enhancement in the spatial domain: some basic gray level transformations, histogram processing, enhancement using arithmetic and logic operations, basics of spatial filters, smoothening and sharpening spatial filters, combining spatial enhancement methods.

Unit – III :

Segmentation: Thresholding, Edge Based Segmentation: Edge Image Thresholding, Region Based Segmentation, Matching, **Representation and Description**: Representation , Boundary Descriptors, Regional Descriptors.

Unit – IV :

Image Compression: Fundamentals, image compression models, elements of information theory, error-free compression, lossy compression,Image Compression Stanadrds.

Unit – V :

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

Color Image Processing: Color fundamentals, Color Models and basics of full-color image processing

Text Books :

1. "Digital Image Processing", Rafael C.Gonzalez and Richard E. Woods, Third Edition, Pearson Education, 2007
2. Digital Image Processing", S.Sridhar, Oxford University Press

Reference Books :

1. "Fundamentals of Digital Image Processing" , S. Annadurai, Pearson Edun, 2001.
2. "Digital Image Processing and Analysis", B. Chanda and D. Dutta Majumdar, PHI, 2003.
3. "Image Processing" , Analysis and Machine Vision , Milan Sonka, Vaclav Hlavac and Roger Boyle, 2nd Edition, Thomson Learning, 2001.
4. "Digital Image Processing" Vipula Singh, Elsevier

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15D51210: PATTERN RECOGNITION
(Elective IV)

Objectives:

- Understand the fundamental pattern recognition and machine learning theories
- Able to design and implement certain important pattern recognition techniques
- Capable of applying the pattern recognition theories to applications of interest.

Unit - I :

Introduction to Pattern Recognition: Data Sets for Pattern Recognition, Different Paradigms for Pattern Recognition,

Pattern Representation: Data Structures for Pattern Representation, Representation of Clusters, Proximity Measures, Size of Patterns, Abstractions of the Data Set, Feature, Feature Selection, Evaluation of Classifiers, Evaluation of Clustering

Unit – II:

Nearest Neighbour Based Classifiers: Nearest Neighbour Algorithm, Variants of the NN Algorithm , Use of the Nearest Neighbour Algorithm for Transaction Databases, Efficient Algorithms, Data Reduction, Prototype Selection,

Bayes Classifier: Bayes Theorem, Minimum error rate classifier, Estimation of Probabilities, Comparison with the NNC, Naive Bayes Classifier, Bayesian Belief Network.

Unit – III :

Hidden Markov Models: Markov Models for Classification, Hidden Markov Models, Classification Using HMMs, Classification of Test Patterns.

Decision Trees: Introduction, Decision Trees for Pattern Classification, Construction of Decision Trees, Splitting at the Nodes, Over fitting and Pruning, Example of Decision Tree Induction.

Unit – IV :

Support Vector Machines: Introduction, Linear Discriminant Functions, Learning the Linear Discriminant Function, Neural Networks, SVM for Classification, Linearly Separable Case, Non-linearly Separable Case.

Combination of Classifiers: Introduction, Methods for Constructing Ensembles of Classifiers, Methods for Combining Classifiers, Evaluation of Classifiers, Evaluation of Clustering

Unit – V :

Clustering: Clustering and its Importance, Hierarchical Algorithms, Partitional Clustering, Clustering Large Data Sets, An Application to Handwritten Digit Recognition: Description of the Digit Data, Pre-processing of Data, Classification Algorithms, Selection of Representative Patterns.

Text Books :

1. Pattern Recognition an Introduction, V. Susheela Devi M. Narasimha Murty, University Press.
2. Pattern Recognition, Segrios Theodoridis,Konstantinos Koutroumbas, Fourth Edition, Elsevier

Reference Books :

1. Pattern Recognition and Image Analysis, Earl Gose, Richard John Baugh, Steve Jost, PHI 2004.
2. C. M. Bishop, 'Neural Networks for Pattern Recognition', Oxford University Press, Indian Edition, 2003.
3. Pattern Classification, R.O.Duda, P.E.Hart and D.G.Stork, Johy Wiley, 2002

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JNTUA COLLEGE OF ENGINEERING (*AUTONOMOUS*) : : ANANTAPUR

Department Of Computer Science & Engineering

M.Tech. I – II Sem.(CS)

15D54201: Research Methodology (Audit Course)

(Audit Course For M.Tech. –II Semester Program from 2015 admitted batches onwards)

UNIT I

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

UNIT II

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design.
Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation.
Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

UNIT III

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

UNIT IV

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multi-variate Analysis.

UNIT V

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

Text books:

1. **Research Methodology:Methods and Techniques – C.R.Kothari, 2nd Edition,New Age International Publishers.**

2. **Research Methodology: A Step by Step Guide for Beginners- Ranjit Kumar, Sage Publications (Available as pdf on internet)**
3. **Research Methodology and Statistical Tools – P.Narayana Reddy and G.V.R.K.Acharyulu, 1st Edition,Excel Books,New Delhi.**

REFERENCES:

1. **Scientists must Write - Robert Barrass (Available as pdf on internet)**
2. **Crafting Your Research Future –Charles X. Ling and Quiang Yang (Available as pdf on internet)**

(w.e.f 2015-2016)

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) : : ANANTAPURAMU

Department Of Computer Science & Engineering

M.Tech. I – II Sem.(CS)	**T**	**P**	**C**
	0	**4**	**2**

15D51211: SERVICE ORIENTED ARCHITECTURE & SOFTWARE TESTING LAB

Student is expected to complete the following experiments as a part of laboratory work.

Part - A

1. Develop at least 5 components such as Order Processing, Payment Processing, etc., using .NET component technology.
2. Develop at least 5 components such as Order Processing, Payment Processing, etc., using EJB Component Technology.
3. Invoke .NET components as web services.
4. Invoke EJB components as web services.
5. Develop a Service Orchestration Engine (workflow) using WS-BPEL and Implement Service Composition. For Example, a business process for planning business travels will invoke several services. This process will invoke several airline companies (such as American Airlines, Delta Airlines etc.) to check the airfare price and buy at the lowest price.
6. Develop a J2EE client to access a .NET web service.
7. Develop a .NET client to access a J2EE web service.

Part - B

1. Write programs in C Language to demonstrate the working of the following constructs: i) do...while ii) while….do iii) if…else iv) switch v) for
2. A program written in C language for Matrix Multiplication fails. Introspect the causes for its failure and write down the possible reasons for its failure.
3. Consider ATM System and Study its system specifications and report the various bugs.
4. Write the test cases for Banking application.
5. Create test plan document for Library Management System.
6. Create test cases for Railway Reservation.
7. Create test plan document for Online Shopping.

Working with Tool's:

Understand the Automation Testing Approach, Benefits, Workflow, Commands and Perform Testing on one application using the following Tool's.

1. Win runner Tool for Testing.
2. Load runner Tool for Performance Testing.
3. Selenium Tool for Web Testing.
4. Bugzilla Tool for Bug Tracking.
5. Test Director Tool for Test Management.
6. Test Link Tool for Open Source Testing.

Part-C

1. Transforming Data into ARFF

2. Transforming CSV into ARFF.

3. Visualizing Arff Data Files using WEKA

4. Simulating Apriori Algorithm in WEKA

5. Create OLAP Cube from Student Data Base

6. Demonstrating Decision trees using J48 Classifier

7. Create OLAP Cube from Library Data Base

8. Create OLAP Cube from Hotel Data Base

9. Create OLAP Cube from shopping Data Base.

10.Create OLAP Cube from sales Data Base

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Course Structure of R21 Academic Regulations for M.Tech (Regular) Programs with effect from AY 2021-2022

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COMPUTER SCIENCE

I SEMESTER

S.No.	Course Code	Subject Name	Cate Gory	Hours Per Week			Credits
				L	T	P	
1	21D51101	Advanced Computer Networks	PC	3	0	0	3
2	21D51102	Fundamentals of Data Science	PC	3	0	0	3
3	**Professional Elective – I**						
	21D51103	Computer Vision	PE	3	0	0	3
	21D51104	Machine Learning					
	21D51105	Agile Secure Software Engineering					
4	**Professional Elective – II**						
	21D51106	Distributed Systems	PE	3	0	0	3
	21D51107	Information Security					
	21D51108	Data Visualization					
5	21D11109	Research Methodology and IPR	MC	2	0	0	2
6	21D11110	English for Research Paper Writing	AC	2	0	0	0
	21D11111	Value Education					
	21D11112	Pedagogy Studies					
7	21D51109	Advanced Computer Networks Lab	PC	0	0	4	2
8	21D51110	Data Science Lab	PC	0	0	4	2
Total				**16**	**00**	**08**	**18**

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Course Structure of R21 Academic Regulations for M.Tech (Regular) Programs with effect from AY 2021-2022

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COMPUTER SCIENCE

II SEMESTER

S.No.	Course Code	Subject Name	Cate Gory	Hours Per Week			Credits
				L	T	P	
1	21D51201	Internet of Things	PC	3	0	0	3
2	21D51202	Virtual Reality and Augmented Reality	PC	3	0	0	3
3	**Professional Elective – III**						
	21D51203	Cyber Security & Digital Forensics	PE	3	0	0	3
	21D51204	Deep Learning					
	21D51205	Service Oriented Architecture					
4	**Professional Elective – IV**						
	21D51206	Predictive Data Analytics	PE	3	0	0	3
	21D51207	Software Defined Networks					
	21D51208	Randomized Approximation Algorithms					
5	21D11209	Technical Seminar	PR	0	0	4	2
6	21D11210	Disaster Management	AC	2	0	0	0
	21D11211	Constitution of India					
	21D11212	Stress Management by Yoga					
7	21D51209	Internet of Things Lab	PC	0	0	4	2
8	21D51210	Virtual Reality and Augmented Reality Lab	PC	0	0	4	2
Total				**14**	**00**	**12**	**18**

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COMPUTER SCIENCE

III SEMESTER

S.No.	Course Code	Subject Name	Cate Gory	Hours Per Week			Credits
				L	T	P	
1	**Professional Elective – V**						
	21D51301	Block chain Technologies	PE	3	0	0	3
	21D51302	Reinforcement Learning					
	21D51303	Software Reliability					
2	**Open Elective**						
	21D50301	Software Development and IT Services	OE	3	0	0	3
3	21D51304	Dissertation Phase – I	PR	0	0	20	10
4	21D00301	Co-Curricular Activities	PR				2
Total				**06**	**00**	**20**	**18**

IV SEMESTER

S.No.	Course Code	Subject Name	Cate Gory	Hours Per Week			Credits
				L	T	P	
1	21D51401	Dissertation Phase – II	PR	0	0	32	16
Total				**00**	**00**	**32**	**16**

R21 COURSE STRUCTURE &SYLLABUS FOR M.TECH COURSES
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(COMPUTER SCIENCE)

Course Code	21D51101	ADVANCED COMPUTER NETWORKS (21D51101)	L	T	P	C
Semester	I		3	0	0	3

Course Objectives:

- To introduce the wireless and mobile network environment.
- To discuss the working of GSM
- To teach the emerging technologies in the mobile environment.
- To transmit knowledge regarding wireless LANs.
- To elucidate the data dissemination techniques
- To educate the importance of adaptability of the transport layer for the wirelessenvironment.

Course Outcomes (CO): Student will be able to

- Describe the mobile network environment
- Justify the need for continuous emergence of technologies
- Experiment with the protocols of GSM environment
- Develop new routing protocols for mobile environment
- Propose new data dissemination techniques
- Recommend modifications to network and transport protocols

UNIT – I		Lecture Hrs:

Introduction: Mobility of Bits and Bytes, Wireless- The Beginning, Mobile Computing, Dialogue Control, Networks, Middleware and Gateways, Application and Services, Developing Mobile Computing Applications, Security in Mobile Computing, Standards-Why are they Necessary?, Standards Bodies, Players in the wireless Space.

Mobile Computing Architecture: History of Computers, History of Internet, Internet-The Ubiquitous Network, Architecture for mobile computing, 3-tier architecture, Design considerations for Mobile Computing, Mobile Computing through Internet, Making existing applications mobile-enabled.

Mobile Devices and Systems: Mobile Smartphones, Smart mobiles, and Systems, Handheld Packet Computers, Handheld devices, Smart systems, Limitations of Mobile Devices, Automotive Systems

UNIT – II		Lecture Hrs:

Emerging Technologies: Introduction, Bluetooth, Radio frequency identification (RFID), Mobile IP, Internet Protocol Version 6(IPV6).

Wireless Medium Access Control, CDMA, 3G, Wireless Broadband (WIMAX), 4G and 5G Networks

UNIT – III		Lecture Hrs:

Short Message Service(SMS): Mobile Computing over SMS, SMS, Value added Services through SMS.

General Packet Radio Service(GPRS): Introduction,GPRS and Packet data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications and limitations for GPRS, Billing and charging in GPRS, Enhanced Data rates for GSM Evolution(EDGE).

Wireless Application Protocol: Introduction, WAP, MMS.

UNIT – IV		Lecture Hrs:
Wireless LAN: Introduction, Advantages, IEEE 802.11 Standards, Architecture, Mobility in Wireless LAN, Deploying wireless LAN, Mobile adhoc Networks and Sensor Networks, Wireless LAN Security, Wireless Access in Vehicular environment, Wireless Local loop, Hiper LAN. **Mobile Network Layer:** Mobile Internet Protocol, Packet delivery and Handover management, Location management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP, VOIP, IPSec.		
UNIT – V		Lecture Hrs:
Mobile Transport Layer: Conventional TCP/IP transport layer protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other methods for Mobile TCP layer Transmission. **Data Dissemination and Systems for Broadcasting:** Communication Asymmetry, Classification of data delivery mechanism, Data dissemination Broadcast Models, Selective tuning and Indexing Techniques, Digital Audio Broadcasting(DAB), Digital Video Broadcasting		
Textbooks:		
1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing: Technology, Applications and Service Creation", 2nd edition, McGraw Hill, 2010. 2. RaJ Kamal, "Mobile Computing", 3rd edition, Oxford University Press.		
Reference Books:		
1. Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition, 2009. 2. UWE Hansmann, LotherMerk, Martin S. Nocklous, Thomas Stober, "Principles of Mobile Computing," Second Edition, Springer.		

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R21 COURSE STRUCTURE &SYLLABUS FOR M.TECH COURSES
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(COMPUTER SCIENCE)

Course Code	21D51102	FUNDAMENTALS OF DATA SCIENCE (21D51102)	L	T	P	C
Semester	I		3	0	0	3

Course Objectives:

- Provide you with the knowledge and expertise to become a proficient data scientist.
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science
- Produce Python code to statistically analyse a dataset
- Critically evaluate data visualizations based on their design and use for communicating stories from data

Course Outcomes (CO): Student will be able to

- Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists
- Explain how data is collected, managed and stored for data science
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science
- Critically evaluate data visualizations based on their design and use for communicating stories from data

UNIT – I		Lecture Hrs:

Introduction, What Is Statistical Learning?, Why Estimate f?, How Do We Estimate f?, The Trade-Off Between Prediction Accuracy and Model Interpretability, Supervised Versus Unsupervised Learning, Regression Versus Classification Problems, Assessing Model Accuracy, Measuring the Quality of Fit, The Bias-Variance Trade-of, The Classification Setting, Introduction to R, Basic Commands, Graphics, Indexing Data, Loading Data, Additional Graphical and Numerical Summaries.

UNIT – II		Lecture Hrs:

Linear Regression, Simple Linear Regression, Multiple Linear Regression, Other Considerations in the Regression Model, Comparison of Linear Regression with K-Nearest Neighbours, Linear Regression.

UNIT – III		Lecture Hrs:

Classification, Logistic Regression, Linear Discriminant Analysis, A Comparison of Classification Methods, Logistic Regression, LDA, QDA, and KNN.

UNIT – IV		Lecture Hrs:

Programming for basic computational methods such as Eigen values and Eigen vectors, sparse matrices, QR and SVD, Interpolation by divided differences. Data Wrangling: Data Acquisition, Data Formats, Imputation, The split-apply-combine paradigm.

UNIT – V		Lecture Hrs:

Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. Data Warehouse: Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction.

Textbooks:

1. Gareth James Daniela Witten Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, February 11, 2013, web link: www.statlearning.com.

2. Mark Gardener, Beginning R The statistical Programming Language, Wiley, 2015.
3. Han ,Kamber, and J Pei, Data Mining Concepts and Techniques, 3rd edition, Morgan Kaufman, 2012.

Reference Books:

1. SinanOzdemir, Principles of Data Science, Packt Publishing Ltd Dec 2016.
2. Joel Grus, Data Science from Scratch, Oreilly media, 2015.

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R21 COURSE STRUCTURE &SYLLABUS FOR M.TECH COURSES
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(COMPUTER SCIENCE)

Course Code	21D51103	COMPUTER VISION	L	T	P	C
Semester	I	(21D51103) PE – I	3	0	0	3

Course Objectives:

- Be familiar with both the theoretical and practical aspects of computing with images.
- Have described the foundation of image formation, measurement, and analysis.
- Understand the geometric relationships between 2D images and the 3D world.
- Grasp the principles of state-of-the-art deep neural networks

Course Outcomes (CO): Student will be able to

- Develop the practical skills necessary to build computer vision applications.
- To have gained exposure to object and scene recognition and categorization from images

UNIT - I		Lecture Hrs:

LINEAR FILTERS: Introduction to Computer Vision, Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Technique: Normalized Correlation and Finding Patterns, Technique: Scaleand Image Pyramids.

UNIT - II		Lecture Hrs:

EDGE DETECTION: Noise- Additive Stationary Gaussian Noise, Why Finite Differences, Respond to Noise, Estimating Derivatives - Derivative of Gaussian Filters, Why SmoothingHelps, Choosing a Smoothing Filter, Why Smooth with a Gaussian? Detecting Edges-Using theLaplacian to Detect Edges, Gradient-Based Edge Detectors, Technique: OrientationRepresentations and Corners.

UNIT - III		Lecture Hrs:

TEXTURE:Representing Texture - Extracting Image Structure with Filter Banks, Representing Texture, Using the Statistics of Filter Outputs, Analysis (and Synthesis) Using Oriented Pyramids – TheLaplacian Pyramid, Filters in the Spatial Frequency Domain, Oriented Pyramids,
Application:Synthesizing Textures for Rendering, Homogeneity, Synthesis by Sampling Local Models,Shape from Texture, Shape from Texture for Planes

UNIT - IV		Lecture Hrs:

SEGMENTATION BY CLUSTERING: What is Segmentation, Human Vision: Grouping andGestalt, Applications: Shot Boundary Detection and Background Subtraction, ImageSegmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering. The HoughTransform, Fitting Lines, Fitting Curves.

UNIT - V		Lecture Hrs:

RECOGNIZATION BY RELATIONS BETWEEN TEMPLATES: Finding Objects byVoting on Relations between Templates, Relational Reasoning Using Probabilistic Models andSearch, Using Classifiers to Prune Search, Hidden Markov Models, Application: HMM and SignLanguage Understanding, Finding People with HMM.

Textbooks:

1. David A.Forsyth, Jean Ponce, Computer Vision-A Modern Approach, PHI, 2003.

Reference Books:

1. Geometric Computing With Clifford Algebras: Theoretical Foundations and Applicationsin Computer Vision and Robotics, Springer; 1 edition,2001 by Sommer.
2. Digital Image Processing and Computer Vision, 1/e, by Sonka.
3. Computer Vision and Applications: Concise Edition (With CD) by Jack, Academy Press,2000.

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R21 COURSE STRUCTURE &SYLLABUS FOR M.TECH COURSES
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(COMPUTER SCIENCE)

Course Code	21D51104	MACHINE LEARNING (21D51104) PE – I	L	T	P	C
Semester	I		3	0	0	3

Course Objectives:

- To understand the basic theory underlying machine learning.
- To be able to formulate machine learning problems corresponding to different applications
- To understand a range of machine learning algorithms along with their strengths and weaknesses
- To be able to apply machine learning algorithms to solve problems of moderate complexity

Course Outcomes (CO): Student will be able to

- Ability to understand what is learning and why it is essential to the design of intelligent machines
- Apply theoretical foundations of decision trees to identify best split and Bayesian classifier to label data points
- Acquire knowledge in deep learning and be able to implement deep learning models for language, vision, speech and decision making
- Illustrate the working of classifier models like SVM, Neural Networks and identify classifier model for typical machine learning applications
- Illustrate and apply clustering algorithms and identify its applicability in real lifeproblems.

UNIT - I		Lecture Hrs:

INTRODUCTION
Learning Problems – Perspectives and Issues – Concept Learning – VersionSpaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm-Heuristic SpaceSearch.

UNIT - II		Lecture Hrs:

NEURAL NETWORKS AND GENETIC ALGORITHMS
Neural Network Representation – Problems – Perceptrons – Multilayer Networks and BackPropagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT - III		Lecture Hrs:

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 – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT - IV		Lecture Hrs:

INSTANT BASED LEARNING
K- Nearest Neighbour Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning.

UNIT - V		Lecture Hrs:
ADVANCED LEARNING: Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCLAlgorithm-Reinforcement Learning – Task – Q-Learning – Temporal DifferenceLearning		
Textbooks:		
1. Machine Learning – Tom M. Mitchell, -MGH		
Reference Books:		
1. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor &Francis		

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R21 COURSE STRUCTURE &SYLLABUS FOR M.TECH COURSES
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(COMPUTER SCIENCE)

Course Code	21D51105	AGILE SECURE SOFTWARE ENGINEERING (21D51105)	L	T	P	C
Semester	I	PE – I	3	0	0	3

Course Objectives:

- To understand security in delivery of more useful software
- To understand the essence of agile development methods
- To understand the risks and attacks of agile programming
- To understand the principles and practices of extreme programming

Courses Outcomes:

- Introduce the concept of development agility and the Agile enablers
- Review each of the major agile development methods underscoring their strengths and weaknesses of security threats
- Understand how to manage an agile environment even within a structured organizational approach
- Learn how to introduce agility into a development organization

UNIT - I | Lecture Hrs:

Getting started with Security: Security is about Risk, Threat actors and Knowing Your Enemy, Security Values: Protecting our data, systems and people, Common security misconceptions or mistakes.

Agile Enablers: Build Pipeline, Automated Testing, Continuous Integration, Infrastructure as code, Release Management, Visible Tracking, Centralised Feedback, The Only Good code is deployed code, Operating Safely and at Speed.

Welcome to the Agile Revolution: Agile: A Potted Landscape, Scrum, the Most Popular of Agile Methodologies,Extreme Programming, Kanban, Lean, Agile Methods in General,What about DevOps?, Agile and Security.

Working with Your Existing Agile Life Cycle: Traditional Application Security Models, Per-Iteration Rituals, Pre-Iteration Involvement, Post-Iteration Involvement, Setting Secure Baselines, What About When You Scale? , Building Security Teams That Enable.

UNIT - II | Lecture Hrs:

Security and Requirements: Dealing with Security in Requirements, Agile Requirements: Telling Stories, Tracking and Managing Stories: The Backlog, Dealing with Bugs, Getting Security into Requirements, Security Personas and Anti-Personas, Attacker Stories: Put Your Black Hat On, Attack Trees, Infrastructure and Operations Requirements.

Agile Vulnerability Management: Vulnerability Scanning and Patching, Dealing with Critical Vulnerabilities, Securing Your Software Supply Chain, How to Fix Vulnerabilities in an Agile Way, Security Sprints, Hardening Sprints, and Hack Days, Taking On and Paying Down Security Debt.

Risk for Agile Teams: Security Says, No, Understanding Risks and Risk Management, Risks and Threats, Dealing with Risk, Risk Management in Agile and DevOps, Handling Security Risks in Agile and DevOps.

Threat Assessments and Understanding Attacks: Understanding Threats: Paranoia and Reality, Your System's Attack Surface, Agile Threat Modelling, Common Attack Vectors.

UNIT - III		Lecture Hrs:
Building Secure and Usable Systems: Design to Resist Compromise ,Security Versus Usability , Technical Controls, Security Architecture, Complexity and Security **Code Review for Security:** Why Do We Need to Review Code?, Types of Code Reviews, Peer Code Reviews, When Should You Review Code?, How to Review Code, Who Needs to Review Code?, Automated Code Reviews, Code Review Challenges and Limitations, Adopting Secure Code Reviews, Reviewing Security Features and Controls, Reviewing Code for Insider Threats. **Agile Security Testing:** How Is Testing Done in Agile? , If You Got Bugs, You'll Get Pwned, The Agile Test Pyramid , Unit Testing and TDD, Service-Level Testing and BDD Tool, Acceptance Testing, Functional Security Testing and Scanning, Testing Your Infrastructure, Creating an Automated Build and Test Pipeline, A Place for Manual Testing in Agile, How Do You Make Security Testing Work in Agile and DevOps?		
UNIT - IV		Lecture Hrs:
External Reviews, Testing, and Advice: Why Do We Need External Reviews?, Vulnerability Assessment, Penetration Testing, Red Teaming, Bug Bounties, How Bug Bounties ,Configuration Review, Secure Code Audit, Crypto Audit, Choosing an External Firm, Getting Your Money's Worth. **Operations and OpSec:** System Hardening: Setting Up Secure Systems, Network as Code, Monitoring and Intrusion Detection, Catching Mistakes at Runtime, Runtime Defense, Incident Response: Preparing for Breaches, Securing Your Build Pipeline, Shh…Keeping Secrets Secret. **Compliance:** Compliance and Security, Different Regulatory Approaches, Which Approach Is Better?, Risk Management and Compliance, Traceability of Changes, Data Privacy, How to Meet Compliance and Stay Agile, Building Compliance into Your Culture, Certification and Attestation.		
UNIT – V		Lecture Hrs:
Security Culture: The Importance of Security Culture, Building a Security Culture, Principles of Effective Security, Security Outreach. **What Does Agile Security Mean?:** Laura's Story, Jim's Story, Michael's Story, Rich's Story.		
Textbooks:		
1. "Agile Application Security: Enabling Security in a Continuous Delivery Pipeline", By Laura Bell, Michael Brunton-Spall, Rich Smith, Jim Bird, O'Reilly Media, Inc.,2017		
Reference Books: 1. James Shore and Shane Warden, " The Art of Agile Development", O'REILLY, 2007		

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R21 COURSE STRUCTURE &SYLLABUS FOR M.TECH COURSES
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(COMPUTER SCIENCE)

Course Code	21D51106	DISTRIBUTED SYSTEMS	L	T	P	C
Semester	I	(21D51106) PE – II	3	0	0	3

Course Objectives:

- To introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems

Course Outcomes (CO): Student will be able to

- Design trends in distributed systems.
- Apply network virtualization.
- Apply remote method invocation and objects

UNIT - I		Lecture Hrs:

Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts
DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues

UNIT - II		Lecture Hrs:

DISTRIBUTED DATABASE DESIGN
Alternative design strategies; Distributed design issues; Fragmentation; Data Allocation
SEMANTICS DATA CONTROL
View management; Data security; Semantic Integrity Control
QUERY PROCESSING ISSUES
Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data

UNIT - III		Lecture Hrs:

Factors governing query optimization; Centralized query optimization; Ordering offragment queries; Distributed query optimization algorithms
TRANSACTION MANAGEMENT
The transaction concept; Goals of transaction management; Characteristics oftransactions; Taxonomy of transaction models
CONCURRENCY CONTROL
Concurrency control in centralized database systems; Concurrency control in DDBSs;Distributed concurrency control algorithms; Deadlock management

UNIT - IV		Lecture Hrs:

Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols

UNIT - V		Lecture Hrs:

PARALLEL DATABASE SYSTEMS
Parallel architectures; parallel query processing and optimization; load balancing
ADVANCED TOPICS
Mobile Databases, Distributed Object Management, Multi-databases

Textbooks:

1. Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991.

Reference Books:

1. Distributed Database Systems, D. Bell and J.Grimson, Addison-Wesley, 1992.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
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Course Code	21D51107	INFORMATION SECURITY (21D51107) PE – II	L	T	P	C
Semester	I		3	0	0	3

Course Objectives:

- To understand basics of Cryptography and Network Security.
- To be able to secure a message over insecure channel by various means.
- To learn about how to maintain the Confidentiality, Integrity and Availability of a Data
- To understand various protocols for network security to protect against the threats in the networks.

Course Outcomes (CO): Student will be able to

- Provide security of the data over the network.
- Do research in the emerging areas of cryptography and network security.
- Implement various networking protocols.
- Protect any network from the threats in the world

UNIT - I		Lecture Hrs:

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

UNIT - II		Lecture Hrs:

Conventional Encryption Principles, Conventional encryption algorithms, cipher block modes of operation, location of encryption devices, key distribution Approaches of Message Authentication, Secure Hash Functions and HMAC.

UNIT - III		Lecture Hrs:

Public key cryptography principles, public key cryptography algorithms, digital signatures, digital Certificates, Certificate Authority and key management Kerberos, X.509 Directory Authentication Service.

UNIT - IV		Lecture Hrs:

Email privacy: Pretty Good Privacy (PGP) and S/MIME.IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

UNIT - V		Lecture Hrs:

Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3. Intruders, Viruses and related threats.

Textbooks:

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn IdoDubrawsky, Steve W.Manzuik and Ryan Permeh, wileyDreamtech,
3. Cryptography and network Security, Third edition, Stallings, PHI/Pearson

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Reference Books:

1. Network Security and Cryptography‖, Bernard Menezes ,Cengage Learning.
2. Cryptography and Security‖C.K. Shymala, N. Harini and Dr. T.R. Padmanabhan,Wiley-India.
3. Applied Cryptography, Bruce Schiener, 2nd edition, John Wiley & Sons.
4. Cryptography and Network Security‖, AtulKahate, TMH.
5. ‗Introduction to Cryptography‖, Buchmann, Springer.
6. ‗Number Theory in the Spirit of Ramanujan‖, Bruce C.Berndt, University Press
7. Introduction to Analytic Number Theory‖, Tom M.Apostol, University Press

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Course Code	21D51108	DATA VISUALIZATION	L	T	P	C
Semester	I	(21D51108) PE – II	3	0	0	3

Course Objectives:

- To develop skills to both design and critique visualizations.
- To introduce visual perception and core skills for visual analysis.
- To understand visualization for time-series analysis.
- To understand visualization for ranking analysis.
- To understand visualization for deviation analysis..

Course Outcomes (CO): Student will be able to

- Explain principles of visual perception
- Apply core skills for visual analysis
- Apply visualization techniques for various data analysis tasks
- Design information dashboard

UNIT - I		Lecture Hrs:

Information visualization – effective data analysis – traits of meaningful data – visual perception – making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views – focus and context – details on demand – over-plotting reduction – analytical patterns – pattern examples.

UNIT - II		Lecture Hrs:

Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices – correlation analysis – describing correlations – correlation patterns – correlation displays – correlation analysis techniques and best practices – multivariate analysis – multivariate patterns – multivariate displays – multivariate analysis techniques and best practices.

UNIT - III		Lecture Hrs:

Information dashboard – Introduction– dashboard design issues and assessment of needs – Considerations for designing dashboard-visual perception – Achieving eloquence.

UNIT - IV		Lecture Hrs:

Advantages of Graphics _Library of Graphs – Designing Bullet Graphs – Designing Sparklines – Dashboard Display Media –Critical Design Practices – Putting it all together- Unveiling the dashboard.

UNIT - V		Lecture Hrs:

Plotting Geospatial Data: Introduction to Geoplotlib, Design Principles of Geoplotlib, Geospatial Visualizations, Plotting Geospatial Data on a Map Web-Based Visualizations: Concepts of Bokeh, Interfaces-Plotting and Model Interfaces, Output, Bokeh Server, Presentation, Integrating – HTML Document and Bokeh Applications

Textbooks:

1. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
2. Mario Dobler, Tim Grobmann, “Data Visualization with Python”, O’Reilly, First Edition, 2019

3.Scott Murray, “Interactive data visualization for the web”, O‟Reilly Media, Inc., 2013

Reference Books:

1. Stephen Few, "Information dashboard design: Displaying data for at-a-glance monitoring", second edition, Analytics Press, 2013.
2. Greg Conti, “Security Data Visualization: Graphical Techniques for Network Analysis”, No Starch Press Inc, 2007.

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Course Code	21D51109	ADVANCED COMPUTER NETWORKS LAB (21D51109)	L	T	P	C
Semester	I		0	0	4	2

Course Objectives:

- Aims to provide advanced background on relevant computer networking topics to have a comprehensive and deep knowledge in computer networks

Course Outcomes (CO):

- Develop programs for client-server application
- Perform packet sniffing and analyze packets in network traffic.
- Implement error detecting and correcting codes
- Implement network security algorithms

List of Experiments:

1. Implementation of client server programs for different network applications
2. Study and analysis of the network using Wireshark network protocol analyser
3. Implementation of topology generation for network simulation
4. Implementation of queuing management
5. Implementation of MAC-layer protocols
6. Implementation of routing protocols
7. Implementation of transport-layer protocols
8. Implementation of network security mechanisms

References:

Online learning resources/Virtual labs

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Course Code	21D51110	Data Science Lab (21D51110)	L	T	P	C
Semester	I		0	0	4	2

Course Objectives:

- To make students understand learn about a Big Data – R Programming, way of solving problems.
- To teach students to write programs in Scala to solve problems.

Course Outcomes (CO):

- Develop new algorithms and software tools for data management and mining, and to use them for social good.
- Applying machine learning, data mining, and network analysis to real-world problems in society and industry.
- Exploring the creation of novel statistical and computational methods for scalable data mining, machine learning, optimization as well as statistical modelling with complex data sets

List of Experiments:

1. Write an R program to evaluate the following expression ax+b/ax-b.
2. Write an R program to read input from keyboard (hint: readLine()).
3. Write an R program to find the sum of n natural numbers: 1+2+3+4+….n
4. Write an R program to read n numbers. (i) Sum of all even numbers (ii) Total number of even numbers.
5. Write an R program to read n numbers. (i) Total number of odd numbers (ii) Sum of all odd numbers
6. Write an R program to obtain (i)sum of two matrices A and B (ii) subtraction of two matrices A and B (iii) Product of two matrices.
7. Write an R program for “declaring and defining functions “
8. Write an R program that uses functions to add n numbers reading from keyboard
9. Write an R program uses functions to swap two integers.
10. Write an R program that use both recursive and non-recursive functions for implementing the Factorial of a given number, n.
11. Write an R program to reverse the digits of the given number {example 1234 to be written as 4321}
12. Write an R program to implement (i)Linear search (ii) Binary Search.
13. Write an R program to implement (i)Bubble sort (ii) selection sort.
14. Write a R program to implement the data structures (i) Vectors (ii) Array (iii) Matrix (iv) Data Frame (v) Factors
15. Write a R program to implement scan(), merge(), read.csv() and read.table() commands.
16. Write an R program to implement “Executing Scripts” written on the note pad, by calling to the R console.
17. Write a R program, Reading data from files and working with datasets (i) Reading data from csv files, inspection of data. (ii) Reading data from Excel files.
18. Write a R program to implement Graphs (i) Basic high-level plots (ii)Modifications of scatter plots (iii) Modifications of histograms, parallel box plots.

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References:
1. Big data – Black Book: 2015 edition: dreamtech press. Pg. (490- 642)
2. Introducing to programming and problem solving by scala, mark c. lewis, lisal.lacher. CRC press, second edition.

Online Learning Resources:
1. https://www.tutorialspoint.com/scala/
2. https://www.tutorialspoint.com/r/

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Course Code	21D51201	INTERNET OF THINGS (21D51201)	L	T	P	C
Semester	II		3	0	0	3

Course Objectives:

- To provide students with good depth of knowledge of Designing Industrial IOT Systems for various applications.
- Knowledge for the design and analysis of Industry 4.0 Systems

Course Outcomes (CO): Student will be able to

CO1: Knowledge of theory and practice related to Industrial IoT Systems.
CO2: Ability to identify, formulate and solve engineering problems by using Industrial IoT.
CO3: Ability to implement real field problem by gained knowledge of Industrial applications with IoT capability.

UNIT – I Lecture Hrs:

IoT Data Management and Compute Stack, Fog Computing, Edge Computing,The Hierarchy of Edge, Fog and Cloud, Smart Objects: The "Things" in IoT Sensors, Actuators, and Smart Objects Sensors.

UNIT – II Lecture Hrs:

Actuators Micro-Electro-Mechanical Systems (MEMS) Smart Objects Smart Objects: A Definition Trends in Smart Objects,Sensor Networks, Wireless Sensor Networks (WSNs),Communication Protocols for Wireless Sensor Networks.

UNIT – III Lecture Hrs:

Connecting Smart Objects,Communications Criteria, Range Frequency Bands, Power Consumption Topology,Constrained Devices, Constrained-Node Networks, Data Rate and Throughput Latency and Determinism Overhead and Payload IoT Access Technologies,IEEE 802.15.4,Standardization and Alliances,Physical Layer, MAC Layer, Topology Security, Competitive Technologies.

UNIT – IV Lecture Hrs:

Smart and Connected Cities, An IoT Strategy for Smarter Cities, Vertical IoT Needs for Smarter Cities, Global vs. Siloed Strategies,Smart City IoT Architecture,Street Layer City Layer, Data Center Layer, Services Layer, On-Premises vs. Cloud Smart City Security Architecture, Smart City Use-Case Examples, Connected Street Lighting, Connected Street Lighting Solution Street Lighting .

UNIT – V Lecture Hrs:

Architecture Smart Parking, Smart Parking Use Cases,Smart Parking Architecture, Smart Traffic Control, Smart Traffic Control Architecture,Smart Traffic Applications, Connected Environment,The Need for a Connected Environment, Connected Environment Architecture.

Textbooks:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.

Reference Books:

1. Industry 4.0: The Industrial Internet of Things Alasdair Gilchrist Publications: A press.

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R21 COURSE STRUCTURE &SYLLABUS FOR M.TECH COURSES
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Course Code	21D51202	VIRTUAL REALITY AND AUGMENTED REALITY (21D51202)	L	T	P	C
Semester	II		3	0	0	3

Course Objectives:

- To Teach about human interaction with computers
- To Demonstrate Virtual reality
- To introduce to the current state of VR Hardware and Software.
- To explain how to apply VR/MR/AR for various applications.

Course Outcomes (CO): Student will be able to

CO1: Study the fundamentals of VR, AR and MR
CO2: Select appropriate software and hardware for developing VR Applications
CO3: Design VR Applications
CO4: Create game objects using unity

UNIT – I Lecture Hrs:

Introduction to Virtual Reality
What is Virtual Reality, Modern VR experiences, History Repeats.
Unity: Virtually Everything for you, what is virtual reality to you, types of head-mounted displays: Desktop VR, Mobile VR, The difference between virtual reality and augmented reality, Applications vs Games, Types of VR experiences, and Technical skills that are important to VR.

UNIT – II Lecture Hrs:

Bird's-Eye View
Hardware, Software, Human Physiology and Perception.
Unity: Objects and Scale: Getting started with unity, creating a simple Diorama, Measurement tools, First Person Character: Understanding the Unity characters, Unity standard assets.

UNIT – III Lecture Hrs:

The Geometry of Virtual Worlds & Light and Optics:
Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations
Light and Optics: Basic behavior of light, lenses, Optical Aberrations, Human Eye, Cameras, and Displays.

UNIT – IV Lecture Hrs:

The Physiology of Human Vision
From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, Implications for VR.

UNIT – V Lecture Hrs:

Motion in Real and Virtual Worlds The Vestibular System, Physics in the Virtual World.
Audio: The Physics of Sound, the Physiology of Human Hearing, Auditory Perception

Textbooks:

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016

Reference Books:

1. Unity Virtual reality Projects, Jonathan Linowes, PACKT Publishing.

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Course Code	21D51203	CYBER SECURITY & DIGITAL FORENSICS (21D51203)	L	T	P	C
Semester	II	PE – III	3	0	0	3

Course Objectives:

- To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
- To understand how to examine digital evidences such as the data acquisition, identification analysis.
- Understand key terms and concepts in Cryptography, Governance and Compliance.
- Develop cyber security strategies and policies
- Understand principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.

Course Outcomes (CO): Student will be able to

CO1: Analyze and evaluate the cyber security needs of an organization.
CO2: Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.
CO3: Measure the performance and troubleshoot cyber security systems.
CO4: Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools.

UNIT – I		Lecture Hrs:

Infrastructure security in Real world: Security Challenges, Understanding Access-Control and Monitoring Systems: A Quick Primer on Infrastructure Security, Access Control, Security Policies, Physical, Security Controls, Access-Control Gates, Authentication Systems, Remote access Monitoring.

UNIT – II		Lecture Hrs:

Understanding Video Surveillance systems, Understanding Intrusion-Detection and Reporting Systems, Local Host Security in the Real world, Securing Devices, Protecting the Inner Perimeter.

UNIT – III		Lecture Hrs:

Protecting Remote Access: Protecting Local Computing Devices, Implementing Local Protection Tools, Using Local Intrusion-Detection Tools, Configuring Browser Security Options, Defending against Malicious Software, Hardening Operating systems, Overseeing Application Software Security, Applying Software Updates and Patches. Local Network Security in the Real world, Perimeter Security in the Real world.

UNIT – IV		Lecture Hrs:

Hiding the Private Network, Protecting the Perimeter: Understanding the perimeter, Firewalls, Network Appliances, Proxy Servers, Demilitarized Zones (DMZs), Honeypots, Extranets, Protecting Data Moving Through the Internet: Securing Data in Motion, Cryptography.

UNIT – V		Lecture Hrs:

Tools and Utilities: Using Basic Tools, Monitoring Tools and Software.
Identifying and Defending against Vulnerabilities: Zero Day Vulnerabilities, Software Exploits, Social Engineering Exploits, Network Threats and Attacks, Dictionary Attacks, Denial of service (DoS) Attacks, Spam, Other Exploits.

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Textbooks:
1. Charles J. Brooks, Christopher Grow, Philip Craig: Cyber Security- Essentials.
Reference Books:
1. Warren G.KruseII 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 investigators, 2 edition, Thomson Course Technology, 2006, ISBN: 0-619-21706-5.

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Course Code	21D51204	DEEP LEARNING (21D51204)	L	T	P	C
Semester	II	PE – III	3	0	0	3

Course Objectives:

- Demonstrate the major technology trends driving DeepLearning
- Build, train and apply fully connected deep neuralnetworks
- Implement efficient (vectorized) neuralnetworks
- Analyze the key parameters and hyper parameters in a neural network'sarchitecture

Course Outcomes (CO): Student will be able to

CO1: Apply linear algebra and probability theory in the deep learning applications
CO2: Elaborate the challenges and motivations to Deep learning
CO3: Differentiate the architectures of deep neuralnetwork
CO4: Build a convolutional neuralnetwork
CO5: Build and train RNN andLSTMs

UNIT – I Lecture Hrs:

Linear Algebra: Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms, Eigen decomposition, Singular Value Decomposition, Principal Components Analysis.

Probability and Information Theory: Random Variables, Probability Distributions, Marginal Probability, Conditional Probability, Expectation, Variance and Covariance, Bayes' Rule, Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.

UNIT – II Lecture Hrs:

Machine Learning: Basics and Under-fitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Bayesian Statistics, Supervised and Unsupervised Learning, Stochastic Gradient Descent, Challenges Motivating Deep Learning.

Deep Feed-forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and other Differentiation Algorithms

UNIT – III Lecture Hrs:

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.

Optimization for Training Deep Models: 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 Lecture Hrs:

Convolutional Networks: The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks.

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UNIT – V		Lecture Hrs:

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, LSTM, Gated RNNs, Optimization for Long-Term Dependencies, Auto encoders, Deep Generative Models.

Textbooks:

1. Deep Learning", Ian Goodfellow, YoshuaBengio , Aaron Courville, MIT Press 2016.
2. Josh Patterson and Adam Gibson, "Deep learning: A practitioner's approach", O'Reilly Media, First Edition,2017

Reference Books:

1. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O'Reilly, Shroff Publishers,2019.
2. Deep learning Cook Book, Practical recipes to get started Quickly, DouweOsinga, O'Reilly, Shroff Publishers,2019

Online Learning Resources:

1. https://keras.io/datasets/
2. http://deeplearning.net/tutorial/deeplearning.pdf
3. https://arxiv.org/pdf/1404.7828v4.pdf

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Course Code	21D51205	SERVICE ORIENTED ARCHITECTURE (21D51205)	L	T	P	C
Semester	II	PE – III	3	0	0	3

Course Objectives:

- Understand SOA and evolution of SOA.
- Understand web services and primitive, contemporary SOA.
- Understand various service layers.
- Understand service-oriented analysis and design based on guidelines.

Course Outcomes (CO): Student will be able to

CO1: Design and motivate software architecture for large scale software systems
C02 : Recognize major software architectural styles, design patterns, and frameworks
CO3: Describe a software architecture using various documentation approaches and architectural description languages
CO4 : Generate architectural alternatives for a problem and select among them
CO5: Use well-understood paradigms for designing new systems

UNIT – I Lecture Hrs:

Introducing SOA: Fundamental SOA, Common Characteristics of Contemporary SOA, Common Tangible Benefits of SOA, Common Pitfalls of Adopting SOA. The Evolution of SOA: An SOA Timeline, The Continuing Evolution of SOA, The Roots of SOA.

UNIT – II Lecture Hrs:

Web Services and Primitive SOA: The Web Services Frame Work, Services, Service Descriptions, Messaging. Web Services and Contemporary SOA (Part I-Activity management and Composition): Message Exchange Patterns, Service Activity, Coordination, Atomic Transactions, Orchestration, Choreography. Web Services and Contemporary SOA (Part-II-Advanced Messaging, Metadata and Security): Addressing, Reliable Messaging, Correlation, Policies, Metadata exchange, Security.

UNIT – III Lecture Hrs:

Principles of Service-Orientation: Service–Orientation and the Enterprise, Anatomy of SOA, Common Principles of Service–Orientation, Interrelation between Principles of ServiceOrientation, Service Orientation and Object Orientation, Native Web Services Support for Principles of Service-Orientation. Service Layers: Service-Orientation and Contemporary SOA, Service Layer abstraction, Application Service Layer, Business Service Layer, Orchestration Service Layer, Agnostic Services, Service Layer Configuration Scenarios.

UNIT – IV Lecture Hrs:

SOA Delivery Strategies: SOA Delivery Lifecycle Phases, The Top-Down Strategy, The Bottom-up Strategy, The Agile Strategy. Service Oriented Analysis (Part I-Introduction): Introduction to Service Oriented Analysis, Benefits of a Business Centric SOA, Deriving Business Services.

Service Oriented Analysis (Part-II-Service Modelling): Service Modeling, Service Modelling Guidelines, Classifying Service Model Logic, Contrasting Service Modeling Approaches. Service Oriented Design (Part I-Introduction): Introduction to Service-Oriented Design, WSDL Related XML Schema Language Basics, WSDL Language Basics, Service

Interface Design Tools. Service Oriented Design (Part II-SOA Composition Guidelines): SOA Composing Steps, Considerations for Choosing Service Layers, Considerations for Positioning Core SOA Standards, Considerations for Choosing SOA Extensions.

UNIT – V		Lecture Hrs:

Service Oriented Design (Part III- Service Design): Service Design Overview, Entity-Centric Business Service Design, Application Service Design, Task-Centric Business Service Design, Service Design Guidelines.

Service Oriented Design (Part IV-Business Process Design): WS-BPEL Language Basics, WS- Coordination Overview, Service Oriented Business Process Design.

Textbooks:

1. Service-Oriented Architecture-Concepts, Technology, and Design, Thomas Erl, Pearson Education.
2. Understanding SOA with Web Services, Eric Newcomer, Greg Lomow, Pearson Education.

Reference Books:

1. The Definitive guide to SOA, Jeff Davies & others, Apress, Dreamtech.
2. Java SOA Cook book, E.Hewitt, SPD.
3. SOA in Practice, N.M.Josuttis, SPD.
4. Applied SOA, M.Rosen and others, Wiley India pvt. Ltd.
5. Java Web Services Architecture, J.Mc Govern, and others, Morgan Kaufmann Publishers, Elsevier.
6. SOA for Enterprise Applications, Shankar.K, Wiley India Edition.
7. SOA-Based Enterprise Integration, W.Roshen, TMH.
8. SOA Security, K.RamaRao, C.Prasad, dreamtech press

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Course Code	21D51206	PREDICTIVE DATA ANALYTICS (21D51206)	L	T	P	C
Semester	II	PE – IV	3	0	0	3

Course Objectives:

- To learn, how to develop models to predict categorical and continuous outcomes, using such techniques as neural networks, decision trees, logistic regression, support vector machines and Bayesian network models.
- To know the use of the binary classifier and numeric predictor nodes toautomate model selection.
- To advice on when and how to use each model. Also learn how to combine two or more models to improve prediction.

Course Outcomes (CO): Student will be able to

CO1: Understand the process of formulating business objectives, data selection/collection preparation and process to successfully design, build, evaluate and implement predictive models for a various business application.
CO2: Analyze Probability and Random experiments.
CO3: Define sampling techniques and apply various distribution models.
CO4: Solving Testing of Hypothesis Problems.
CO5: Apply predictive modeling approaches using a suitable package.

UNIT – I Lecture Hrs:

Statistic Fundamentals- Frequency Distributions and Measures of Central Tendency-Frequency Distribution, Graphic Representation of a Frequency Distribution, Averages or Measures of Central Tendency or measures of Location, Requisites for an Ideal Measure of Central Tendency, Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean, Selection of an Average, Partition Values, Measures of Dispersion, Skewness and Kurtosis–Dispersion, Characteristics for an Ideal Measure of Dispersion, Measures of Dispersion, Range, Quartile Deviation, Mean Deviation, Standard Deviation and Root Mean Square Deviation, Coefficient of Dispersion, Moments, Skewness, Kurtosis.

UNIT – II Lecture Hrs:

Probability and Random Variables- Basic Probability - Random Experiments, Sample Spaces Events, The Concept of Probability, The Axioms of Probability, Some Important Theorems on Probability, Assignment of Probabilities, Conditional Probability, Theorems on Conditional Probability, Independent Events, Bayes Theorem or Rule, Discrete Random Variables, Continuous Random Variables and examples of Random Variables.

UNIT – III Lecture Hrs:

Sampling- Sampling-Introduction, Types or Sampling, Parameter and Statistic, Tests of Significance, Null Hypothesis, Errors in Sampling, Critical Region and Level of Significance, Sampling of Attributes, Sampling of Variable, Unbiased Estimate for population Mean and Variance, Standard Error of Sample Mean, Test of Significance for Single Mean, Difference of Means and Difference of Standard Deviations; Chi-Square Variate, Derivation of the Chisquare Distribution, Applications or Chi-square Distribution

UNIT – IV Lecture Hrs:

Inferential Statistics- Introduction, Characteristics of Estimators, Methods or Estimation, Confidence Interval and Confidence Limits, Statistical Hypothesis-Simple and Composite, Steps in Solving Testing of Hypothesis Problem, Optimum Test Under Different Situations,

Neyman-Pearson Lemma .		
UNIT – V		Lecture Hrs:
Linear Models and Regression- Overview of Supervised Learning - Two Simple Approaches to Prediction, Statistical Decision Theory, Statistical Models, Supervised Learning and Function Approximation, Structured Regression Models, Classes of Restricted Estimators; Linear Methods for Regression- Linear Regression Models and Least Squares, Subset Selection, Shrinkage Methods, Methods Using Derived Input Directions, Lasso and Related Path Algorithms; Logistic Regression		
Textbooks:		
1. Fundamentals of mathematical statistics; S.C. Gupta, V.K. Kapoor; Sultan Chand & Sons. 2. Probability and statistics; Murray R. Spiegel, John Schiller and R. AluSrinivasan;Sschaum's outline series, Mcgraw-hill. 3. The Elements of Statistical leaning; Trevor Hastie, Robert Tibshirani, Jerome Friedman; Springer.		
Reference Books:		
1. Applied Linear Statistical Models, Michael H. Kutner, Christopher J. Nachtsheim, John Neter; McGraw Hill 2. Applied logistic Regression, David W. Hosme, Stanley lemeshow; Wiley 3. Practical Statistics for Data Scientists, Peter Bruce & Andrew Bruce, O'Reilly		

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Ananthapuramu – 515 002, Andhra Pradesh, India

R21 COURSE STRUCTURE &SYLLABUS FOR M.TECH COURSES
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(COMPUTER SCIENCE)

Course Code	21D51207	SOFTWARE DEFINED NETWORKS (21D51207)	L	T	P	C
Semester	II	PE – IV	3	0	0	3

Course Objectives:

This course introduces about software defined networking, an emerging paradigm in computer networking that allows a logically centralized software program to control the behavior of an entire network.

Course Outcomes (CO): Student will be able to

CO1: Differentiate between traditional networks and software defined networks and understand the key benefits and use cases of SDN.
CO2: Interpret the SDN data plane devices and Open-Flow Protocols
CO3: Implement the operation of SDN control plane with different controllers
CO4: Apply techniques that enable applications to control the underlying network using SDN
CO5: Evaluate Network Functions Virtualization components and their roles in SDN

UNIT – I Lecture Hrs:

Introduction: basic packet switching terminology, Historical background, the modern data centre, traditional switch architecture, Autonomous and Dynamic forwarding tables, Can we increase the packet forwarding IQ, Open source and technological shifts.

Why SDN: Evolution of switches and control panels, Cost, SDN Implications for research and innovation, Data centre innovation, Data centre needs.

UNIT – II Lecture Hrs:

Genesis of SDN: The evolution of networking technology, Forerunners of SDN, Legacy mechanisms evolve toward SDN, Software defined networking is born, Sustaining SDN interoperability, Open source contributions, Network virtualization, May I please call my network SDN.

How SDN Works: Fundamentals characteristics of SDN, SDN operation, SDN devices, SDN controller, SDN applications, Alternate SDN methods.

UNIT – III Lecture Hrs:

The OpenFlow Specification: Chapter-specific terminology, OpenFlow overview, OpenFlow 1.0 and OpenFlow basics, OpenFlow 1.1 additions, OpenFlow 1.2 additions, OpenFlow 1.3 additions, OpenFlow 1.4 additions, OpenFlow 1.5 additions, Improving OpenFlow interoperability, Optical transport protocol extensions, OpenFlow limitations

UNIT – IV Lecture Hrs:

SDN in the data centre: Data centre definition, Data centre demands, Tunnelling technologies for the data centre, Path technologies in the data centre, Ethernet fabrics in the data centre, SDN use cases in the data centre, Comparison of open SDN, Overlays and APIs, Real-world data centre implementations.

Network Function Virtualization: Definition of NFV, what can we virtualize, Standards, OPNFV, Leading NFV vendors, SDN vs NFV, In-Line Network functions.

UNIT – V Lecture Hrs:

SDN Applications: Terminology, before you begin, Application Types, A brief history of SDN controllers, Using floodlight for training purposes, A simple reactive java application,

Controller considerations, Network device considerations, Creating network virtualization tunnels, Offloading flows in the data centre, Access control for the campus, traffic Engineering for service providers.

SDN Futures: Current state of affairs, SD-WAN, Potential novel applications of Open SDN.

Textbooks:

1. Paul Goransson Chuck Black timothy Culver: Software Defined Networks: A Comprehensive Approach, Morgan Kaufmann, Second Edition.

Reference Books:

1. Ken Gray Thomas Nadeau: network Function Virtualization, Morgan Kaufmann, 2016.

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R21 COURSE STRUCTURE &SYLLABUS FOR M.TECH COURSES
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(COMPUTER SCIENCE)

Course Code	21D51208	RANDOMIZED APPROXIMATION ALGORITHMS (21D51208) PE – IV	L	T	P	C
Semester	II		3	0	0	3

Course Objectives:

- some familiarity with several of the main thrusts of work in randomized algorithms--giving you context for formulating and seeking known solutions to an algorithmic problem;
- Design and analysis of new algorithms for new problems that you encounter

Course Outcomes (CO): Student will be able to

CO1: Design and analyze efficient randomized algorithms.
CO2: Analyze randomized algorithms with respect to probability error and expected running time.
CO3: Analyze approximation algorithms and determine approximation factor.

UNIT – I		Lecture Hrs:

Introduction to Approximation Algorithms, Greedy algorithms and local search, Rounding data and dynamic programming.

UNIT – II		Lecture Hrs:

Random sampling and randomized rounding of linear programs randomized rounding of semi definite programs, cuts and metrics.

UNIT – III		Lecture Hrs:

Introduction: A Min-Cut Algorithm, Las Vegas and Monte Carlo, Binary Planar Partitions, A Probabilistic Recurrence, Computation Model and Complexity Classes, Game-Theoretic Techniques, Moments and Deviations, Tail Inequalities.

UNIT – IV		Lecture Hrs:

The Probabilistic Method, Markov Chains and Random Walks, Algebraic Techniques

UNIT – V		Lecture Hrs:

Applications: Geometric Algorithms and Linear Programming, Parallel and Distributed Algorithms, The Fundamental Data-structuring Problem.

Textbooks:

1. The Design of Approximation Algorithms by David P. Williamson and David B. Shmoys I(Unit I and Unit II)

Reference Books:

1. Randomized Algorithms by Rajeev Motwani, PrabhakarRaghavan (Unit III to Unit V)

R21 COURSE STRUCTURE &SYLLABUS FOR M.TECH COURSES
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(COMPUTER SCIENCE)

Course Code	21D51209	INTERNET OF THINGS LAB (21D51209)	L	T	P	C
Semester	II		0	0	4	2

Course Objectives:

The main objective IOT applications are to know the different real time sensors used to measure the different electrical parameters and to control the different devices from anywhere through IOT.

Course Outcomes (CO): Student will be able to

CO1: The students will be thorough about the technology behind the IoT and associated technologies
CO2: The students will be able to use the IoT technologies in practical domains of society
CO3: The students will be able to gain knowledge about the state of the art methodologies in IoT application domains.

LIST OF EXPERIMENTS:

1. Setting up of Raspberry Pi and connect to a network.
2. Familiarization with GPIO pins and control hardware through GPIO pins.
3. Speed Control of motors using PWM with python programming.
4. Use sensors to measure temperature, humidity, light and distance.
5. Web based hardware control.
6. Connect IOT devices through cloud using IoT protocol such as MQTT.
7. Controlling IoT devices using Arduino.
8. Create Wireless network of sensors using Zigbee.
9. Experiment on connectivity of Rasberry Pi with existing system components.
10. Exercise on working principle of Rasberry Pi.

Reference:

Online learning resources/Virtual labs

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R21 COURSE STRUCTURE &SYLLABUS FOR M.TECH COURSES
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(COMPUTER SCIENCE)

Course Code	21D51210	VIRTUAL REALITY AND AUGMENTED REALITY LAB (21D51210)	L	T	P	C
Semester	II		0	0	4	2

Course Objectives:

The objective of this course is to explore the concepts of Virtual reality and develop 3D virtual environment.

Course Outcomes (CO): Student will be able to

CO1: Create and deploy a VR application.
CO2: understand the physical principles of VR
CO3: Create a comfortable, high-performance VR application using Unity
CO4: Identify, examine and develop software that reflects fundamental techniques for the design and deployment of VR experiences.

LIST OF EXPERIMENTS:

1. Installation of Unity and Visual Studio, setting up Unity for VR development, understanding documentation of the same.
2. Demonstration of the working of HDMs
3. Develop a scene in Unity that includes:
   i. a cube, plane and sphere, apply transformations on the 3 game objects.
   ii. add a video and audio source
4. Develop a scene in Unity that includes a cube, plane and sphere. Create a new material and texture separately for three Game objects. Change the colour, material and texture of each Game object separately in the scene. Write a C# program in visual studio to change the colour and material/texture of the game objects dynamically onbutton click.
5. Develop a scene in Unity that includes a sphere and plane. Apply Rigid body component, material and Box collider to the game Objects. Write a C# program to grab and throw the sphere using vr controller.
6. Develop a simple UI(User interface) menu with images, canvas, sprites and button. Write a C# program to interact with UI menu through VR trigger button such that on each successful trigger interaction display a score on scene.
7. Create a Simple Mini Project

References:

Online learning resources/Virtual labs

R21 COURSE STRUCTURE &SYLLABUS FOR M.TECH COURSES
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(COMPUTER SCIENCE)

Course Code	21D51302	REINFORCEMENT LEARNING (PE – V)	L	T	P	C
Semester	II		3	0	0	3

Course Objectives:

1. Reinforcement Learning is a subfield of Machine Learning, but is also a general-purpose formalism for automated decision-making and AI.
2. This course introduces you to statistical learning techniques where an agent explicitly takes actions and interacts with the world.

Course Outcomes:

CO1: Formulate Reinforcement Learning problems
CO2: Apply various Tabular Solution Methods to Markov Reward Process Problems
CO3: Apply various Iterative Solution methods to Markov Decision Process Problems
CO4: Comprehend Function approximation methods

UNIT I:

Introduction: Introduction to Reinforcement Learning (RL) – Difference between RL and Supervised Learning, RL and Unsupervised Learning. Elements of RL, Markov property, Markov chains, Markov reward process (MRP).

UNIT II:

Evaluative Feedback - Multi-Arm Bandit Problem: An n-Armed Bandit Problem, Exploration vs Exploitation principles, Action value methods, Incremental Implementation, tracking a non-stationary problem, optimistic initial values, upper-confidence-bound action selection, Gradient Bandits. Introduction to and proof of Bellman equations for MRPs

UNIT III:

Introduction to Markov decision process (MDP), state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations. Dynamic Programming (DP): Overview of dynamic programming for MDP, principle of optimality, Policy Evaluation, Policy Improvement, policy iteration, value iteration, asynchronous DP , Generalized Policy Iteration.

UNIT IV:

Monte Carlo Methods for Prediction and Control: Overview of Monte Carlo methods for model free RL, Monte Carlo Prediction, Monte Carlo estimation of action values, Monto Carlo Control, On policy and off policy learning, Importance sampling. Temporal Difference Methods: TD Prediction, Optimality of TD(0), TD Control methods - SARSA, Q-Learning and their variants.

UNIT V:

Eligibility traces: n-Step TD Prediction, Forward and Backward view of TD(λ), Equivalence of forward and backward view, Sarsa(λ),, Watkins's Q(λ), Off policy eligibility traces using importance of sampling. Function Approximation Methods: Value prediction with function

approximation, gradient descent methods, Linear methods, control with function approximation.

Textbooks:

1. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction", 2nd Edition, The MIT Press.
2. CsabaSzepesvari – Algorithms for Reinforcement Learning – Morgan & Claypool, 2010.

References:

1. Reinforcement Learning By Richard S. (University Of Alberta) Sutton,Andrew G. (Co-Director Autonomous Learning Laboratory) Barto

R21 COURSE STRUCTURE &SYLLABUS FOR M.TECH COURSES
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(COMPUTER SCIENCE)

Course Code	21D50301	SOFTWARE DEVELOPMENT AND IT SERVICES-ORDER (OPEN ELECTIVE)	L	T	P	C
Semester	III		3	0	0	3

Course objectives:

- Take user stories and translate them into functioning web applications using HTML, CSS, and JavaScript
- Evaluate alternative approaches to software implementations
- Work through coding issues with analytical debugging techniques

Course Outcomes:

UNIT – I:
The Big Picture: A Snapshot of Devops Culture, The Evolution of Culture, The Value of the Story, Illustrating Devops with Stories, What is Devops? The Devops equation, A History of Devops, Developer as Operator, The Advent of Software Engineering, The Advent of Proprietary Software and Standardization, The Age of the Network, The Beginnings of a Global Community,The Age of Applications and the Web, The Growth of Software Development Methodologies, Open Source Software, Proprietary Services, Agile Infrastructure, The Beginning of devopsdays, The Current State of Devops.
Foundational Terminology and Concepts: Software Development Methodologies, Operations Methodologies, Systems Methodologies, Development, Release, and Deployment Concepts, Infrastructure Concepts, Cultural Concepts
Devops Misconceptions and Anti-Patterns: Common Devops Misconceptions, Devops Anti-Patterns, The Four Pillars of Effective Devops

UNIT – II:
Collaboration: Individuals Working Together, Defining Collaboration, Individual Differences and Backgrounds, Opportunities for Competitive Advantage, Mentorship, Introducing Mindsets, Mindsets and Learning Organizations, the Role of Feedback, Reviews and Rankings, Communication and Conflict Resolution Styles, Communication Context and Power Differentials, Empathy and Trust, Humane Staffing and Resources, Effective Collaboration with Sparkle Corp.
Collaboration: Misconceptions and Troubleshooting: Collaboration Misconceptions, Collaboration Troubleshooting.

UNIT – III:
Affinity: From Individuals to Teams, What Makes a Team, Teams and Organizational Structure, Finding Common Ground Between Teams, Improving Team Communication, Case Study: United States Patent and Trademark Office, Bene‡ts of Improved Affinity, Requirements for Affinity, Measuring Affinity
Misconceptions and Troubleshooting: Affinity Misconceptions, Affinity Troubleshooting**.**

UNIT – IV:

Overview of Software, Automation, Monitoring, Metrics, Logging, Alerting, Events, Evolution of the Ecosystem.

Tools: Accelerators of Culture, What Are Tools? Irrelevance of Tools, Selection of Tools, Auditing Your Tool Ecosystem, Case Studies, Examining Etsy, Motivations and Decision-Making Challenges.

UNIT – V:

Scaling: Inflection Points, Understanding Scaling, Organizational Structure, Team Flexibility, Organizational Lifecycle, Complexity and Change, Scaling for Teams.

Case Studies: Growing and Scaling Teams, Job Postings and Recruitment Issues, Developing Individuals and Teams, Team Scaling and Growth Strategies, Managing Conflict, Scaling for Organizations.

Misconceptions and Troubleshooting: ScalingMisconceptions, ScalingTroubleshooting.

TEXT BOOKS:

1. Effective DevOps Building a Culture of Collaboration, A□nity , and Tooling at Scale, Jennifer Davis and Ryn Daniels
2. DevOpsfor Developers, Michael Hüttermann