AMRITA SAI INSTITUTE OF SCIENCE & TECHNOLOGY
(AUTONOMOUS)
Approved by AICTE, New Delhi, Permanently Affiliated to JNTUK, Kakinada,
Recognized by UGC under 2(f) & 12(B) of 1956 Act.,
ISO 9001:2015 Certified Institution, Accredited by NAAC "A" Grade,
Paritala, Kanchikacherla, Krishna Dist, Andhra Pradesh- 521180.
www.amritasai.edu.in, Phone: 0866 2428399.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE STRUCTURE & SYLLABUS
M.TECH COMPUTER SCIENCE & ENGINEERING PROGRAMME

(Applicable for batches admitted from 2020-2021)
AR-20

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I-SEMESTER

S.No	Course Code	Courses	Category	L	T	P	C
1	20CP1T1	**Program Core-1** Mathematical Foundations of Computer Science	PC	3	0	0	3
2	20CP1T2	**Program Core-2** Advanced Data Structures & Algorithms	PC	3	0	0	3
		Program Elective-1					
3	20CP1T3A	1. Big Data Analytics	PE	3	0	0	3
	20CP1T3B	2. Digital Image Processing					
	20CP13C	3. Advanced Operating Systems					
		Program Elective-2					
4	20CP1T4A	1. Advanced Computer Networks	PE	3	0	0	3
	20CP1T4B	2. Internet of Things					
	20CP1T4C	3. Object Oriented Software Engineering					
5	20CP1C1	**Research Methodology and IPR**	CC			0	2
6	20CP1L1	**Laboratory-1** Advanced Data Structures & Algorithms Lab	LB	0	0	4	2
7	20CP1L2	**Laboartory-2** Advanced Computing Lab	LB	0	0	4	2
8	20CP1A1	**Audit Course-1***	AC	2	0	0	0
Total Credits							18

Student has to choose any one audit course listed below.

II SEMESTER

S.No	Course Code	Courses	Cat	L	T	P	C
1	20CP2T1	**(Program Core-3)**Machine learning	PC	3	0	0	3
2	20CP2T2	**(Program Core-4)**MEAN Stack Technologies	PC	3	0	0	3
		Program Elective-3					
3	20CP2T3A	Advanced Databases and Mining	PE	3	0	0	3
	20CP2T3B	Ad Hoc & Sensor Networks					
	20CP2T3C	Soft Computing					
		Program Elective-4					
4	20CP2T4A	**1.** Cloud Computing	PE	3	0	0	3
	20CP2T4B	**2.** Principles of computer security					
	20CP2T4C	3. High Performance Computing					
5	20CP2L1	**Laboratory-3** Machine Learning with python lab	LB	0	0	4	2
6	20CP2L2	**Laboartory-4** MEAN Stack Technologies Lab	LB	0	0	4	2
7		**Mini Project with Seminar**	MP	2	0	0	2
8	20CP2A1	**Audit Course-2 ***	AC	2	0	0	0
Total Credits							18

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Student has to choose any one audit course listed below.

Audit Course 1 & 2:

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills

III-SEMESTER

S.No	Course Code	Courses	Category	L	T	P	C
1	20CP3T1A	**Program Elective-5** 1. Deep Learning	PE	3	0	0	3
	20CP3T1B	2. Social Network Analysis					
	20CP3T1C	3. MOOCs-1 (NPTEL/SWAYAM) 12					
	20CP3T1D	4. Week Program related to the programme which is not listed in the course structure					
2	20CP3T2A	**Open Elective** 1. MOOCs-2 (NPTEL/SWAYAM)-Any 12 Week Course on Engineering/ Management/ Mathematics offered by other than parent department	OE	3	0	0	3
	20CP3T2B	2. Course offered by other departments in the college					
3	20CP3P1	**Dissertation-I/ Industrial Project #**	PJ	0	0	20	10
Total Credits							16

#Students going for Industrial Project/Thesis will complete these courses through MOOCs

M. Tech. (CSE) IV SEMESTER							
S.No	Course Code	Courses	Category	L	T	P	C
1	20CP4P1	**Dissertation-II**	PJ	0	0	32	16
Total Credits							16

Open Electives offered by the Department of CSE

1. Python Programming
2. Principles of Cyber Security
3. Internet of Things
4. Machine Learning
5. Digital forensics
6. Next Generation Databases

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I Year - I Semester		L	T	P	C
		3	0	0	3
Mathematical Foundations of Computer Science (MTCSE1101)					

Course Objectives: This course is aimed at enabling the students to

To understand the mathematical fundamentals that is prerequisites for variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems bioinformatics, Machine learning.

To develop the understanding of the mathematical and logical basis to many modern techniques in computer science technology like machine learning, programming language design, and concurrency.

To study various sampling and classification problems.

Course Outcomes:

After the completion of the course, student will be able to

To apply the basic rules and theorems of probability theory such as Baye's Theorem, to determine probabilities that help to solve engineering problems and to determine the expectation and variance of a random variable from its distribution.

Able to perform and analyze of sampling, means, proportions, variances and estimates the maximum likelihood based on population parameters.

To learn how to formulate and test hypotheses about sample means, variances and proportions and to draw conclusions based on the results of statistical tests.

Design various ciphers using number theory.

Apply graph theory for real time problems like network routing problem.

UNIT I: Basic Probability and Random Variables: 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. Random Variables, Discrete Probability Distributions, Distribution Functions for Random Variables, Distribution Functions for Discrete Random Variables, Continuous Random Variables

UNIT II: Sampling and Estimation Theory: Population and Sample, Statistical Inference Sampling With and Without Replacement Random Samples, Random Numbers Population Parameters Sample Statistics Sampling Distributions, Frequency Distributions, Relative Frequency Distributions, Computation of Mean, Variance, and Moments for Grouped Data. Unbiased Estimates and Efficient Estimates Point Estimates and Interval Estimates. Reliability Confidence Interval Estimates of Population Parameters, Maximum Likelihood Estimates

UNIT III: Tests of Hypothesis and Significance: Statistical Decisions Statistical Hypotheses. Null Hypotheses Tests of Hypotheses and Significance Type I and Type II Errors Level of Significance Tests Involving the Normal Distribution One-Tailed and Two-Tailed Tests P Value Special Tests of Significance for Large Samples Special Tests of Significance for Small Samples Relationship between Estimation Theory and Hypothesis Testing Operating Characteristic Curves. Power of a Test Quality Control Charts Fitting Theoretical Distributions to Sample Frequency

Distributions, The Chi-Square Test for Goodness of Fit Contingency Tables Yates' Correction for Continuity Coefficient of Contingency.

UNIT IV: Algebraic Structures and Number Theory: Algebraic Systems, Examples, General Properties, Semi Groups and Monoids, Homomorphism of Semi Groups and Monoids, Group, Subgroup, Abelian Group, Homomorphism, Isomorphism. Properties of Integers, Division Theorem, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem)

UNIT V: Graph Theory: Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs).

Text Books:

1. Foundation Mathematics for Computer Science, John Vince, Springer.
2. Probability & Statistics, 3rd Edition, Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan, Schaum's Outline Series, Tata McGraw-Hill Publishers
3. Probability and Statistics with Reliability, K. Trivedi, Wiley.
4. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, H. Rosen, Tata McGraw Hill.

Reference Books:

1. Probability and Computing: Randomized Algorithms and Probabilistic Analysis, M. Mitzenmacher and E. Upfal.
2. Applied Combinatorics, Alan Tucker, Wiley.

I Year - I Semester		L	T	P	C
		3	0	0	3
Advanced Data Structures & Algorithms (MTCSE1102)					

Course Objectives: From the course the student will learn

Single Linked, Double Linked Lists, Stacks, Queues, Searching and Sorting techniques, Trees, Binary trees, representation, traversal, Graphs- storage, traversal.

Dictionaries, ADT for List, Stack, Queue, Hash table representation, Hash functions, Priority queues, Priority queues using heaps, Search trees.

AVL trees, operations of AVL trees, Red- Black trees, Splay trees, comparison of search trees.

Course Outcomes:

After the completion of the course, student will be able to

Ability to write and analyze algorithms for algorithm correctness and efficiency

Master a variety of advanced abstract data type (ADT) and data structures and their Implementation

Demonstrate various searching, sorting and hash techniques and be able to apply and solve problems of real life

Design and implement variety of data structures including linked lists, binary trees, heaps, graphs and search trees

Ability to compare various search trees and find solutions for IT related problems

UNIT I: Introduction to Data Structures, Singly Linked Lists, Doubly Linked Lists, Circular Lists-Algorithms. **Stacks and Queues**: Algorithm Implementation using Linked Lists.

UNIT II: Searching-Linear and Binary, Search Methods, **Sorting**-Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort. **Trees**- Binary trees, Properties, Representation and Traversals (DFT, BFT), Expression Trees (Infix, prefix, postfix). **Graphs**-Basic Concepts, Storage structures and Traversals.

UNIT III: Dictionaries, ADT, The List ADT, Stack ADT, Queue ADT, Hash Table Representation, Hash Functions, Collision Resolution-Separate Chaining, **Open Addressing**- Linear Probing, Double Hashing.

UNIT IV: Priority queues- Definition, ADT, Realizing a Priority Queue Using Heaps, Definition, Insertion, Deletion .**Search Trees**- Binary Search Trees, Definition, ADT, Implementation, **Operations**-Searching, Insertion, Deletion.

UNIT V: Search Trees- AVL Trees, Definition, Height of AVL Tree, Operations-, Insertion, Deletion and Searching, Introduction to Red-Black and Splay Trees, B-Trees, Height of B-Tree, Insertion, Deletion and Searching, Comparison of Search Trees.

Text Books:

1. Data Structures: A Pseudo Code Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon and Cengage
2. Data Structures, Algorithms and Applications in java, 2/e, Sartaj Sahni, University Press

Reference Books:

1. Data Structures and Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson.
2. Data Structures and Algorithms, 3/e, Adam Drozdek, Cengage
3. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering Examples, N.B.Venkateswarulu, E.V.Prasad and S Chand & Co, 2009

I Year - I Semester		L	T	P	C
		3	0	0	3
Big Data Analytics (MTCSE11XX)					

Course Objectives: This course is aimed at enabling the students to

To provide an overview of an exciting growing field of big data analytics.
To introduce the tools required to manage and analyze big data like Hadoop, NoSQL, Map Reduce, HIVE, Cassandra, Spark.
To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
To optimize business decisions and create competitive advantage with Big Data analytics

Course Outcomes:

After the completion of the course, student will be able to

Illustrate on big data and its use cases from selected business domains.
Interpret and summarize on No SQL, Cassandra
Analyze the HADOOP and Map Reduce technologies associated with big data analytics and explore on Big Data applications Using Hive.
Make use of Apache Spark, RDDs etc. to work with datasets.
Assess real time processing with Spark Streaming.

UNIT I: What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

UNIT II: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, Working with Cassandra ,Table creation, loading and reading data.

UNIT III: Data formats, analyzing data with Hadoop, scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance ,with data replication, High availability, Data locality , Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization. Introduction to Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, Logical joins, Window functions, Optimization, Table partitioning, Bucketing, Indexing, Join strategies.

UNIT IV: Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Data frames ,RDD to Data frames, Catalyst optimizer, Data Frame Transformations, Working with Dates and Timestamps, Working with Nulls in Data, Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables,

Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers- Standalone Mode, Spark on YARN , Spark Logs, The Spark UI- Spark UI History Server, Debugging and Spark First Aid

UNIT V: Spark-Performance Tuning, Stream Processing Fundamentals, Event-Time and State full Processing - Event Time, State full Processing, Windows on Event Time- Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream, Structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.

Text Books:

1. Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj
2. SPARK: The Definitive Guide, Bill Chambers & Matei Zaharia, O'Reilley, 2018 Edition
3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013
4. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional, 2012
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012

Reference Books:

1. "Hadoop Operations", O'Reilley, Eric Sammer, 2012
2. "Programming Hive", O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen, 2012
3. "HBase: The Definitive Guide", O'Reilley, Lars George, 2011
4. "Cassandra: The Definitive Guide", O'Reilley, Eben Hewitt, 2010
5. "Programming Pig", O'Reilley, Alan Gates, 2011

I Year - I Semester		L	T	P	C
		3	0	0	3
Digital Image Processing (MTCSE11XX)					

Course Objectives:

Describe and explain basic principles of digital image processing.

Design and implement algorithms that perform basic image processing (e.g. noise removal and image enhancement).

Design and implement algorithms for advanced image analysis (e.g. image compression, image segmentation).

Assess the performance of image processing algorithms and systems.

Course Outcomes:

After the completion of the course, student will be able to

Demonstrate the components of image processing

Explain various filtration techniques.

Apply image compression techniques.

Discuss the concepts of wavelet transforms.

Analyze the concept of morphological image processing.

UNIT I: Introduction: Fundamental steps in Image Processing System, Components of Image Processing System, Elements of Visual Perception, Image Sensing and acquisition, Image sampling & Quantization, Basic Relationship between pixels. **Image Enhancement Techniques**: Spatial Domain Methods: Basic grey level transformation, Histogram equalization, Image subtraction, image averaging.

UNIT II: Spatial filtering: Smoothing, sharpening filters, Laplacian filters, Frequency domain filters, Smoothing and sharpening filters, Homomorphism is filtering. **Image Restoration & Reconstruction**: Model of Image Degradation/restoration process, Noise models, Spatial filtering, Inverse filtering, Minimum mean square Error filtering, constrained least square filtering, Geometric mean filter, Image reconstruction from projections. Color Fundamentals, Color Models, Color Transformations.

UNIT III: Image Compression: Redundancies- Coding, Interpixel, Psycho visual; Fidelity, Source and Channel Encoding, Elements of Information Theory; Loss Less and Lossy Compression; Run length coding, Differential encoding, DCT, Vector quantization, Entropy coding, LZW coding; Image Compression Standards-JPEG, JPEG 2000, MPEG; Video compression.

UNIT IV: Wavelet Based Image Compression: Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT), Continuous, Wavelet Transform, Fast Wavelet Transform, 2-D wavelet Transform, JPEG-2000 encoding.

UNIT V: Image Segmentation: Discontinuities, Edge Linking and boundary detection, Thresholding, Region Based Segmentation, Watersheds; Introduction to morphological operations; binary morphology- erosion, dilation, opening and closing operations, applications; basic gray-scale morphology operations; Feature extraction; Classification; Object recognition. **Digital Image Watermarking**: Introduction, need of Digital Image Watermarking, applications of watermarking in copyright protection and Image quality analysis.

Text Books:

1. Digital Image Processing. 2nd ed. Gonzalez, R.C. and Woods, R.E. India: Person Education, (2009)

Reference Books:

1. Digital Image Processing. John Wiley, Pratt, W. K, (2001)
2. Digital Image Processing, Jayaraman, S., Veerakumar, T. and Esakkiranjan, S. (2009),Tata McGraw-Hill

I Year - I Semester		L	T	P	C
		3	0	0	3
Advanced Operating Systems (MTCSE11XX)					

Course Objectives: This course is aimed at enabling the students to

To provide comprehensive and up-to-date coverage of the major developments in distributed Operating System, Multi-processor Operating System and Database Operating System and to cover important theoretical foundations including Process Synchronization, Concurrency, Event ordering, Mutual Exclusion, Deadlock, Agreement Protocol, Security, Recovery and fault tolerance.

Course Outcomes:

After the completion of the course, student will be able to

Illustrate on the fundamental concepts of distributed operating systems, its architecture and distributed mutual exclusion.

Analyze on deadlock detection algorithms and agreement protocols.

Make use of algorithms for implementing DSM and its scheduling.

Apply protection and security in distributed operating systems.

Elaborate on concurrency control mechanisms in distributed database systems.

UNIT-1: Architectures of Distributed Systems, System Architecture types, issues in distributed operating systems, communication networks, communication primitives. Theoretical Foundations, inherent limitations of a distributed system, lamp ports logical clocks, vector clocks, casual ordering of messages, global state, cuts of a distributed computation, termination detection. Distributed Mutual Exclusion, introduction, the classification of mutual exclusion and associated algorithms, a comparative performance analysis.

UNIT-2: Distributed Deadlock Detection, Introduction, deadlock handling strategies in distributed systems, issues in deadlock detection and resolution, control organizations for distributed deadlock detection, centralized and distributed deadlock detection algorithms, hierarchical deadlock detection algorithms. Agreement protocols, introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, and applications of agreement algorithms. Distributed resource management: introduction- architecture, mechanism for building distributed file systems design issues, log structured file systems.

UNIT- 3: Distributed shared memory, Architecture, algorithms for implementing DSM, memory coherence and protocols, design issues. Distributed Scheduling, introduction, issues in load distributing, components of a load distributing algorithm, stability, load distributing algorithm, performance comparison, selecting a suitable load sharing algorithm, requirements for load distributing, task migration and associated issues. Failure Recovery and Fault tolerance: introduction, basic concepts, classification of failures, backward and forward error recovery, backward error recovery, recovery in concurrent systems, consistent set of check points, synchronous and asynchronous check pointing and recovery, check pointing for distributed database systems, recovery in replicated distributed databases.

UNIT- 4: Protection and security, preliminaries, the access matrix model and its implementations.-safety in matrix model, advanced models of protection. Data security, cryptography: Model of cryptography, conventional cryptography modern cryptography, private key cryptography, data encryption standard public key cryptography, multiple encryptions, authentication in distributed systems.

UNIT-5: Multiprocessor operating systems, basic multiprocessor system architectures, inter connection networks for multiprocessor systems, caching hypercube architecture. Multiprocessor Operating System, structures of multiprocessor operating system, operating system design issues, threads, process synchronization and scheduling. Database Operating systems: Introduction, requirements of a database operating system Concurrency control :Theoretical aspects, introduction, database systems, a concurrency control model of database systems, the problem of concurrency control, serializability theory, distributed database systems, concurrency control algorithms, introduction, basic synchronization primitives, lock based algorithms, timestamp based algorithms, optimistic algorithms, concurrency control algorithms, data replication.

Text Books:

1. "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", Mukesh Singhal, Niranjan and G.Shivaratri, TMH, 2001

Reference Books:

1. "Modern operating system", Andrew S.Tanenbaum, PHI, 2003
2. "Distributed operating system-Concepts and design", Pradeep K.Sinha, PHI, 2003
3. "Distributed operating system", Pearson education, AndrewS.Tanenbaum, 2003

I Year - I Semester		L	T	P	C
		3	0	0	3
ADVANCED COMPUTER NETWORKS (MTCSE11YY)					

Course Objectives: This course is aimed at enabling the students to

The course is aimed at providing basic understanding of Computer networks starting with OSI Reference Model, Protocols at different layers with special emphasis on IP, TCP & UDP and Routing algorithms.

Some of the major topics which are included in this course are CSMA/CD, TCP/IP implementation, LANs/WANs, internetworking technologies, Routing and Addressing.

Provide the mathematical background of routing protocols.

Aim of this course is to develop some familiarity with current research problems and research methods in advance computer networks.

Course Outcomes:

After the completion of the course, student will be able to

Illustrate reference models with layers, protocols and interfaces.

Describe the routing algorithms, Sub netting and Addressing of IP V4and IPV6.

Describe and Analysis of basic protocols of computer networks, and how they can be used to assist in network design and implementation.

Describe the concepts Wireless LANS, WIMAX, IEEE 802.11, Cellular telephony and Satellite networks

Describe the emerging trends in networks-MANETS and WSN

Unit-I:**Network layer:** Network Layer design issues: store-and forward packet switching, services provided transport layers, implementation connection less services, implementation connection oriented services, comparison of virtual – circuit and datagram subnets, Routing Algorithms-shortest path routing, flooding, distance vector routing, link state routing, Hierarchical routing, **congestion control algorithms :**Approaches to congestion control, Traffic aware routing, Admission control, Traffic throttling, choke Packets, Load shedding, Random early detection, Quality of Service, Application requirements, Traffic shaping, Leaky and Token buckets

Unit-II: Internetworking and IP protocols: How networks differ, How net works can be connected, internetworking, tunneling, The network layer in the internet,IPV4 Protocol, IP addresses, Subnets, CIDR, classful and Special addressing, network address translation (NAT),IPV6 Address structure address space, IPV6 Advantages, packet format, extension Headers, Transition from IPV4 to IPV6 , Internet Control Protocols-IMCP, ARP, DHCP

Unit-III: Transport Layer Protocols: Introduction, Services, Port numbers,
User Datagram Protocol: User datagram, UDP services, UDP Applications, Transmission control Protocol: TCP services, TCP features, Segment, A TCP connection, State transition diagram, Windows in TCP, Flow control and error control, TCP Congestion control, TCP Timers, **SCTP:** SCTP services SCTP features, packet format, An SCTP association, flow control, error control.

Unit- IV: Wireless LANS: Introduction, Architectural comparison, Access control, The IEEE 802.11 Project: Architecture, MAC sub layer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture, Bluetooth Layers **Other Wireless Networks:** WIMAX: Services, IEEE project 802.16, Layers in project 802.16, Cellular Telephony: Operations, First Generation (1G), Second Generation (2G), Third Generation (3G), Fourth Generation (4G), Satellite Networks: Operation, GEO Satellites, MEO satellites, LEO satellites.

Unit–V: Emerging trends in Computer networks:
Mobile computing: Motivation for mobile computing, Protocol stack issues in mobile computing environment, mobility issues in mobile computing, security issues in mobile networks, MOBILE Ad Hoc Networks: Applications of Ad Hoc Networks, Challenges and Issues in MANETS, MAC Layer Issues Routing Protocols in MANET, Transport Layer Issues, Ad hoc Network Security. **Wireless Sensor Networks:** WSN functioning, Operating system support in sensor devices, WSN characteristics, sensor network operation, Sensor Architecture: Cluster management, Wireless Mesh Networks: WMN design , Issues in WMNs, Computational Grids, Grid Features, Issues in Grid construction design, Grid design features,P2P Networks: Characteristics of P2P Networks, Classification of P2P systems, Gnutella, BitTorrent, Session Initiation Protocol(SIP) , Characteristics and addressing, Components of SIP, SIP establishment, SIP security.

Text Books:

1. Data communications and networking 4th edition Behrouz A Fourzan,TMH
2. Computer networks 4th edition Andrew S Tanenbaum, Pearson
3. Computer networks, Mayank Dave, CENGAGE

Reference Books:

1. Computer networks, A system Approach, 5th ed, Larry L Peterson and Bruce S Davie, Elsevier

I Year - I Semester		L	T	P	C
		3	0	0	3
Internet of Things (MTCSE11YY)					

Course Objectives:

- To Understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications.

Course Outcomes:

After the completion of the course, student will be able to

- Summarize on the term 'internet of things' in different contexts.
- Analyze various protocols for IoT.
- Design a PoC of an IoT system using Rasperry Pi/Arduino
- Apply data analytics and use cloud offerings related to IoT.
- Analyze applications of IoT in real time scenario

UNIT I: FUNDAMENTALS OF IoT: Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II: IoT PROTOCOLS: IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.

UNIT III: DESIGN AND DEVELOPMENT: Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.

UNIT IV: DATA ANALYTICS AND SUPPORTING SERVICES: Structured Vs
Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning – No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web Application Framework, Django, AWS for IoT, System Management with NETCONF-YANG.

UNIT V: CASE STUDIES/INDUSTRIAL APPLICATIONS: Cisco IoT system, IBM Watson
IoT platform, Manufacturing, Converged Plant wide Ethernet Model (CPwE), Power Utility Industry, Grid Blocks Reference Model, Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

Text Books:

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. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015
2. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).
3. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Jan Ho¨ ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
4. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.
5. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O'Reilly Media, 2011.

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I Year - I Semester		L	T	P	C
		3	0	0	3
Object Oriented Software Engineering (MTCSE11YY)					

Course Objectives:

To elicit, analyze and specify software requirements through a productive working relationship with various stakeholders of the project.

To understand the what software life cycle is, how software projects are planned and managed, types of resources involved in software development projects, risks are identified and assessed, predictions and assessments are made.

To identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements

Course Outcomes:

After the completion of the course, student will be able to

Apply the Object Oriented Software-Development Process to design software

Analyze and Specify software requirements through a SRS documents.

Design and Plan software solutions to problems using an object-oriented strategy.

Model the object oriented software systems using Unified Modeling Language (UML)

Estimate the cost of constructing object oriented software.

UNIT I: Introduction to Software Engineering: Software, Software Crisis, Software Engineering definition, Evolution of Software Engineering Methodologies, Software Engineering Challenges. Software Processes: Software Process, Process Classification, Phased development life cycle, Software Development Process Models, Process, use, applicability and Advantages/limitations.

UNIT II: Object oriented Paradigm, Object oriented Concepts, Classes, Objects, Attributes, Methods and services, Messages, Encapsulation, Inheritance, Polymorphism, Identifying the elements of object model, management of object oriented Software projects, Object Oriented Analysis, Domain Analysis, Generic Components of OOA model,OOA Process, Object Relationship model, Object Behavior Model.

UNIT III: Object Oriented Design: Design for Object- Oriented systems, The Generic components of the OO design model, The System design process, The Object design process, Design Patterns, Object Oriented Programming.

UNIT IV: Object Oriented testing: Broadening the view of Testing, Testing of OOA and OOD models, Object-Oriented testing strategies, Test case design for OO software, testing methods applicable at the class level, Interclass test case design.

UNIT V: Technical Metrics for Object Oriented Systems: The Intent of Object Oriented metrics, The distinguishing Characteristics, Metrics for the OO Design model, Class-Oriented metrics, Operation-Oriented Metrics, Metrics foe Object Oriented testing, Metrics for Object Oriented projects. CASE Tools.

Text Books:

1. Object oriented and Classical Software Engineering, 7/e, Stephen R. Schach, TMH.
2. Object oriented and Classical Software Engineering, Timothy Lethbridge, Robert Laganiere, TMH
3. Software Engineering by Roger S Pressman, Tata McGraw Hill Edition.

Reference Books:

1. Component based software engineering: 7th International symposium, ivicaCrnkovic, Springer, CBSE 2004

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I Year - I Semester		L	T	P	C
		2	0	0	2
RESEARCH METHODOLOGY AND IPR					

UNIT 1:
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT 2:
Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT 3:
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT 4:
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT 5:
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

REFERENCES:

(1) Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
(2) Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
(3) Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
(4) Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
(5) Mayall, "Industrial Design", McGraw Hill, 1992.
(6) Niebel, "Product Design", McGraw Hill, 1974.
(7) Asimov, "Introduction to Design", Prentice Hall, 1962.
(8) (8) Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
(9) T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

I Year - I Semester		L	T	P	C
		0	0	4	2
Advanced Data Structures & Algorithms Lab (MTCSE1106)					

Course Objectives:

From the course the student will learn

Knowing about oops concepts for a specific problem.
Various advanced data structures concepts like arrays, stacks, queues, linked lists, graphs and trees.

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

Identify classes, objects, members of a class and relationships among them needed for a specific problem.
Examine algorithms performance using Prior analysis and asymptotic notations.
Organize and apply to solve the complex problems using advanced data structures (like arrays, stacks, queues, linked lists, graphs and trees.)
Apply and analyze functions of Dictionary

Experiment 1:
Write a java program to perform various operations on single linked list

Experiment 2:
Write a java program for the following
a) Reverse a linked list
b) Sort the data in a linked list
c) Remove duplicates
d) Merge two linked lists

Experiment 3:
Write a java program to perform various operations on doubly linked list.

Experiment 4:
Write a java program to perform various operations on circular linked list.

Experiment 5:
Write a java program for performing various operations on stack using linked list.

Experiment 6:
Write a java program for performing various operations on queue using linked list.

Experiment 7:
Write a java program for the following using stack

a) Infix to postfix conversion.
b) Expression evaluation.
c) Obtain the binary number for a given decimal number.

Experiment 8:
Write a java program to implement various operations on Binary Search Tree Using Recursive and Non-Recursive methods.

Experiment 9:
Write a java program to implement the following for a graph.
a) BFS b) DFS

Experiment 10:
Write a java program to implement Merge & Heap Sort of given elements.

Experiment 11:
Write a java program to implement Quick Sort of given elements.

Experiment 12:
Write a java program to implement various operations on AVL trees.

Experiment 13:
Write a java program to perform the following operations:
a) Insertion intoa B-tree b) Searching in a B-tree

Experiment 14:
Write a java program to implementation of recursive and non-recursive functions to Binary tree Traversals

Experiment 15:
Write a java program to implement all the functions of Dictionary (ADT) using Hashing.

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I Year - I Semester		L	T	P	C
		0	0	4	2
Advanced Computing Lab (MTCSE1107)					

Course Objectives:

From the course the student will learn

The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.

Course Outcomes:

After the completion of the course, student will be able to

The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.

Development and use of s IoT technology in Societal and Industrial Applications.

Skills to undertake high quality academic and industrial research in Sensors and IoT.

To classify Real World IoT Design Constraints, Industrial Automation in IoT.

Experiment 1: Start Raspberry Pi and try various Linux commands in command terminal window: ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping etc.

Experiment 2: Study and Install IDE of Arduino and different types of Arduino.

Experiment 3: Study and Implement Zigbee Protocol using Arduino / RaspberryPi.

Experiment 4: Write a map reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented.

Experiment 5: Data analytics using Apache Spark on Amazon food dataset, find all the pairs of items frequently reviewed together.

Write a single Spark application that

Transposes the original Amazon food dataset, obtaining a PairRDD of the type<user_id>→

<list of the product_ ids reviewed by user_id>

Counts the frequencies of all the pairs of products reviewed together.

Writes on the output folder all the pairs of products that appear more than once and their frequencies. The pairs of products must be sorted by frequency.

Experiment 6:

Write a program to Implement Bankers algorithm for Dead Lock Avoidance.

Experiment 7:

Write a program to Producer-consumer problem Using semaphores.

Experiment 8:

Write a program for an image enhancement using pixel operation.

Experiment 9:
Write a Program to enhance image using image arithmetic and logical operations.

Experiment 10:
Write a program of bit stuffing used by Data Link Layer.

Experiment 11:
Write a program to configure a Network using Distance Vector Routing protocol.

Experiment 12:
Write a program to perform the function oriented diagram: DFD and Structured chart.

Experiment 13:
Write a program to perform the system analysis: Requirement analysis, SRS.

Experiment 14:
Write a program to draw the structural view diagram: Class diagram, object diagram.

Experiment 15:
Write C programs for implementing the Demorgan's law.