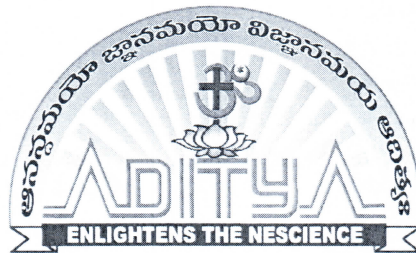# DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAM STRUCTURE AND SYLLABUS

For

M.TECH (COMPUTER SCIENCE AND ENGINEERING)
(Applicable from the Academic Year 2023-24 onwards)

ADITYA COLLEGE OF ENGINEERING & TECHNOLOGY (A)
(An Autonomous Institution)
Approved by AICTE, Affiliated to JNTUK, Accredited by NBA,
Accredited by NAAC A+ Grade with CGPA 3.4
Recognized by UGC under sections 2(f) and 12(B) of UGC act 1956
Aditya Nagar, ADB Road, Surampalem – 533 437, Kakinada District, A.P.
Email: office@acet.ac.in, www.acet.ac.in

PRINCIPAL
Aditya College of
Engineering & Technology
SURAMPALEM

VISION & MISSION OF THE INSTITUTE

VISION

To induce higher planes of learning by imparting technical education with
- International standards
- Applied research
- Creative Ability
- Value based instruction and to emerge as a premiere institute.

MISSION

Achieving academic excellence by providing globally acceptable technical education by forecasting technology through
- Innovative Research and development
- Industry Institute Interaction
- Empowered Manpower

VISION & MISSION OF THE DEPARTMENT

VISION

To become a center for excellence in Computer Science and Engineering education and innovation.

MISSION

M1: Provide state of art infrastructure.
M2: Adapt Skill based learner centric teaching methodology.
M3: Organize socio-cultural events for better society.
M4: Undertake collaborative works with academia and industry.
M5: Encourage students and staff self-motivated, problem solving individuals using Artificial Intelligence.
M6: Encourage entrepreneurship in young minds.

PROGRAM STRUCTURE

M.Tech. – I Year I Semester

S.No.	Course Code	Category	Title	L/D	T	P	Credits
1	232CS1T01	BSC	Mathematical Foundations of Computer Science	3	0	0	3
2	232CS1T02	PCC	Advanced Data Structures & Algorithms	3	0	0	3
3	---	PEC	Professional Elective – I	3	0	0	3
4	---	PEC	Professional Elective – II	3	0	0	3
5	232HS1T01	HSMC	Research Methodology and IPR	2	0	0	2
6	232CS1L01	PCC	Advanced Data Structures & Algorithms Lab	0	0	4	2
7	232CS1L02	PCC	Advanced Computing Lab	0	0	4	2
8	---	MC	Audit Course-I	2	0	0	0
Total				**16**	**0**	**8**	**18**

M.Tech. – I Year II Semester

S.No.	Course Code	Category	Title	L/D	T	P	Credits
1	232CS2T03	PCC	Machine learning	3	0	0	3
2	232CS2T04	PCC	MEAN Stack Technologies	3	0	0	3
3	---	PEC	Professional Elective – III	3	0	0	3
4	---	PEC	Professional Elective – IV	3	0	0	3
5	232CS2L03	PCC	Machine Learning with Python lab	0	0	4	2
6	232CS2L04	PCC	MEAN Stack Technologies Lab	0	0	4	2
7	232CS2P01	PROJ	Mini Project with Seminar	0	0	4	2
8	---	MC	Audit Course – II	2	0	0	0
Total				**14**	**0**	**12**	**18**

BSC – Basic Science Courses
PCC – Professional Core Courses
HSMC – Humanities and Social Sciences including Management Courses
PEC – Professional Elective Courses
PROJ – Project
MC – Mandatory Courses
OEC – Open Elective Courses

Audit Course – I and Audit Course – II has to be chosen from the following list of courses.

S.No.	Course Code		Name of the Course
	I Semester	II Semester	
1	232MC1A01	232MC2A01	English for Research Paper Writing
2	232MC1A02	232MC2A02	Disaster Management
3	232MC1A03	232MC2A03	Sanskrit for Technical Knowledge
4	232MC1A04	232MC2A04	Value Education
5	232MC1A05	232MC2A05	Constitution of India
6	232MC1A06	232MC2A06	Pedagogy Studies
7	232MC1A07	232MC2A07	Stress Management by Yoga
8	232MC1A08	232MC2A08	Personality Development through Life Enlightenment Skills

Professional Elective – I (I Semester)		
S.No	Course Code	Name of the Course
1	232CS1E01	Big Data Analytics
2	232CS1E02	Digital Image Processing
3	232CS1E03	Advanced Operating Systems

Professional Elective – II (I Semester)		
S.No	Course Code	Name of the Course
1	232CS1E04	Advanced Computer Networks
2	232CS1E05	Internet of Things
3	232CS1E06	Object Oriented Software Engineering

Professional Elective – III (II Semester)		
S.No	Course Code	Name of the Course
1	232CS2E07	Advanced Databases and Mining
2	232CS2E08	Ad Hoc & Sensor Networks
3	232CS2E09	Soft Computing

Professional Elective – IV (II Semester)		
S.No	Course Code	Name of the Course
1	232CS2E10	Cloud Computing
2	232CS2E11	Principles of computer security
3	232CS2E12	High Performance Computing

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Semester: I			L	T	P	C
Course code: 232CS1T01			3	0	0	3

Course Objectives:

COB 1:	To teach 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.
COB 2:	To train the students understand of the mathematical and logical basis to many modern techniques in computer science technology like machine learning, programming language design, and concurrency.
COB 3:	To discuss various sampling and classification problems.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	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.
CO 2:	Apply sampling, means, proportions, variances and estimates the maximum likelihood based on population parameters.
CO 3:	Analyze how to formulate and test hypotheses about sample means, variances and proportions and to draw conclusions based on the results of statistical tests.
CO 4:	Apply the principles of number theory to design various ciphers.
CO 5:	Apply graph theory for the 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.

Web Links:
1. http://mathworld.wolfram.com/topics/NumberTheory.html
2. http://nptel.ac.in/courses/106106094/
3. http://www.tutor.com/elementary-statistics
4. http://mathworld.wolfram.com/topics/GeneralLogic.html

ADVANCED DATA STRUCTURES & ALGORITHMS

Semester: I				L	T	P	C
Course code: 232CS1T02				3	0	0	3

Course Objectives:

COB 1:	To make the students understand the concepts of linked lists, stack and queues.
COB 2:	To illustrate the concepts of searching and sorting techniques.
COB 3:	To demonstrate the students, learn the concept of dictionaries.
COB 4:	To facilitate the students, learn the various operations of priority queues.
COB 5:	To teach the basic concepts of various search trees.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Demonstrate the concepts of Linked lists, Stack and Queue.
CO 2:	Summarize various searching and sorting techniques.
CO 3:	Make use of different traversals of Binary Trees and Graphs to solve real time problems.
CO 4:	Illustrate the concepts of Dictionaries.
CO 5:	Explain the concept of Priority Queues using Heaps.
CO 6:	Analyse various Search Trees with its time complexities.

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 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.

Web Links:
1. https://nptel.ac.in/courses/106102064/
2. https://www.geeksforgeeks.org/advanced-data-structures/
3. https://www.hackerearth.com/practice/notes/heaps-and-priority-queues/
4. https://www.csc.lsu.edu/~kundu/dstr/1-intr.pdf
5. https://pdfs.semanticscholar.org/dcc9/ebe2b24635f8fd9555bee411cf1bd405f008.pdf
6. https://klevas.mif.vu.lt/~algis/dsax/Data-Structures-Applications.pdf

BIG DATA ANALYTICS
(Professional Elective-I)

		L	T	P	C
Semester: I		3	0	0	3
Course code: 232CS1E01					

Course Objectives:

COB 1:	To facilitate the awareness on growing field of the big data analytics.
COB 2:	To discuss the tools required to manage and analyze big data like Hadoop, NoSQL, Map Reduce, HIVE, Cassandra, and Spark.
COB 3:	To train the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
COB 4:	To demonstrate the business decisions and create competitive advantage with Big Data analytics.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Illustrate on big data and its use cases from selected business domains.
CO 2:	Summarize on No SQL, Cassandra.
CO 3:	Analyze the HADOOP and Map Reduce technologies associated with big data analytics and explore on Big Data applications Using Hive.
CO 4:	Make use of Apache Spark, RDDs etc. to work with datasets.
CO 5:	Assess real time processing with Spark Streaming.

UNIT-I:
Big Data: 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:
No SQL: Introduction, 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:
Hadoop: 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.

Web Links:
1. https://www.edureka.co/big-data-hadoop-training certification
2. https://swayam.gov.in/nd1_noc19_cs59/preview
3. https://www.tutorialspoint.com/big_data_analytics/index.htm
4. https://lecturenotes.in/notes/6099-notes-for-data-analytics-da-by-prasanta-bal

DIGITAL IMAGE PROCESSING
(Professional Elective-I)

Semester: I		L	T	P	C
Course code: 232CS1E02		3	0	0	3

Course Objectives:

COB 1:	To enable the students to learn the basic principles of digital image processing.
COB 2:	To make the students implement algorithms that perform basic image processing.
COB 3:	To facilitate the students to write algorithms for advanced image analysis.
COB 4:	To Assess the performance of image processing algorithms and systems.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Demonstrate the components of image processing.
CO 2:	Summarize various filtration techniques.
CO 3:	Apply image compression techniques to real time applications.
CO 4:	Discuss the concepts of wavelet transforms.
CO 5:	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, Gonzalez, R.C. and. Woods R.E, 2nd Edition, Person Education, 2009.

Reference Books:
1. Digital Image Processing, Pratt, W. K, John Wiley (2001).
2. Digital Image Processing, Jayaraman, S., Veerakumar, T. and Esakkiranjan, S. Tata McGraw-Hill, 2009.
3. Digital Image Processing with MATLAB and LABVIEW, Vipul Si.

Web Links:
1. http://nptel.ac.in/courses/117105079/
2. http://freevideolectures.com/Course/2316/Digital-Image-Processing-IIT-Kharagpur
3. https://www.cs.nmt.edu/~ip/lectures.html
4. https://www.robotix.in/tutorial/imageprocessing/basicIp/
5. http://nptel.ac.in/courses/117105135/

ADVANCED OPERATING SYSTEMS
(Professional Elective-I)

Semester: I		L	T	P	C
Course code: 232CS1E03		3	0	0	3

Course Objectives:

COB 1:	To provide comprehensive and up-to-date coverage of the major developments in distributed Operating System, Multi-processor Operating System and Database Operating System.
COB 2:	To cover important theoretical foundations including Process Synchronization, Concurrency, Event ordering, Mutual Exclusion, Deadlock, Agreement Protocol, Security, Recovery and fault tolerance.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Illustrate on the fundamental concepts of distributed operating systems, its architecture and distributed mutual exclusion.
CO 2:	Analyze on deadlock detection algorithms and agreement protocols.
CO 3:	Make use of algorithms for implementing DSM and its scheduling.
CO 4:	Apply protection and security in distributed operating systems.
CO 5:	Elaborate on concurrency control mechanisms in distributed database systems.

UNIT-I:
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-II:
Dead Lock Detection: 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-III:
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-IV:
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-V:
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, Andrew S. Tanenbaum, 2003.

Web Links:
1. https://www.udacity.com › course › advanced-operating-systems--ud189
2. https://www.omscs.gatech.edu › cs-6210-advanced-operating-systems
3. https://www.operating-system.org › betriebssystem › _english › fa-ibm

ADVANCED COMPUTER NETWORKS
(Professional Elective-II)

Semester: I			L	T	P	C
Course code: 232CS1E04			3	0	0	3

Course Objectives:

COB 1:	To facilitate the students for the basic understanding of Computer networks starting with OSI Reference Model, Protocols at different layers with special emphasis on IP, TCP & UDP and Routing algorithms.
COB 2:	To train for the implementation of CSMA/CD, TCP/IP, LANs/ WANs, internetworking technologies, Routing and Addressing.
COB 3:	To provide the mathematical background of routing protocols.
COB 4:	To demonstrate the some familiarity with current research problems and research methods in advance computer networks.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Illustrate reference models with layers, protocols and interfaces.
CO 2:	Describe the routing algorithms, congestion control algorithms, Sub netting and Addressing of IPV4and IPV6.
CO 3:	Explain TCP/UDP protocols and how they can be used to assist in network design and implementation.
CO 4:	Summarize the concepts Wireless LANS, WIMAX, IEEE 802.11, Cellular telephony and Satellite networks.
CO 5:	Extend 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 networks can be connected, internetworking, tunnelling, 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.

Web Links:
1. https://www.coursera.org/learn/fundamentals-network-communications.
2. http://www.tutorialspoint.com/data_communication_computer_network/.
3. https://in.udacity.com/course/computer-networking--ud436.
4. http://www.dauniv.ac.in/downloads/Mobilecomputing/MobileCompChap06L01UD P&TCP.pdf
5. https://nptel.ac.in/courses/106105160/

INTERNET OF THINGS
(Professional Elective-II)

		L	T	P	C
Semester: I		3	0	0	3
Course code: 232CS1E05					

Course Objectives:

COB 1:	To understand Smart Objects and IoT Architectures.
COB 2:	To learn about various IOT-related protocols.
COB 3:	To build simple IoT Systems using Arduino and Raspberry Pi.
COB 4:	To understand data analytics and cloud in the context of IoT.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Summarize on the term 'internet of things' in different contexts.
CO 2:	Analyze various protocols for IoT.
CO 3:	Design a PoC of an IoT system using Rasperry Pi/Arduino.
CO 4:	Apply data analytics and use cloud offerings related to IoT.
CO 5:	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 (IoT WF) 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: Co AP 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.

Web Links:
1. https://onlinecourses.nptel.ac.in/noc18_cs46/preview
2. https://swayam.gov.in/courses/public?keyword=Introduction%20to%20internet%20 of%20things
3. https://swayam.gov.in/courses/public?keyword=Design%20for%20internet%20of%2 0things
4. https://www.coursera.org/specializations/iot
5. https://www.coursera.org/learn/iot
6. https://www.udemy.com/hands-on-internet-of-things-raspberry-pi/

OBJECT ORIENTED SOFTWARE ENGINEERING
(Professional Elective-II)

		L	T	P	C
Semester: I		3	0	0	3
Course code: 232CS1E06					

Course Objectives:

COB 1:	To elicit, analyze and specify software requirements through a productive working relationship with various stakeholders of the project.
COB 2:	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.
COB 3:	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: At the end of the Course, Student will be able to:

CO 1:	Apply the Object Oriented Software-Development Process to design software
CO 2:	Analyze software requirements through a SRS documents.
CO 3:	Plan software solutions to problems using an object-oriented strategy.
CO 4:	Model the object oriented software systems using Unified Modeling Language (UML).
CO 5:	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. Analysis and Models: 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. 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, ivica Crnkovic, Springer, CBSE 2004

Web Links:
1. https://en.wikipedia.org/wiki/Object-oriented_software_engineering
2. https://pl.cs.jhu.edu/oose/index.shtml
3. http://cs-exhibitions.uni-klu.ac.at/index.php?id=448
4. https://www.geeksforgeeks.org/software-engineering-object-oriented-life-cycle-model/
5. https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_orient ed_paradigm.htm

RESEARCH METHODOLOGY AND IPR

Semester: I   **L**   **T**   **P**   **C**
  Course code: 232HS1T01   2   0   0   2

Course Objectives:

COB 1:	To demonstrate the identification of the research problems.
COB 2:	To make the awareness on the literature studies, plagiarism and ethics.
COB 3:	To train the knowledge on technical writing.
COB 4:	To analyze the nature of intellectual property rights and new developments
COB 5:	To facilitate the need of the patent rights.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Understand research problem formulation.
CO 2:	Analyze research related information.
CO 3:	Demonstrate research ethics.
CO 4:	Explain the today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CO 5:	Discuss that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO 6:	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT-I:
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-II:
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-III:
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-IV:
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT-V:
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.

Text Books:
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".

References:
1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
2. Mayall, "Industrial Design", McGraw Hill, 1992.
3. Niebel, "Product Design", McGraw Hill, 1974.
4. Asimov, "Introduction to Design", Prentice Hall, 1962.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
6. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

Web Links:
1. https://www.wipo.int › documents › ip_innovation_development_fulltext
2. https://www.wipo.int › patent-law › developments › research
3. https://www.cencenelec.eu › research › innovation › IPR › Pages

ADVANCED DATA STRUCTURES & ALGORITHMS LAB

Semester: I   **L   T   P   C**
Course code: 232CS1L01   0   0   4   2

Course Objectives:

COB 1:	To demonstrate the students to learn the Linked list, Stack and Queues.
COB 2:	To make students to learn the concepts of iterative and recursive algorithms.
COB 3:	To demonstrate the basic operations on Binary heap, AVL tree.
COB 4:	To enable the students to learn about B-Tree and B+ Tree operations.
COB 5:	To impart knowledge on Dictionaries using hashing techniques.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Identify classes, objects, members of a class and relationships among them needed for a specific problem.
CO 2:	Examine algorithms performance using Prior analysis and asymptotic notations.
CO 3:	Solve the complex problems using advanced data structures (like arrays, stacks, queues, linked lists, graphs and trees.)
CO 4:	Analyze the 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 Reverse a linked list
Sort the data in a linked list Remove duplicates
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. Infix to postfix conversion.
Expression evaluation.
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.

Reference Books:
1. Data Structures, Algorithms and Applications in java, 2/e, Sartaj Sahni, University Press.
2. Data Structures and Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson.

Web Links:
1. https://www.udacity.com/course/intro-to-algorithms--cs215
2. https://www.hackerearth.com/practice/notes/heaps-and-priority-queues/
3. https://www.geeksforgeeks.org/advanced-data-structures/
4. https://www.tutorialspoint.com/data_structures_algorithms/algorithms_basics.htm
5. htttps://www.codechef.com/certification/data-structures-and-algorithms/prepare

ADVANCED COMPUTING LAB

Semester: I   **L   T   P   C**
Course code: 232CS1L02   **0   0   4   2**

Course Objectives:

COB 1:	To train the students for exploring 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: At the end of the Course, Student will be able to:

CO 1:	Make use of various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.
CO 2:	Develop and use of IoT technology in Societal and Industrial Applications.
CO 3:	Develop high quality academic and industrial research in Sensors and IoT.
CO 4:	Analyze Real World IOT Design Constraints, Industrial Automation in IoT.

Experiments:

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.
2. Study and Install IDE of Arduino and different types of Arduino.
3. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
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.
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 Pair RDD 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.
6. Write a program to Implement Bankers algorithm for Dead Lock Avoidance.
7. Write a program to Producer-consumer problem Using semaphores.
8. Write a program for an image enhancement using pixel operation.
9. Write a Program to enhance image using image arithmetic and logical operations.
10. Write a program of bit stuffing used by Data Link Layer.
11. Write a program to configure a Network using Distance Vector Routing protocol.
12. Write a program to perform the function oriented diagram: DFD and Structured chart.
13. Write a program to perform the system analysis: Requirement analysis, SRS.
14. Write a program to draw the structural view diagram: Class diagram, object diagram.
15. Write C programs for implementing the Demorgan's law.

Reference Books:
1. Operating Systems: A Concept-Based Approach, D M Dhamdhere, 2nd Edition, Tata Mc Graw-Hill Education.
2. Computer Networks – A system's approach, Larry L Peterson, Bruce S Davie, 5th Edition, Elsevier, 2011.
3. The Unified modeling language Reference manual, James Rumbaugh, Ivar Jacobson, Grady Booch, Addison-Wesley.
4. Designing the Internet of Things, Adrian McEwen, Hakim Casimally, Wiley and Sons publications, 2014.

Web Links:
1. http://www.scribd.com/doc/58478622/Computer-Networks-Forouzan.
2. http://www.geeksforgeeks.org/operating-systems
3. https://www.geeksforgeeks.org/unified-modeling-language-uml
4. https://www.coursera.org/learn/object-oriented-design/lecture/6GJtg/1-1-3-object-oriented-modeling
5. http://www.technolamp.co.in/2010/08/computer-networks-tanenbaum-power point. html.

MACHINE LEARNING

Semester: II   **L   T   P   C**
Course code: 232CS2T03   **3   0   0   3**

Course Objectives:

COB 1:	To discuss for what is involved in learning from data.
COB 2:	To make the awareness on a wide variety of learning algorithms.
COB 3:	To train the students to apply a variety of learning algorithms to data.
COB 4:	To make the awareness on how to perform evaluation of learning

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Domain Knowledge for Productive use of Machine Learning and Diversity of Data.
CO 2:	Demonstrate on Supervised and Computational Learning problems.
CO 3:	Analyze on Statistics in learning techniques and Logistic Regression
CO 4:	Illustrate on Support Vector Machines and Perceptron Algorithm
CO 5:	Design a Multilayer Perceptron Networks and classification of decision tree

UNIT-I:
Introduction-Towards Intelligent Machines, Well posed Problems, Example of Applications in diverse fields, Data Representation, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured / Unstructured, Forms of Learning, Machine Learning and Data Mining, Basic Linear Algebra in Machine Learning Techniques.

UNIT-II:
Supervised Learning- Rationale and Basics: Learning from Observations, Bias and Why Learning Works: Computational Learning Theory, Occam's Razor Principle and Overfitting Avoidance Heuristic Search in inductive Learning, Estimating Generalization Errors, Metrics for assessing regression, Metris for assessing classification.

UNIT-III:
Statistical Learning- Machine Learning and Inferential Statistical Analysis, Descriptive Statistics in learning techniques, Bayesian Reasoning: A probabilistic approach to inference, K-Nearest Neighbor Classifier. Discriminant functions and regression functions, Linear Regression with Least Square Error Criterion, Logistic Regression for Classification Tasks, Fisher's Linear Discriminant and Thresholding for Classification, Minimum Description Length Principle.

UNIT-IV:
Support Vector Machines (SVM)- Introduction, Linear Discriminant Functions for Binary Classification, Perceptron Algorithm, Large Margin Classifier for linearly seperable data, Linear Soft Margin Classifier for Overlapping Classes, Kernel Induced Feature Spaces, Nonlinear Classifier, Regression by Support vector Machines.

Learning with Neural Networks: Towards Cognitive Machine, Neuron Models, Network Architectures, Perceptrons, Linear neuron and the Widrow-Hoff Learning Rule, The error correction delta rule.

UNIT -V:
Multilayer Perceptron Networks and error back propagation algorithm, Radial Basis Functions Networks.
Decision Tree Learning: Introduction, Example of classification decision tree, measures of impurity for evaluating splits in decision trees, ID3, C4.5, and CART decision trees, pruning the tree, strengths and weakness of decision tree approach.

Textbooks:
1. Applied Machine Learning,1e, M.Gopal, Mc Graw Hill Education, 2018

Reference Books
1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

Web Links:
1. https://www.coursera.org/learn/machine-learning
2. https://classroom.udacity.com/courses/ud120
3. http://videolectures.net/Top/Computer_Science/Machine_Learning/
4. https://onlinecourses.nptel.ac.in/noc18_cs26
5. https://www.youtube.com/channel/UCR4_akQ1HYMUcDszPQ6jh8Q

MEAN STACK TECHNOLOGIES

Semester: II
Course code: 232CS2T04

L	T	P	C
3	0	0	3

Course Objectives:

COB 1:	To teach the students translate user requirements into the overall architecture and implementation of new systems and Manage Project and coordinate with the Client.
COB 2:	To make the students Write optimized front end code HTML and JavaScript.
COB 3:	To enable the students Monitor the performance of web applications & infrastructure and Troubleshooting web application with a fast and accurate a resolution.
COB 4:	To make the students Design and implement Robust and Scalable Front End Applications.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Identify the Basic Concepts of Web & Markup Languages.
CO 2:	Develop web Applications using Scripting Languages & Frameworks.
CO 3:	Make use of Express JS and Node JS frameworks.
CO 4:	Illustrate the uses of web services concepts like restful, react js.
CO 5:	Adapt to Deployment Techniques & Working with cloud platform.

UNIT-I:
Introduction to Web: Internet and World Wide Web, Domain name service, Protocols: HTTP, FTP, SMTP. Html5 concepts, CSS3, Anatomy of a web page. XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX Approaches.

UNIT-II:
JavaScript: The Basic of JavaScript: Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions. Angular Java Script Angular JS Expressions: ARRAY, Objects, $eval, Strings, Angular JS Form Validation & Form Submission, Single Page Application development using Angular JS.

UNIT-III: Node.js:
Introduction, Advantages, Node.js Process Model, Node JS Modules. Express.js: Introduction to Express Framework, Introduction to Nodejs , What is Nodejs, Getting Started with Express, Your first Express App, Express Routing, Implementing MVC in Express, Middleware, Using Template Engines, Error Handling , API Handling, Debugging, Developing Template Engines, Using Process Managers, Security & Deployment.

UNIT-IV:
RESTful Web Services:
Using the Uniform Interface, Designing URIs, Web Linking, Conditional Requests. React Js: Welcome to React, Obstacles and Roadblocks, React's Future, Keeping Up with the Changes,

Working with the Files, Pure React, Page Setup, The Virtual DOM, React Elements, React DOM, Children, Constructing Elements with Data, React Components, DOM Rendering, Factories

UNIT-V: Mongo DB:
Introduction, Architecture, Features, Examples, Database Creation & Collection in Mongo DB. Deploying Applications: Web hosting & Domains, Deployment Using Cloud Platforms.

Text Books:
1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford
3. Pro Mean Stack Development, ELad Elrom, Apress
4. Restful Web Services Cookbook, Subbu Allamraju, O'Reilly
5. JavaScript & jQuery the missing manual, David sawyer mcfarland, O'Reilly
6. Web Hosting for Dummies, Peter Pollock, John Wiley Brand

Reference Books:
1. Ruby on Rails up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, Oreilly (2006)
2. Programming Perl, 4ed, Tom Christiansen, Jonathan Orwant, Oreilly (2012)
3. Web Technologies, HTML< JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech
4. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning
5. Express.JS Guide, The Comprehensive Book on Express.js, AzatMardan, Lean Publishing.

Web Links:
1. https://www.udemy.com/course/angular-2-and-nodejs-the-practical-guide/
2. https://www.simplilearn.com/full-stack-web-developer-mean-stack-certification-training
3. https://www.coursera.org/specializations/full-stack-react
4. http://www.webdevelopmenthelp.net/2017/01/learn-mean-stack-development.html
5. https://www.pluralsight.com/courses/building-angularjs-nodejs-apps-mean

ADVANCED DATABASES AND MINING
(Professional Elective-III)

		L	T	P	C
Semester: II		3	0	0	3
Course code: 232CS2E07					

Course Objectives:

COB 1:	To teach the maintains of the real world, maintaining data without any redundancy, several techniques involved in DBMS to recover the problems caused due to redundancy, storing data for quick insertion, manipulation and deletion operations in order to retrieve data from the database.
COB 2:	To make awareness on the multi-disciplinary field of data mining, the general data features, techniques for data preprocessing, general implementation of data warehouses and OLAP, the relationship between data warehousing and other generalization methods
COB 3:	To facilitate the concepts of data clustering includes a different method of clustering such as k-means, k-mediods, DB scan algorithm, role of data mining in web mining.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Analyze on normalization techniques.
CO 2:	Elaborate on concurrency control techniques and query optimization.
CO 3:	Summarize the concepts of data mining, data warehousing and data preprocessing strategies.
CO 4:	Apply data mining algorithms.
CO 5:	Assess various classification & cluster techniques.

UNIT-I: Introduction:
Concepts and Definitions, Relational models, Data Modelling and Query Languages, Database Objects. Normalization Techniques: Functional Dependency, 1NF, 2NF, 3NF, BCNF; Multi valued Dependency; Loss-less Join and Dependency Preservation.

UNIT-II:
Transaction Processing:
Consistency, Atomicity, Isolation and Durability, Serializable Schedule, Recoverable Schedule, Concurrency Control, Time-stamp based protocols, Isolation Levels, Online Analytical Processing,
Database performance Tuning and Query optimization: Query Tree, Cost of Query, Join, Selection and Projection Implementation Algorithms and Optimization Database Security: Access Control, MAC, RBAC, Authorization, SQL Injection Attacks.

UNIT-III: Data Mining:
Stages and techniques, knowledge representation methods, data mining approaches (OLAP, DBMS, Statistics and ML).

Data Warehousing: data warehouse and DBMS, multidimensional data model, OLAP operations. Data processing: cleaning, transformation, reduction, filters and discretization with weka.

UNIT-IV:
Knowledge Representation:
Background knowledge, representing input data and output knowledge, visualization techniques and experiments with weka. Data mining algorithms: association rules, mining weather data, generating item sets and rules efficiently, correlation analysis

UNIT-V:
Classification & Clustering:
1R algorithm, decision trees, covering rules, task prediction, statistical classification, Bayesian network, instance based methods, linear models, Cluster/2, Cobweb, k-means, **Hierarchical methods. Mining real data:** preprocessing data from a real medical domain, data mining techniques to create a comprehensive and accurate model of data. Advanced topics: text mining, text classification, web mining, data mining software.

Text Books:
1. Fundamentals of Database Systems, Ramez Elmasri, Shamkant B. Navathe, Addison-Wesley, 6th edition-
2. Data Mining: Concepts and Techniques, J. Han and M. Kamber, Morgan Kaufmann C.J. Date, Database Systems, Pearson, 3rd edition-

Reference Books:
1. Principles of Distributed Database Systems, Prentice Hall, P. Valduriez, M. Tamer Ozsu 3rd edition-2000
2. Database systems: Design, implementation and Management, C.M. Coronel, S. Morris, P. Rob,
3. Boston: Cengage Learning,9th edition-2011

Web Links
1. https://nptel.ac.in/courses/106106093/
2. https://www.coursera.org/courses?query=database
3. https://nptel.ac.in/courses/106105174/
4. https://www.udacity.com/courses/school-of-data-science
5. https://nptel.ac.in/courses/106104021/

AD HOC & SENSOR NETWORKS
(Professional Elective-III)

		L	T	P	C
Semester: II		3	0	0	3
Course code: 232CS2E08					

Course Objectives:

COB 1:	To discuss the architect sensor networks for various application setups.
COB 2:	To make awareness on devise appropriate data dissemination protocols and model links cost.
COB 3:	To discuss of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.
COB 4:	To train the finding the performance of sensor networks and identify bottlenecks.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Explain the Fundamental Concepts and applications of ad hoc and wireless sensor networks.
CO 2:	Discuss the MAC protocol issues of ad hoc networks.
CO 3:	Enumerate the concept of routing protocols for ad hoc wireless networks with respect to TCP design issues.
CO 4:	Analyze & Specify the concepts of network architecture and MAC layer protocol for WSN.
CO 5:	Discuss the WSN routing issues by considering QoS measurements.

UNIT-I: Introduction:
Fundamentals of Wireless Communication Technology, The Electromagnetic Spectrum, Radio propagation Mechanisms, Characteristics of the Wireless channel mobile ad hoc networks (MANETs), Wireless Sensor Networks (WSNs): concepts and architectures, Applications of Ad Hoc and Sensor Networks, Design Challenges in Ad hoc and Sensor Networks.

UNIT-II:
MAC Protocols For Ad Hoc Wireless Networks:
Issues in designing a MAC Protocol, Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks, Design Goals of a MAC Protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols, Contention based protocols, Contention based protocols with Reservation Mechanisms, Contention based protocols with Scheduling Mechanisms, Multi channel MAC - IEEE 802.11.

UNIT-III:
Routing Protocols And Transport Layer In Ad Hoc Wireless Networks:
Routing Protocol: Issues in designing a routing protocol for Ad hoc networks, Classification, proactive routing, reactive routing (on-demand), hybrid routing, Transport Layer protocol for Ad hoc networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks,

Classification of Transport Layer solutions-TCP over Ad hoc wireless, Network Security, Security in Ad Hoc Wireless Networks, Network Security Requirements.

UNIT-IV:
Wireless Sensor Networks (WSNS) And Mac Protocols:
Single node architecture-hardware and software components of a sensor node, WSN Network architecture: typical network architectures, data relaying and aggregation strategies, MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC -IEEE 802.15.4.

UNIT-V:
WSN Routing, Localization & QoS:
Issues in WSN routing, OLSR, Localization, Indoor and Sensor Network Localization, absolute and relative localization, triangulation, QOS in WSN, Energy Efficient Design, Synchronization.

Text Books:
1. "Ad Hoc Wireless Networks: Architectures and Protocols ", C. Siva Ram Murthy, and B. S. Manoj, Pearson Education, 2008.
2. "Wireless Adhoc and Sensor Networks", Labiod. H, Wiley, 2008.
3. "Wireless ad -hoc and sensor Networks: theory and applications", Li, X, Cambridge University Press, 2008.

Reference Books:
1. "Ad Hoc & Sensor Networks: Theory and Applications", 2nd edition, Carlos De Morais Cordeiro, Dharma Prakash Agrawal ,World Scientific Publishing Company, 2011.
2. "Wireless Sensor Networks", Feng Zhao and Leonides Guibas, Elsevier Publication.
3. "Protocols and Architectures for Wireless Sensor Networks", Holger Karl and Andreas Willig,Wiley, 2005 (soft copy available).
4. "Wireless Sensor Networks Technology, Protocols, and Applications", Kazem Sohraby, DanielMinoli, & TaiebZnati, John Wiley, 2007. (Soft copy available).

Web Links
1. https://ieeexplore.ieee.org/document/7981546/
2. https://nptel.ac.in/courses/106105160/
3. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105160/lec29. pdf
4. https://cse.iitkgp.ac.in/~smisra/course/wasn.html
5. https://www.coursera.org/courses?query=wireless

SOFT COMPUTING
(Professional Elective-III)

	L	T	P	C
Semester: II	3	0	0	3
Course code: 232CS2E09				

Course Objectives:

COB 1:	To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
COB 2:	To implement soft computing-based solutions for real-world problems.
COB 3:	To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
COB 4:	To provide student a hand-on experience on MATLAB to implement various strategies.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Elaborate fuzzy logic and reasoning to handle uncertainty in engineering problems.
CO 2:	Make use of genetic algorithms to combinatorial optimization problems.
CO 3:	Distinguish artificial intelligence techniques, including search heuristics, knowledge representation, planning and reasoning.
CO 4:	Formulate and apply the principles of self-adopting and self organizing neuro fuzzy inference systems.
CO 5:	Evaluate and compare solutions by various soft computing approaches for a given problem.

UNIT-I:
Fuzzy Set Theory:
Introduction to Neuro, Fuzzy and Soft Computing, Fuzzy Sets, Basic function and Terminology, Set-theoretic Operations, Member Function Formulation and arameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models, Input Space Partitioning and Fuzzy Modeling.

UNIT-II: Optimization:
Derivative based Optimization, Descent Methods, and The Method of Steepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms, Simulated Annealing, and Random Search, Downhill Simplex Search.

UNIT-III:
Artificial Intelligence:
Introduction, Knowledge Representation, Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning Under Uncertainty Basic knowledge Representation Issues Knowledge acquisition, Heuristic Search: Techniques for

Heuristic search Heuristic Classification State Space Search: Strategies Implementation of Graph Search based on Recursion Patent-directed Search Production System and Learning.

UNIT-IV:
Neuro Fuzzy Modeling:
Adaptive Neuro-Fuzzy Inference Systems, Architecture Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN Coactive Neuro Fuzzy Modeling, Framework Neuron Functions for Adaptive Networks Neuro Fuzzy Spectrum.

UNIT-V:
Applications Of Computational Intelligence:
Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction, Soft Computing for Coloripe Prediction.

Text Books:
1. "Neuro-Fuzzy and Soft Computing", J.S.R.Jang, C.T.Sun and E.Mizutani, PHI, 2004, Pearson Education 2004.
2. Artificial Intelligence by Saroj Koushik, Cengage Learning.
3. "Artificial Intelligence and Intelligent Systems", N.P.Padhy, Oxford University Press, 2006.

Reference Books:
1. Artificial Intelligence, Second Edition, Elaine Rich & Kevin Knight, Tata McGraw Hill Publishing Comp., New Delhi, 2006.
2. "Fuzzy Logic with Engineering Applications", Timothy J.Ross, McGraw-Hill, 1997.

Web Links:
1. https://nptel.ac.in/courses/106105173/
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105173/lec1.pdf
3. https://www.coursera.org/courses?query=neural%20networks

CLOUD COMPUTING
(Professional Elective-IV)

Semester: II   **L   T   P   C**
Course code: 232CS2E10   **3   0   0   3**

Course Objectives:

COB 1:	To impart the knowledge on fundamental concepts.
COB 2:	To make the students to apply Cloud Infrastructure for own organizations.
COB 3:	To enable the students to work in groups to analyze Resource virtualization and Management.
COB 4:	To impart the knowledge of cloud storage and security.
COB 5:	To enable the students to implement cloud applications.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Explain the basic issues and different systems in cloud computing.
CO 2:	Examine the economics, financial, and technological implications for selecting cloud computing for own organization.
CO 3:	Illustrate Virtualization and Resource management for Data - Center Automation.
CO 4:	Analyze the storage systems and security in cloud computing.
CO 5:	Develop cloud application with the use of Google and Microsoft.

UNIT-I: Introduction:
Network centric computing, Network centric content, peer-to –peer systems, cloud computing delivery models and services, Ethical issues, Vulnerabilities, Major challenges for cloud computing.
Parallel and Distributed Systems: Introduction, architecture, distributed systems, communication protocols, logical clocks, message delivery rules, concurrency, model concurrency with Petri Nets.

UNIT-II:
Cloud Infrastructure:
At Amazon, The Google Perspective, Microsoft Windows Azure, Open Source Software Platforms, Cloud storage diversity, Inter cloud, energy use and ecological impact, responsibility sharing, user experience, Software licensing.
Cloud Computing: Applications and Paradigms: Challenges for cloud, existing cloud applications and new opportunities, architectural styles, workflows, The Zookeeper, The Map Reduce Program model, HPC on cloud, biological research.

UNIT-III:
Cloud Resource virtualization:
Virtualization, layering and virtualization, virtual machine monitors, virtual machines, virtualization- full and para, performance and security isolation, hardware support for virtualization, Case Study: Xen, vBlades.

Cloud Resource Management and Scheduling: Policies and Mechanisms, Applications of control theory to task scheduling, Stability of a two-level resource allocation architecture, feedback control based on dynamic thresholds, coordination, resource bundling, scheduling algorithms, fair queuing, start time fair queuing, cloud scheduling subject to deadlines, Scheduling Map Reduce applications, Resource management and dynamic application scaling.

UNIT-IV: Storage Systems:
Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system. Apache Hadoop, Big Table, Megastore (text book 1), Amazon Simple Storage Service (S3) (Text book 2).
Cloud Security: Cloud security risks, security – a top concern for cloud users, privacy and privacy impact assessment, trust, OS security, Virtual machine security, Security risks.

UNIT-V:
Cloud Application Development:
Amazon Web Services : EC2 – instances, connecting clients, security rules, launching, usage of S3 in Java, Installing Simple Notification Service on Ubuntu 10.04, Installing Hadoop on Eclipse, Cloud based simulation of a Distributed trust algorithm, Cloud service for adaptive data streaming (Text Book 1), Google: Google App Engine, Google Web Toolkit (Text Book 2), Microsoft: Azure Services Platform, Windows live, Exchange Online, Share Point Services, Microsoft Dynamics CRM (Text Book 2).

Text Books:
1. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
2. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH.

Reference Books:
1. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammarai selvi, TMH.
2. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley India, 1st Edition 2010.

Web Links:
1. https://www.udemy.com/introduction-to-cloud-computing/
2. https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/
3. http://www.businessnewsdaily.com/5791-virtualization-vs-cloud-computing.html
4. https://en.wikipedia.org/wiki/Cloud_computing

PRINCIPLES OF COMPUTER SECURITY
(Professional Elective-IV)

Semester: II	L	T	P	C
Course code: 232CS2E11	3	0	0	3

Course Objectives:

COB 1:	To provide an overview of modern cryptographic theories and techniques, mainly focusing on their application into real systems.
COB 2:	To teach the awareness on Database and Cloud Security, Malicious Software, Denial-of-Service Attacks, Software Security, Operating System Security, Wireless Network Security and mobile device security.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Describe the key security requirements of confidentiality, integrity, and availability, types of security threats and attacks and summarize the functional requirements for computer security.
CO 2:	Explain the basic operation of symmetric block encryption algorithms, use of secure hash functions for message authentication, digital signature mechanism.
CO 3:	Discuss the issues involved and the approaches for user authentication and explain how access control fits into the broader context that includes authentication, authorization, and audit.
CO 4:	Explain the basic concept of a denial-of-service attack, nature of flooding attacks, distributed denial-of-service attacks and describe how computer security vulnerabilities are a result of poor programming practices.
CO 5:	List the steps used to secure the base operating system, specific aspects of securing Unix/Linux systems, Windows systems, and security in virtualized systems and describe the security threats and countermeasures for wireless networks.

UNIT-I:
Introduction:
Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, Fundamental Security Design Principles, Attack Surfaces and Attack Trees, Computer Security Strategy. Cryptographic Tools: Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random and Pseudorandom Numbers.

UNIT-II:
User Authentication:
Electronic User Authentication Principles, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication. Access Control: Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, UNIX File Access Control, Role-Based Access Control, Attribute-Based Access Control, Identity, Credential, and Access Management, Trust Frameworks.

UNIT-III:
Database and Cloud Security:
The Need for Database Security, Database Management Systems, Relational Databases, Sql Injection Attacks, Database Access Control, Database Encryption, Cloud Computing, Cloud Security Risks And Countermeasures, Data Protection In The Cloud, Cloud Security As A Service. Malicious Software: Types of Malicious Software (Malware), Advanced Persistent Threat, Propagation, Infected Content, Viruses, Propagation, Vulnerability Exploit, Worms, Propagation, Social Engineering, Spam E-Mail, Trojans, Payload, System Corruption, Payload, Attack Agent, Zombie, Bots, Payload, Information Theft, Key loggers, Phishing, Spyware, Payload, Stealthing, Backdoors, Root kits, Countermeasures.

UNIT-IV:
Denial-of-Service Attacks:
Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Reflector and Amplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to a Denial-of-Service Attack. Software Security: Software Security Issues, Handling Program Input, Writing Safe Program Code, Interacting with the Operating System and Other Programs.

UNIT V:
Operating System Security:
Introduction To Operating System Security, System Security Planning, Operating Systems Hardening, Application Security, Security Maintenance, Linux/Unix Security, Windows Security, Virtualization Security. Wireless **Network Security:** Wireless Security, Mobile Device Security, IEEE 802.11Wireless LAN Overview, IEEE 802.11i Wireless LAN Security.

Text Book:
1. Computer Security: Principles and Practices, 3e, William Stallings, Lawrie Brown, Pearson

Reference Book:
1. Network Security Essentials, Principles and Practices, William Stallings, Pearson.

Web Links:
1. https://nptel.ac.in/courses/106105031/
2. https://nptel.ac.in/courses/106105162/
3. https://www.udacity.com/course/network-security--ud199

HIGH PERFORMANCE COMPUTING
(Professional Elective-IV)

Semester: II   L   T   P   C
Course code: 232CS2E12   3   0   0   3

Course Objectives:

COB 1:	To teach the basic concepts related to HPC architecture and parallel computing.
COB 2:	To discuss various computational techniques for studying soft matter systems.
COB 3:	To apply these concepts to examine complex bimolecular/materials systems that generally require large-scale HPC platform with hybrid CPU-GPU architectures.
COB 4:	To make the students Design and implement Robust and Scalable Front End Applications.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Design, formulate, solve and implement high performance versions of standard single threaded algorithms.
CO 2:	Demonstrate the architectural features in the GPU and MIC hardware accelerators.
CO 3:	Analyze Symmetric and Distributed architectures.
CO 4:	Develop and deploy large scale parallel programs on tightly coupled parallel systems using the message passing paradigm..

UNIT-I:
Graphics Processing Units:
Introduction to Heterogeneous Parallel Computing, GPU architecture, Thread hierarchy, GPU Memory Hierarchy.

UNIT-II:
GPU Programming:
Vector Addition, Matrix Multiplication algorithms. 1D, 2D, and 3D Stencil Operations, Image Processing algorithms – Image Blur, Gray scaling. Histogramming, Convolution, Scan, Reduction techniques.

UNIT-III:
Many Integrated Cores:
Introduction to Many Integrated Cores. MIC, Xeon Phi architecture, Thread hierarchy, Memory Hierarchy, Memory Bandwidth and performance considerations.

UNIT-IV:
Shared Memory Parallel Programming:
Symmetric and Distributed architectures, OpenMP Introduction, Thread creation, Parallel regions. Work sharing, Synchronization.

UNIT-V:
Message Passing Interface:
MPI Introduction, Collective communication, Data grouping for communication.

Text Books:
1. Programming Massively Parallel Processors A Hands-on Approach, 3e, Wen-Mei W Hwu, David B Kirk and Morgan Kaufmann-2019.
2. Intel Xeon Phi Coprocessor Architecture and Tools, Rezaur Rahman, Apress Open, 1st edition-2013.
3. Using OpenMP, Barbara Chapman, Gabriele Jost, Rudd Vander Pas, MIT Press, 2008.
4. "A Parallel Algorithm Synthesis Procedure for High-Performance Computer Architectures" by Dunn Ian N, 2003.

Reference books:
1. "A Parallel Algorithm Synthesis Procedure for High-Performance Computer Architectures" by Dunn Ian N, 2003.

Web Links:
1. https://nptel.ac.in/courses/106108055/
2. https://aws.amazon.com/hpc/
3. https://www.udacity.com/course/high-performance-computing--ud281
4. https://journals.sagepub.com/toc/hpc/current
5. https://johnfoster.pge.utexas.edu/HPC/video-lectures/

MACHINE LEARNING WITH PYTHON LAB

Semester: II

Course code: 232CS2L03

	L	T	P	C
	0	0	4	2

Course Objectives:

COB 1:	To train the different Data sets in implementing the machine learning algorithms.
COB 2:	To make the students get familiar with the machine learning concepts and algorithms in any suitable language of choice.
COB 3:	To train on the SQL and Mongo databases.
COB 4:	To learn complete web development process.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Implement procedures for the machine learning algorithms.
CO 2:	Design Python programs for various Learning algorithms.
CO 3:	Apply appropriate data sets to the Machine Learning algorithms.
CO 4:	Identify and apply Machine Learning algorithms to solve real world problems.

Experiment-1:
Exercises to solve the real-world problems using the following machine learning methods: Linear Regression, Logistic Regression.

Experiment-2:
Write a program to Implement Support Vector Machines.

Experiment-3:
Exploratory Data Analysis for Classification using Pandas and Matplotlib.

Experiment-4:
Implement a program for Bias, Variance, and Cross Validation.

Experiment-5:
Write a program to simulate a perception network for pattern classification and function approximation.

Experiment-6:
Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Experiment-7:
Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

Experiment-8:
Write a program to implement the naïve Bayesian classifier for Iris data set. Compute the accuracy of the classifier, considering few test data sets.

Experiment-9:
Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

Experiment-10:
Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.
You can add Java/Python ML library classes/API in the program.

Experiment-11:
Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

Text Books:
1. Python Machine Learning by Sebastian Raschka Released September 2015 Publisher(s): Packt Publishing.

Reference Books:
1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online).

Web Links:
1. https://www.pyimagesearch.com/2019/01/14/machine-learning-in-python/
2. https://www.coursera.org/learn/machine-learning
3. https://classroom.udacity.com/courses/ud120
4. http://videolectures.net/Top/Computer_Science/Machine_Learning/
5. https://onlinecourses.nptel.ac.in/noc18_cs26

MEAN STACK TECHNOLOGIES LAB

Semester: II   **L   T   P   C**
Course code: 232CS2L04   **0   0   4   2**

Course Objectives:

COB 1:	To teach the students core concepts of both the frontend and backend programming course.
COB 2:	To make the students get familiar with the latest web development technologies.
COB 3:	To teach the students SQL and Mongo databases.
COB 4:	To Learn complete web development process.

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Identify the Basic Concepts of Web & Markup Languages.
CO 2:	Develop web Applications using Scripting Languages & Frameworks.
CO 3:	Create Applications using JSP libraries.
CO 4:	Develop First Controller Working with and Displaying in Angular Js and Nested Forms with ngform.
CO 5:	Create the Files in React JS and Constructing Elements with Data.

Experiment-1:
Develop static pages (using only HTML) of an online Book store. The pages should resemble: www.amazon.com. The website should consist of the following pages. Home page • Registration and user Login • User profile page • Books catalog • Shopping cart • Payment by credit card Order Conformation.

Experiment-2:
Develop HTML page including any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.

Experiment-3:
Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems:
a. Input: Click on Display Date button using on click ( ) function Output: Display date in the textbox
b. Input: A number n obtained using prompt Output: Factorial of n number using alert
c. Input: A number n obtained using prompt Output: A multiplication table of numbers from 1 to 10 of n using alert
d. Input: A number n obtained using prompt and add another number using confirm Output: Sum of the entire n numbers using alert

Experiment-4:
Create a simple visual bean with a area filled with a color. The shape of the area depends on the property shape. If it is set to true then the shape of the area is Square and it is Circle, if it is false. The color of the area should be changed dynamically for every mouse click.

Experiment-5:
Create an XML document that contains 10 users information. Write a Java Program, which takes User Id as input and returns the user details by taking the user information from XML document using DOM parser or SAX parser.

Experiment-6:
Develop and demonstrate PHP Script for the following problems: a) Write a PHP Script to find out the Sum of the Individual Digits. b) Write a PHP Script to check whether the given number is Palindrome or not

Experiment-7:
Implement the following in CSS a) Implementation of 'get' and 'post' methods. b) Implementation in colors, boarder padding. c) Implementation button frames tables, navigation bars.

Experiment-8:
Implement the web applications with Database using a) PHP, b) Servlets and c) JSP.

Experiment-9:
Write a program to design a simple calculator using a) JavaScript b) PHP c) Servlet and d) JSP.

Experiment-10:
Create registration and login forms with validations using Jscript query.

Experiment-11:
Jscript to retrieve student information from student database using database connectivity.

Experiment-12:
Implement the following in React JS a) Using React Js creating constructs data elements. b) Using React Js implementations DoM.

Experiment-13:
Implement the following in Angular JS a) Angular Js data binding. b) Angular JS directives and Events. c) Using angular Js fetching data from MySQL.

Experiment-14:
Develop and demonstrate Invoking data using Jscript from Mongo DB.

Experiment-15:
Create an Online fee payment form using JSCript and MangoDB.

Text Books:
1. Pro Mean Stack Development, ELadElrom, Apress.
2. Restful Web Services Cookbook, SubbuAllamraju, O'Reilly.
3. JavaScript & jQuery the missing manual, David sawyer mcfarland, O'Reilly.

Reference Books:
1. Ruby on Rails up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, Oreilly (2006).
2. Programming Perl, 4ed, Tom Christiansen, Jonathan Orwant, Oreilly (2012).
3. Web Technologies, HTML, Java Script, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
4. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage.

Web Links:
1. http://www.stars.com/Authoring/Style/Sheets/
2. http://webreference.com/programming/javascript.html>
3. http://jaring.nmhu.edu/notes/javascrp.htm>
4. http://www.webpedia.com/tech/js/tutor/events.html>
5. www.webreference.com
6. www.webdeveloper.com

MINI PROJECT WITH SEMINAR

Semester: II   **L   T   P   C**
Course code: 232CS1P01   **0   0   4   2**

Course Outcomes: At the end of the Course, Student will be able to:

CO 1:	Understand of contemporary / emerging technology for various processes and systems.
CO 2:	Share knowledge effectively in oral and written form and formulate documents.

Syllabus Contents
The students are required to search / gather the material / information on a specific a topic comprehend it and present / discuss in the class.

ENGLISH FOR RESEARCH PAPER WRITING
(Common to all branches)

		L	T	P	C
Semester: I or II		**L**	**T**	**P**	**C**
Course code: 232MC1A01 or 232MC2A01		**2**	**0**	**0**	**0**

Course Objectives:

COB 1:	Understand how to improve the writing skills and level of readability.
COB 2:	Illustrate what to write in each section.
COB 3:	Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission.

Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction.

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Skills are needed when skills are needed when Conclusions. writing the Methods, skills needed when writing the Results, writing the Discussion, skills are needed when writing the conclusions.

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

Text Books:
1. Gold bort R (2006) Writing for Science, Yale University Press (available on Google Books).
2. Day r (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.
3. High man N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. High man's book.
4. Adrian Wall work, English for Writing Research Papers, Springer New York Dordrech Heidelberg London, 2011.

DISASTER MANAGEMENT
(Common to all branches)

		L	T	P	C
Semester: I or II		2	0	0	0
Course code: 232MC1A02 or 232MC2A02					

Course Objectives:

COB 1:	Demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
COB 2:	Evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
COB 3:	Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
COB 4:	Understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Introduction:
Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Repercussions of Disasters and Hazards:
Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem.
Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, DroughtsAnd Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Disaster Prone Areas in India:
Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.

Disaster Preparedness and Management:
Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Risk Assessment:
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Disaster Mitigation:
Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

Text Books:
1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies" New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.)," Disaster Mitigation Experiences And Reflections",Prentice Hall Of India, New Delhi.
3. Goel S. L., "Disaster Administration And Management Text And Case Studies",Deep & Deep Publication Pvt. Ltd., New Delhi.

SANSKRIT FOR TECHNICAL KNOWLEDGE
(Common to all branches)

Semester: I or II   **L   T   P   C**
Course code: 232MC1A03 or 232MC2A03   **2   0   0   0**

Course Objectives:

COB 1:	Knowledge in illustrious Sanskrit, the scientific language in the world.
COB 2:	Improve brain functioning.
COB 3:	Develop the logic in mathematics, science & other subjects enhancing the memory power.
COB 4:	Explore the huge knowledge from ancient literature.

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Order, Introduction of roots, Technical information about Sanskrit Literature.

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics.

Text Books:
1. "Abhyas pustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi.
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication.
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., NewDelhi.

VALUE EDUCATION
(Common to all branches)

		L	T	P	C
Semester: I or II		2	0	0	0
Course code: 232MC1A04 or 232MC2A04					

Course Objectives:

COB 1:	Understand value of education and self- development.
COB 2:	Explain the need of good values in students.
COB 3:	Developing the overall personality.
COB 4:	Explain the need of character in a student.

Values and self-development: Social values and individual attitudes. Work ethics, Indian vision of humanism, Moral and non- moral valuation. Standards and principles, Value judgments.

Importance of cultivation of values: Sense of duty, Devotion, Self-reliance, Confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism. Love for nature, Discipline.

Personality and Behavior Development: Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship.
Happiness Vs suffering, love for truth, Aware of self- destructive habits, Association and Cooperation, Doing best for saving nature.

Character and Competence: Holy books vs Blind faith, Self-management and Good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively.

Text Books:
1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.

CONSTITUTION OF INDIA
(Common to all branches)

		L	T	P	C
Semester: I or II		2	0	0	0
Course code: 232MC1A05 or 232MC2A05					

Course Objectives:

COB 1:	Describe the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
COB 2:	Explain the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
COB 3:	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
COB 4:	Demonstrate the passage of the Hindu Code Bill of 1956.

History of Making of the Indian Constitution: History.Drafting Committee, (Composition & Working).

Philosophy of the Indian Constitution:
Preamble Salient Features.

Contours of Constitutional Rights & Duties:
Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Organs of Governance:
Parliament Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

Local Administration:
District's Administration head: Role and Importance,
Municipalities: Introduction, Mayor and role of Elected Representative, CE of Municipal Corporation.
Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles.
CEO Zila Pachayat: Position and role.
Block level: Organizational Hierarchy (Different departments),
Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Election Commission:
Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners.
State Election Commission: Role and Functioning, Institute and Bodies for the welfare of

SC/ST/OBC and women.

Text Books:
1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015

PEDAGOGY STUDIES
(Common to all branches)

		L	T	P	C
Semester: I or II		**2**	**0**	**0**	**0**
Course code: 232MC1A06 or 232MC2A06					

Course Objectives:

COB 1:	Distinguish the various pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
COB 2:	Explain the evidence on the effectiveness of various kinds of pedagogical practices, in different conditions.
COB 3:	Discuss the teacher's attitudes and beliefs in line with pedagogic strategies.
COB 4:	Prepare school curriculum and guidance material best support effective pedagogy.
COB 5:	List the research gaps.

Introduction and Methodology:
Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions, Overview of methodology and Searching.

Thematic overview:
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education.

Evidence on the effectiveness of pedagogical practices:
Methodology for the in depth stage: quality assessment of included studies, How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change, Strength and nature of the body of evidence for effective pedagogical practices, Pedagogic theory and pedagogical approaches, Teachers" attitudes and beliefs and Pedagogic strategies.

Professional development:
Alignment with classroom practices and follow-up support.Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Research gaps and future directions:
Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Text Books:
1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools,Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance ofevaluation, Journal of Curriculum Studies, 36 (3): 361-379.

3. A kyeampong K (2003) Teacher training in Ghana - does it count? Multi-siteteacher education research project (MUSTER) country report 1. London: DFID.

4. A kyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching andlearning of basic Maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

5. Alexander RJ (2001) Culture and pedagogy: International comparisons inprimary education. Oxford and Boston: Blackwell.

6. Chavan M (2003) Read India: A mass scale, rapid, learning to read campaign.

Web Link:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.

STRESS MANAGEMENT BY YOGA
(Common to all branches)

		L	T	P	C
Semester: I or II		2	0	0	0
Course code: 232MC1A07 or 232MC2A07					

Course Objectives:

COB 1:	Develop healthy mind in a healthy body to improve social health.

Definitions of Eight parts of yoga. (Ashtanga):
Yam and Niyam. Do`s and Dont's in life:
i)   Ahinsa, satya, astheya, bramhacharya and aparigraha.
ii) Shaucha, santosh, tapa, swadhyay, is hwarpranidhan.

Asan and Pranayam:
1. Various yog poses and their benefits for mind & body.
2. Regularization of breathing techniques and its effects-Types of pranayama.

Text Books:
1. "Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yoga bhyasi Mandal,Nagpur.
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda,Advaita Ashrama (Publication Department), Kolkata.

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(Common to all branches)

		L	T	P	C
Semester: I or II		**2**	**0**	**0**	**0**
Course code: 232MC1A08 or 232MC2A08					

Course Objectives:

COB 1:	Develop his/her personality and achieve the highest goal in life.
COB 2:	Capable of lead the nation and mankind to peace and prosperity.
COB 3:	Develop versatile personality of students.

Neetisatakam-Holistic development of personality
Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue), Verses- 52,53,59 (dont's), Verses- 71,73,75,78 (do's).

Approach to day to day work and duties, Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.

Statements of basic knowledge, Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68, Chapter 12 -Verses 13, 14, 15, 16,17, 18, Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39, Chapter18 – Verses 37,38,63.

Text Books:
1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.