Dept of Computer Science & Engineering
University College of Engineering, JNT University Kakinada

STRUCTURE

and

DETAILED SYLLABUS

for

Two Year PG Programme

in

M. Tech.
(Computer Science and Engineering)

(Applicable for batches admitted from A.Y. 2019 - 20)

Dept of Computer Science & Engineering
University College of Engineering, JNT University Kakinada

VISION OF THE INSTITUTE

To be a premier institute of excellence developing highly talented holistic human capital that contributes to the nation through leadership in technology and innovation through engineering education.

MISSION OF THE INSTITUTE

1. To impart Personnel Skills and Ethical Values for Sustainable Development of the Nation.
2. To create Research & Industry oriented centers of excellence in all engineering disciplines.
3. To be a renowned IPR generator and repository for innovative technologies.
4. To develop Research and Industry oriented technical talent
5. To benchmark globally the academic & research output.

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VISION OF THE DEPARTMENT

Department of Computer Science and Engineering strives rigorously to impart intellectual environment with global standards that fosters the search for new knowledge in a highly dynamic computing-centric society through research & applied efforts.

MISSION OF THE DEPARTMENT

- To provide quality education in both theoretical and applied foundations of computer science and train the students to solve the real world problems effectively thus enhancing their potential for high quality careers.
- To facilitate the students and faculty to inculcate the research culture to advance the state art of computer science and integrate research innovations in multi- disciplinary fields.
- To equip student / faculty with excellent teaching learning capabilities through advanced learning tools and technologies.
- To produce students with critical thinking and lifelong learning capabilities to apply their knowledge to uplift the living standards of the society.
- To produce students with enriched skill set, professional behavior, strong ethical values and leadership capabilities so as to work with commitment for the progress of the nation.

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Programme Education Objectives (PEOs)

After completion of M.Tech (CSE) course students will become

Programme Educational Objectives

PEO 1 Have successful careers in consulting firms, government, academic institutions, NGOs and Research and Development organization.

PEO 2 Sustained learner to bring out creative and innovative ideas by addressing the research issues/to serve as faculty for engineering education.

PEO 3 Entrepreneurs in Computer Science acquainted with interpersonal, managerial skills to make them successful in multidisciplinary fields.

Mapping of Mission Statements to PEOs:

Key components from Department Mission	PEO 1	PEO 2	PEO 3
Quality education	High	Medium	Medium
Research	Medium	High	Low
Teaching-Learning	Medium	High	Medium
Sustained Learning	High	High	Medium
Social Responsibility with Ethics	High	Medium	High

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Programme Outcomes (POs)

After completion of M.Tech (CSE) course students will attain the following programme outcomes

Programme Outcomes

PO 1 Acquire in-depth knowledge of core discipline such as Algorithms and data structures, databases, networking, mobile applications and security.

PO 2 Analyze and synthesis the complex computer science engineering problems with their sound applied knowledge and critical thinking.

PO 3 Solve and arrive at optimal solutions for societal and environmental problems with core expertise and lateral thinking.

PO 4 Develop higher order research skills and innovative ideas to solve unknown problems through the application of appropriate research methodologies, techniques and tools.

PO 5 Learn and Work in competing open ended environment with modern engineering and IT tools.

PO 6 Obtain knowledge in cutting edge technologies to contribute positively towards collaborative multidisciplinary scientific research.

PO 7 Acquire leadership skills and project management techniques to manage projects efficiently to work in teams.

PO 8 Present their knowledge and ideas effectively in any technical forum through the effective design of documents and reports.

PO 9 Engage in lifelong learning independently with commitment to acquire knowledge of contemporary issues to meet the challenges in career.

PO 10 Realize professional and ethical responsibility and act in accordance to social welfare.

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PO 11 Examine mistakes critically and learn to make corrective measures by self-assessment.

Programme Specific Outcomes (PSOs)

Programme Specific Objectives

PSO 1 Analyze software products, processes in a systematic way by applying problem solving skills and employable in product oriented Industry.

PSO 2 Exhibit attitude for continuous learning and deliver proactive solutions for futuristic challenges.

PSO 3 Ability to take up higher studies, Research & Development and Entrepreneurships in the modern computing environment.

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REVISED Bloom's Taxonomy Action Verbs

REVISED Bloom's Taxonomy Action Verbs

Definitions	I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Bloom's Definition	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.
Verbs	• Choose • Define • Find • How • Label • List • Match • Name • Omit • Recall • Relate • Select • Show • Spell • Tell • What • When • Where • Which • Who • Why	• Classify • Compare • Contrast • Demonstrate • Explain • Extend • Illustrate • Infer • Interpret • Outline • Relate • Rephrase • Show • Summarize • Translate	• Apply • Build • Choose • Construct • Develop • Experiment with • Identify • Interview • Make use of • Model • Organize • Plan • Select • Solve • Utilize	• Analyze • Assume • Categorize • Classify • Compare • Conclusion • Contrast • Discover • Dissect • Distinguish • Divide • Examine • Function • Inference • Inspect • List • Motive • Relationships • Simplify • Survey • Take part in • Test for • Theme	• Agree • Appraise • Assess • Award • Choose • Compare • Conclude • Criteria • Criticize • Decide • Deduct • Defend • Determine • Disprove • Estimate • Evaluate • Explain • Importance • Influence • Interpret • Judge • Justify • Mark • Measure • Opinion • Perceive • Prioritize • Prove • Rate • Recommend • Rule on • Select • Support • Value	• Adapt • Build • Change • Choose • Combine • Compile • Compose • Construct • Create • Delete • Design • Develop • Discuss • Elaborate • Estimate • Formulate • Happen • Imagine • Improve • Invent • Make up • Maximize • Minimize • Modify • Original • Originate • Plan • Predict • Propose • Solution • Solve • Suppose • Test • Theory

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M. Tech. (CSE) I SEMESTER							
S.No	**Course Code**	**Courses**	**Category**	**L**	**T**	**P**	**C**
1	R19MCS1151	**Program Core-1** Mathematical Foundations of Computer Science	PC	3	0	0	3
2	R19MCS1152	**Program Core-2** Advanced Data Structures & Algorithms	PC	3	0	0	3
3	R19MCS1153	**Program Elective-1** 1. Big Data Analytics 2. Digital Image Processing 3. Advanced Operating Systems	PE	3	0	0	3
4	R19MCS1154	**Program Elective-2** 1. Advanced Computer Networks 2. Internet of Things 3. Object Oriented Software Engineering	PE	3	0	0	3
5	R19MCS1155	**Research Methodology and IPR**	CC			0	2
6	R19MCS1156	**Laboratory-1** Advanced Data Structures & Algorithms Lab	LB	0	0	4	2
7	R19MCS1157	**Laboartory-2** Advanced Computing Lab	LB	0	0	4	2
8	R19MCS1158	**Audit Course-1** 1. English for Research Paper Writing 2. Disaster Management 3. Sanskrit for Technical Knowledge 4. Value Education	AC	2	0	0	0
Total Credits							18

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M. Tech. (CSE) II SEMESTER							
S.No	**Course Code**	**Courses**	**Category**	**L**	**T**	**P**	**C**
1	R19MCS1251	**Program Core-3** Machine learning	PC	3	0	0	3
2	R19MCS1252	**Program Core-4** MEAN Stack Technologies	PC	3	0	0	3
3	R19MCS1253	**Program Elective-3** 1. Advanced Databases and Mining 2. Ad Hoc & Sensor Networks 3. Soft Computing	PE	3	0	0	3
4	R19MCS1254	**Program Elective-4** 1. Cloud Computing 2. Principles of computer security 3. High Performance Computing	PE	3	0	0	3
5	R19MCS1255	**Laboratory-3** Machine Learning with python lab	LB	0	0	4	2
6	R19MCS1256	**Laboartory-4** MEAN Stack Technologies Lab	LB	0	0	4	2
7	R19MCS1257	**Mini Project with Seminar**	MP	2	0	0	2
8	R19MCS1258	**Audit Course-2** 1. Constitution of India 2. Pedagogy Studies 3. Stress Management by Yoga 4. Personality Development through Life Enlightenment Skills	AC	2	0	0	0
Total Credits							18

**Students are encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break*

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M. Tech. (CSE) III SEMESTER							
S.No	**Course Code**	**Courses**	**Category**	**L**	**T**	**P**	**C**
1	R19MCS2351	**Program Elective-5** 1. Deep Learning 2. Social Network Analysis 3. MOOCs-1 (NPTEL/SWAYAM)	PE	3	0	0	3
2	R19MCS2352	**Open Elective** 1. MOOCs-2 (NPTEL/SWAYAM)-Any 12 Week Course on Engineering/ Management/ Mathematics offered by other than parent department 2. Course offered by other departments in the college	OE	3	0	0	3
3	R19MCS2353	**Dissertation-I/ Industrial Project**	PJ	0	0	20	10
Total Credits							16

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

M. Tech. (CSE) IV SEMESTER							
S.No	**Course Code**	**Courses**	**Category**	**L**	**T**	**P**	**C**
1	R19MCS2451	**Dissertation-II**	PJ	0	0	32	16
Total Credits							16

Open Electives offered by the Department of CSE

1. Python Programming
2. Principles of Cyber Security
3. Internet of Things
4. Artificial Intelligence and Machine Learning

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M.Tech (CSE)-I Semester

Mathematical Foundations of Computer Science

Code: R19MCS1151

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

- To understand the mathematical fundamentals that is prerequisites for variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems bioinformatics, Machine learning.
- To develop the understanding of the mathematical and logical basis to many modern techniques in computer science technology like machine learning, programming language design, and concurrency.
- To study various sampling and classification problems.

Course Outcomes:

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	To apply the basic rules and theorems of probability theory such as Baye's Theorem, to determine probabilities that help to solve engineering problems and to determine the expectation and variance of a random variable from its distribution.	K3
CO2	Able to perform and analyze of sampling, means, proportions, variances and estimates the maximum likelihood based on population parameters.	K4
CO3	To learn how to formulate and test hypotheses about sample means, variances and proportions and to draw conclusions based on the results of statistical tests.	K6
CO4	Design various ciphers using number theory.	K6
CO5	Apply graph theory for real time problems like network routing problem.	K3

 # based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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).

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Text Books:

1. Foundation Mathematics for Computer Science,1st edition, John Vince, Springer,2015
2. Probability & Statistics, 3rd Edition, Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan, Schaum's Outline Series, Tata McGraw-Hill Publishers, 2018
3. Probability and Statistics with Reliability,2nd edition, K. Trivedi, Wiley, 2011
4. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, H. Rosen, Tata McGraw Hill, 2003

Reference Books:

1. Probability and Computing: Randomized Algorithms and Probabilistic Analysis,1st edition, M. Mitzenmacher and E. Upfal,2005
2. Applied Combinatorics,6th edition, Alan Tucker, Wiley,2012

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M.Tech (CSE)-I Semester

Advanced Data Structures & Algorithms

Code: R19MCS1152

Course Objectives: From the course the student will learn

- Single Linked, Double Linked Lists, Stacks, Queues, Searching and Sorting techniques, Trees, Binary trees, representation, traversal, Graphs- storage, traversal.
- Dictionaries, ADT for List, Stack, Queue, Hash table representation, Hash functions, Priority queues, Priority queues using heaps, Search trees.
- AVL trees, operations of AVL trees, Red- Black trees, Splay trees, comparison of search trees.

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Ability to write and analyze algorithms for algorithm correctness and efficiency	K4
CO2	Master a variety of advanced abstract data type (ADT) and data structures and their Implementation	K3
CO3	Demonstrate various searching, sorting and hash techniques and be able to apply and solve problems of real life	K2
CO4	Design and implement variety of data structures including linked lists, binary trees, heaps, graphs and search trees	K6
CO5	Ability to compare various search trees and find solutions for IT related problems	K5

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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

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

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

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

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

Text Books:

1. Data Structures: A Pseudo Code Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon and Cengage,2005
2. Data Structures, Algorithms and Applications in java, 2/e, SartajSahni, University Press,2005

Reference Books:

1. Data Structures and Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson.
2. Data Structures and Algorithms, 3/e, Adam Drozdek, Cengage,2008
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

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Big Data Analytics

Code: R19MCS1153

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

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

Course Outcomes:

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Illustrate on big data and its use cases from selected business domains.	K2
CO2	Interpret and summarize on No SQL, Cassandra	K2
CO3	Analyze the HADOOP and Map Reduce technologies associated with big data analytics and explore on Big Data applications Using Hive.	K4
CO4	Make use of Apache Spark, RDDs etc. to work with datasets.	K3
CO5	Assess real time processing with Spark Streaming.	K5

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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

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

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

UNIT IV: Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Data frames ,RDD to Data frames, Catalyst optimizer, Data Frame Transformations, Working with Dates and Timestamps, Working with Nulls in Data, Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers-Standalone Mode, Spark on YARN , Spark Logs, The Spark UI- Spark UI History Server, Debugging and Spark First Aid

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

Text Books:

1. Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj, 1st edition ,2013
2. SPARK: The Definitive Guide, Bill Chambers &MateiZaharia, O'Reilley, 2018-first Edition.
3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, First edition 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:

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

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M.Tech (CSE)-I Semester

Digital Image Processing

Code: R19MCS1153

Course Objectives:

- Describe and explain basic principles of digital image processing.
- Design and implement algorithms that perform basic image processing (e.g. noise removal and image enhancement).
- Design and implement algorithms for advanced image analysis (e.g. image compression, image segmentation).
- Assess the performance of image processing algorithms and systems.

Course Outcomes:

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Demonstrate the components of image processing	K2
CO2	Explain various filtration techniques.	K5
CO3	Apply image compression techniques.	K3
CO4	Discuss the concepts of wavelet transforms.	K6
CO5	Analyze the concept of morphological image processing.	K4

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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.

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

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

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

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

Text Books:

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

Reference Books:

1. Digital Image Processing. John Wiley, Pratt, W. K, Fourth Edition-2001
2. Digital Image Processing, Jayaraman, S., Veerakumar, T. and Esakkiranjan, S.,Tata McGraw-Hill,Edition-3,2009

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M.Tech (CSE)-I Semester

Advanced Operating Systems

Code: R19MCS1153

- **Course Objectives:** This course is aimed at enabling the students to provide comprehensive and up-to-date coverage of the major developments in distributed Operating System, Multi-processor Operating System and to cover important theoretical foundations including Process Synchronization, Concurrency, Event ordering, Mutual Exclusion, Deadlock.

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Illustrate on the fundamental concepts of operating systems, its architecture and process management.	K2
CO2	Analyses on memory management concepts including page replacement algorithms.	K4
CO3	Elaborate on Process synchronisation mechanisms and deadlocks in operating systems.	K6
CO4	Make use of Distributed systems for implementing synchronisation.	K3
CO5	Apply protection and security in operating systems.	K3

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT-I:
Overview of Operating systems: Introduction, Operating system services, System calls, Types of operating systems. **Process Management:** Process Concepts, Process states, process control block, process scheduling, Operations on processes, Scheduling Algorithms.

UNIT-II:
Memory management concepts: Swapping, Contiguous memory allocation, Paging, Segmentation, Virtual memory, Demand Paging, Page-replacement Algorithms, Thrashing.

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UNIT-III

Process Synchronization: Critical section problem, Semaphores, Readers-Writers problem. **Deadlocks:** System model, Deadlocks Characterization, Methods for handling deadlocks, Deadlock prevention, Avoidance, Detection and Recovery from Deadlocks.

UNIT-IV

Operating System Support in Distributed Systems : Introduction , Operating System layer, Role of protection processes and address space. **Distributed Systems and Synchronization:** Clock Synchronization, logical clocks, mutual exclusion, Data-Centric Consistency Models, Client-Centric Consistency Models, Consistency Protocols, Ricart-Agarwala Algorithm, Maekawa Algorithm.

UNIT- V

File systems and protection: The concept of file, Access methods, Directory structure, File system structure, File system implementation, File sharing, Protection, Directory implementation, Allocation methods, Free space management. Case studies of Android, and iOS.

Text Books:

1. Operating System Concepts, 8th edition, Silberschatz and Galvin, john Wiley,2009.
2. Distributed Systems, 2nd edition, Andrew S. Tanenbaum, Maarten Vanteen,2007.

Reference Books:

1. Advanced Concepts in Operating Systems, Indian edition,Singhal, M and Shivaratri, N.. Tata McGraw Hill,2001.
2. Distributed computing: Principles, Algorithms, and systems,1st edition,Kskhemkalyani, A and SinghalM Cambridge university press,2008.

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M.Tech (CSE)-I Semester

ADVANCED COMPUTER NETWORKS

Code: R19MCS1154

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

- The course is aimed at providing basic understanding of Computer networks starting with OSI Reference Model, Protocols at different layers with special emphasis on IP, TCP & UDP and Routing algorithms.
- Some of the major topics which are included in this course are CSMA/CD, TCP/IP implementation, LANs/WANs, internetworking technologies, Routing and Addressing.
- Provide the mathematical background of routing protocols.
- Aim of this course is to develop some familiarity with current research problems and research methods in advance computer networks.

Course Outcomes:

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Illustrate reference models with layers, protocols and interfaces.	K2
CO2	Describe the routing algorithms, Sub netting and Addressing of IP V4and IPV6.	K4
CO3	Describe and Analysis of basic protocols of computer networks, and how they can be used to assist in network design and implementation.	K3
CO4	Describe the concepts Wireless LANS, WIMAX, IEEE 802.11, Cellular telephony and Satellite networks	K6
CO5	Describe the emerging trends in networks-MANETS and WSN	K2

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

Unit-I:**Network layer:** Network Layer design issues: store-and forward packet

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

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

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

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

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

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Text Books:

1. Data communications and networking 4th edition Behrouz A Fourzan,TMH-2007
2. Computer networks 4th edition Andrew S Tanenbaum, Pearson,2012
3. Computer networks, Mayank Dave,CENGAGE, First edition.2012

Reference Books:

1. Computer networks, A system Approach, 5thed, Larry L Peterson and Bruce S Davie, Elsevier-2012

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M.Tech (CSE)-I Semester

Internet of Things

Code: R19MCS1154

Course Objectives:

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

Course Outcomes:

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Summarize on the term 'internet of things' in different contexts.	K2
CO2	Analyze various protocols for IoT.	K4
CO3	Design a PoC of an IoT system using Rasperry Pi/Arduino	K6
CO4	Apply data analytics and use cloud offerings related to IoT.	K3
CO5	Analyze applications of IoT in real time scenario	K4

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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

UNIT II: IoT PROTOCOLS: IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and

Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.

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

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

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

Text Books:

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

Reference Books:

1. Internet of Things – A hands-on approach, ArshdeepBahga, Vijay Madisetti, Universities Press, First Edition-2015
2. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2nd Edition-2012 (for Unit 2).
3. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 1st edition 2014.
4. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.
5. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O'Reilly Media, 2011.

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M.Tech (CSE)-I Semester

Object Oriented Software Engineering

Code: R19MCS1154

Course Objectives:

- To elicit, analyze and specify software requirements through a productive working relationship with various stakeholders of the project.
- To understand the what software life cycle is, how software projects are planned and managed, types of resources involved in software development projects, risks are identified and assessed, predictions and assessments are made.
- To identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements

Course Outcomes:

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Apply the Object Oriented Software-Development Process to design software	K3
CO2	Analyze and Specify software requirements through a SRS documents.	K4
CO3	Design and Plan software solutions to problems using an object-oriented strategy.	K6
CO4	Model the object oriented software systems using Unified Modeling Language (UML)	K3
CO5	Estimate the cost of constructing object oriented software.	K6

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT I: Introduction to Software Engineering: Software, Software Crisis, Software Engineering definition, Evolution of Software Engineering

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Methodologies, Software Engineering Challenges. Software Processes: Software Process, Process Classification, Phased development life cycle, Software Development Process Models, Process, use, applicability and Advantages/limitations.

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

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

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

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

Text Books:

1. Object oriented and Classical Software Engineering, 7/e, Stephen R. Schach, TMH,2007
2. Object oriented and Classical Software Engineering, Timothy Lethbridge, Robert Laganiere, TMH-first Edition-2001
3. Software Engineering by Roger S Pressman, Tata McGraw Hill Edition,6th Edition-2001

Reference Books:

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

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M.Tech (CSE)-I Semester

Research Methodology and IPR

Code: R19MCS1155

Course Objectives:

- The course has been developed with orientation towards research related activities and recognizing the ensuing knowledge as property.
- It will create consciousness for Intellectual Property Rights and its constituents.
- Learners will be able to perform documentation and administrative procedures relating to IPR in India as well as abroad.

Course Outcomes:

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Understand research problem formulation.	K3
CO2	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.	K4
CO3	Understanding 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.	K3
CO4	Analyze research related information	K6
CO5	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.	K3

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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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.

UNIT III: 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 IV: 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 V: Patent Rights: Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Geographical Indications.
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. "Research Methodology: An introduction for science engineering students", Stuart Melville and Wayne Goddard
2. "Research Methodology: An Introduction", Wayne Goddard and Stuart Melville
3. "Research Methodology: A Step by Step Guide for beginners", Ranjit Kumar, 2nd Edition
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007

Reference Books:

1. "Industrial Design", Mayall, McGraw Hill, 1992
2. "Product Design", Niebel, McGraw Hill, 1974
3. Intellectual Property in New Technological Age", Robert P. Merges, Peter S. Menell, Mark A. Lemley, 2016

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M.Tech (CSE)-I Semester

Advanced Data Structures & Algorithms Lab

Code: R19MCS1156

Course Objectives:
From the course the student will learn

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

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Identify classes, objects, members of a class and relationships among them needed for a specific problem.	K2
CO2	Examine algorithms performance using Prior analysis and asymptotic notations.	K4
CO3	Organize and apply to solve the complex problems using advanced data structures (like arrays, stacks, queues, linked lists, graphs and trees.)	K3
CO4	Apply and analyze functions of Dictionary	K3

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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

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

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

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

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

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

Experiment 7:
Write a java program for the following using stack
a) Infix to postfix conversion.
b) Expression evaluation.
c) Obtain the binary number for a given decimal number.

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

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

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

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

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

Experiment 13:
Write a java program to perform the following operations:
a) Insertion into a 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

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

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M.Tech (CSE)-I Semester
Advanced Computing Lab
Code: R19MCS1157

Course Objectives:
From the course the student will learn

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

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.	K2
CO2	Development and use of s IoT technology in Societal and Industrial Applications.	K4
CO3	Skills to undertake high quality academic and industrial research in Sensors and IoT.	K3
CO4	To classify Real World IoT Design Constraints, Industrial Automation in IoT.	K3

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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

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

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

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

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

- Transposes the original Amazon food dataset, obtaining a PairRDD of the type<user_id>→ <list of the product_ ids reviewed by user_id>
- Counts the frequencies of all the pairs of products reviewed together.
- Writes on the output folder all the pairs of products that appear more than once and their frequencies. The pairs of products must be sorted by frequency.

Experiment 6:
Write a program to Implement Bankers algorithm for Dead Lock Avoidance.

Experiment 7:
Write a program to Producer-consumer problem Using semaphores.

Experiment 8:
Write a program for an image enhancement using pixel operation.

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

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

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

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

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

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

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

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M.Tech (CSE)-I Semester

English for Research Paper Writing

Code: R19MCS1158

Course Objectives:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title ,Ensure the good quality of
  Paper at very first-time submission

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Understand that how to improve your writing skills and level of readability	K2
CO2	Learn about what to write in each section	K3
CO3	Understand the skills needed when writing a Title	K5

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT – 1: Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

UNIT – 2: Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts Introduction.

UNIT – 3: Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT – 4: 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.

UNIT – 5: Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when 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. How to Write and Publish a Scientific Paper, Day R, Cambridge University Press, (2006).
2. Handbook of Writing for the Mathematical Sciences, Highman N,SIAM.Highman'sbook, (1998)

References:

1. Writing for Science, Goldbort R ,Yale University Press (available on Google Books), (2006)

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M.Tech (CSE)-I Semester
Disaster Management
Code: R19MCS1158

Course Objectives:

- Learn To Demonstrate A Critical Understanding Of Key Concepts In Disaster Risk Reduction And Humanitarian Response.
- Critically Evaluate Disaster Risk Reduction And Humanitarian Response Policy And Practice From Multiple Perspectives.
- Develop An Understanding Of Standards Of Humanitarian Response And Practical Relevance In Specific Types Of Disasters And Conflict Situations.
- Critically Understand The Strengths And Weaknesses Of Disaster Management Approaches,
- Planning And Programming in Different Countries, Particularly Their Home Country or the Countries They Work.

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

CO	Description	Knowledge Level (K)#
CO1	Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.	K2
CO2	Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	K3
CO3	Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	K5
CO4	Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work.	K3

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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UNIT – 1: Introduction Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; **Natural and Manmade Disasters**: Difference, Nature, Types and Magnitude.

UNIT – 2: Repercussions Of Disasters And Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, **Man-made disaster**: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT – 3: 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. **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.

UNIT – 4: 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.

UNIT – 5: 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. "Disaster Management in India: Perspectives, issues and strategies "',R. Nishith, Singh AK, New Royal book Company
2. Disaster Mitigation Experiences And Reflections, Sahni, Pardeep Et.Al. (Eds.)," Prentice Hall Of India, New Delhi.

Reference Books

1. Disaster Administration And Management Text And Case Studies" , Goel S. L. , Deep &Deep Publication Pvt. Ltd., New Delhi

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M.Tech (CSE)-I Semester

Sanskrit for Technical Knowledge

Code: R19MCS1158

Course Objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
- Learning of Sanskrit to improve brain functioning.
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

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

CO	Description	Knowledge Level (K)#
CO1	To get a working knowledge in illustrious Sanskrit, the scientific language in the world	K2
CO2	Learning of Sanskrit to improve brain functioning	K3
CO3	Learning of Sanskrit to develop the logic in mathematics, science & other subjects	K5
CO4	The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature	K3

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT – 1: Alphabets in Sanskrit, Past/Present/Future Tense

UNIT – 2: Simple Sentences forming in Sanskrit

UNIT – 3: Order of Sanskrit sentences, Introduction of roots in Sanskrit language

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UNIT – 4: Technical information about Sanskrit Literature

UNIT – 5: Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Text Books:

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

Reference Books

1. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

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M.Tech (CSE)-I Semester

Value Education

Code: R19MCS1158

Course Objective:

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Knowledge of self-development	K2
CO2	Learn the importance of Human values	K3
CO3	Developing the overall personality	K5

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT – 1: 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.

UNIT – 2: 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.

UNIT – 3: Personality and Behavior Development - Soul and Scientific attitude, Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness. Avoid fault Thinking.

UNIT – 4: 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.

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UNIT – 5: 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. "Values and Ethics for organizations Theory and practice", Chakroborty, S.K, Oxford University Press, New Delhi

Dept of Computer Science & Engineering
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M.Tech (CSE)-II Semester

Machine Learning

Code: R19MCS1251

Course Objectives:

- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
- Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).
- Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).
- Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Explain the definition and usage of the term 'the internet of things' in different contexts.	K2
CO2	Demonstrate on various network protocols used in IoT.	K2
CO3	Analyze on various key wireless technologies used in IoT systems, such as WiFi, 6LoWPAN, Bluetooth and ZigBee.	K4
CO4	Illustrate on the role of big data, cloud computing and data analytics in IoT system.	K5
CO5	Design a simple IoT system made up of sensors, wireless network connection, data analytics and display/actuators, and write the necessary control software.	K6

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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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 Over fitting 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, and 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,1st edition, M.Gopal, McGraw Hill Education,2018
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC) 1st Edition-2014

Reference Books:

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William WHsieh, Cambridge Univ Press. 1 edition (August 31,

2009)
2. Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley &SonsInc., 2nd Edition-2001
3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.
4. Machine Learning by Peter Flach , Cambridge-1st Edition 2012

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M.Tech (CSE)-II Semester

MEAN Stack Technologies

Code: R19MCS1252

Course Objectives:
From the course the student will learn

- Translate user requirements into the overall architecture and implementation of new systems and Manage Project and coordinate with the Client.
- Writing optimized front end code HTML and JavaScript.
- Monitor the performance of web applications & infrastructure and Troubleshooting web application with a fast and accurate a resolution
- Design and implementation of Robust and Scalable Front End Applications.

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

CO	Description	Knowledge Level (K)#
CO1	Identify the Basic Concepts of Web & Markup Languages.	K3
CO2	Develop web Applications using Scripting Languages & Frameworks.	K3
CO3	Make use of Express JS and Node JS frameworks	K3
CO4	Illustrate the uses of web services concepts like restful, react js.	K2
CO5	Adapt to Deployment Techniques & Working with cloud platform.	K6

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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.

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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, ReactDOM, 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-2013
2. Web Technologies, Uttam K Roy, Oxford-2010
3. Pro Mean Stack Development, ELadElrom, Apress 1st edition-2016
4. Restful Web Services Cookbook, SubbuAllamraju, O'Reilly-2010
5. JavaScript &jQuery the missing manual, David sawyer mcfarland, O'Reilly 3rd Edition-2015
6. Web Hosting for Dummies, Peter Pollock, John Wiley Brand-2013

Reference Books:

1. Ruby on Rails up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, Oreilly,1st edition-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 1st edition-2013
4. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning,1st edition-2003
5. Express.JS Guide, The Comprehensive Book on Express.js,AzatMardan, Lean Publishing-2014

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M.Tech (CSE)-II Semester

Advanced Databases and Mining

Code: R19MCS1253

Course Objectives:

- This Subject deals with dealing data in 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.
- This subject provides an introduction to multidisciplinary 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
- The concepts of data clustering includes a different methods of clustering such as k-means, k-mediods, db scan algorithm, role of data mining in web mining.

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Analyze on normalization techniques.	K4
CO2	Elaborate on concurrency control techniques and query optimization.	K6
CO3	Summarize the concepts of data mining, data warehousing and data preprocessing strategies.	K2
CO4	Apply data mining algorithms.	K3
CO5	Assess various classification & cluster techniques.	K5

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT I: Introduction: Concepts and Definitions, Relational models, Data Modeling and Query Languages, Database Objects. **Normalization Techniques:**

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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, RamezElmasri, 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. TamerOzsu 3rd edition-2000
2. Database systems: Design, implementation and Management, C.M. Coronel, S. Morris, P. Rob, Boston: Cengage Learning,9th edition-2011

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M.Tech (CSE)-II Semester

Ad Hoc & Sensor Networks

Code: R19MCS1253

Course Objectives:

- Architect sensor networks for various application setups.
- Devise appropriate data dissemination protocols and model links cost.
- Understandings of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.
- Evaluate the performance of sensor networks and identify bottlenecks

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Explain the Fundamental Concepts and applications of ad hoc and wireless sensor networks	K2
CO2	Discuss the MAC protocol issues of ad hoc networks	K6
CO3	Enumerate the concept of routing protocols for ad hoc wireless networks with respect to TCP design issues	K3
CO4	Analyze & Specify the concepts of network architecture and MAC layer protocol for WSN	K4
CO5	Discuss the WSN routing issues by considering QoS measurements	K6

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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.

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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, 1st edition-2008
3. “Wireless ad -hoc and sensor Networks: theory and applications”, Li, X, Cambridge University Press, fifth edition-2008.

Reference Books:

1. “Ad Hoc & Sensor Networks: Theory and Applications”, 2nd edition, Carlos De MoraisCordeiro, Dharma Prakash Agrawal ,World Scientific Publishing Company, 2011
2. "Wireless Sensor Networks", Feng Zhao and LeonidesGuibas,Elsevier Publication 2nd edition-2004
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”, KazemSohraby, Daniel Minoli, &TaiebZnati, John Wiley, 2007. (soft copy available)

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M.Tech (CSE)-II Semester

Soft Computing

Code: R19MCS1253

Course Objectives:

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

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Elaborate fuzzy logic and reasoning to handle uncertainty in engineering problems.	K6
CO2	Make use of genetic algorithms to combinatorial optimization problems	K3
CO3	Distinguish artificial intelligence techniques, including search heuristics, knowledge representation, planning and reasoning.	K4
CO4	Formulate and apply the principles of self-adopting and self organizing neuro fuzzy inference systems.	K6
CO5	Evaluate and compare solutions by various soft computing approaches for a given problem	K5

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT I: Fuzzy Set Theory: Introduction to Neuro, Fuzzy and Soft Computing, Fuzzy Sets, Basic function and Terminology, Set-theoretic Operations,

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Member Function Formulation and Parameterization, 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 SarojKoushik, Cengage Learning 1st edition-2011
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, , 2nd edition-2006
2. "Fuzzy Logic with Engineering Applications", Timothy J.Ross, McGraw-Hill, 3rd edition-1997

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M.Tech (CSE)-II Semester

Cloud Computing

Code: R19MCS1254

Course Objectives:

- To implement Virtualization
- To implement Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.
- Broadly educate to know the impact of engineering on legal and societal issues involved.

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

Course Outcomes		Knowledge Level (K)#
CO1	Interpret the key dimensions of the challenge of Cloud Computing	**K2**
CO2	Examine the economics, financial, and technological implications for selecting cloud computing for own organization.	**K4**
CO3	Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications	**K5**
CO4	Evaluate own organizations' needs for capacity building and training in cloud computing-related IT areas.	**K5**
CO5	To Illustrate Virtualization for Data-Center Automation.	**K2**

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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.

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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 2nd edition-2017
2. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH-2013

Reference book:

1. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH 1st edition-2013

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M.Tech (CSE)-II Semester

Principles of Computer Security

Code: R19MCS1254

Course Objectives:

In the course the student will learn

- This course provides an overview of modern cryptographic theories and techniques, mainly focusing on their application into real systems.
- Topics include Database and Cloud Security, Malicious Software, Denial-of-Service Attacks, Software Security, Operating System Security, Wireless Network Security and mobile device security.

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Describe the key security requirements of confidentiality, integrity, and availability, types of security threats and attacks and summarize the functional requirements for computer security.	K4
CO2	Explain the basic operation of symmetric block encryption algorithms, use of secure hash functions for message authentication, digital signature mechanism	K5
CO3	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	K2
CO4	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	K4
CO5	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.	K5

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

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(Please fill the above with Levels of Correlation, viz., L, M, H)

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 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security.

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Text Book:

1. Computer Security: Principles and Practices, 3e, William Stallings, Lawrie Brown, Pearson,3rd edition-2014

Reference book:

1. Network Security Essentials, Principles and Practices, William Stallings, Pearson,6th edition-2018

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M.Tech (CSE)-II Semester

High Performance Computing

Code: R19MCS1254

Course Objectives:

The objective of the subject is to

- Introduce the basic concepts related to HPC architecture and parallel computing.
- To discuss various computational techniques for studying soft matter systems.
- To apply these concepts to examine complex bimolecular/materials systems that generally require large-scale HPC platform with hybrid CPU-GPU architectures.

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Design, formulate, solve and implement high performance versions of standard single threaded algorithms.	K6
CO2	Demonstrate the architectural features in the GPU and MIC hardware accelerators.	K2
CO3	Design programs to extract maximum performance in a multicore, shared memory execution environment processor.	K6
CO4	Analyze Symmetric and Distributed architectures.	K4
CO5	Develop and deploy large scale parallel programs on tightly coupled parallel systems using the message passing paradigm.	K6

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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

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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

Reference books:

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

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M.Tech (CSE)-II Semester

Machine Learning with Python Lab

Code: R19MCS1255

Course Objectives:

This course will enable students to

- To learn and understand different Data sets in implementing the machine learning algorithms.
- Implement the machine learning concepts and algorithms in any suitable language of choice.

Course Outcomes(COs): At the end of the course, student will be able to

Course Outcomes		Knowledge Level (K)#
CO1	Implement procedures for the machine learning algorithms	**K4**
CO2	Design Python programs for various Learning algorithms	**K6**
CO3	Apply appropriate data sets to the Machine Learning algorithms	**K3**
CO4	Identify and apply Machine Learning algorithms to solve real world problems	**K2**

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											

(Please fill the above with Levels of Correlation, viz., L, M, H)

Experiment-1:

Exercises to solve the real-world problems using the following machine learning methods:

a) Linear Regression

b) Logistic Regression.

Experiment-2:

Write a program to Implement Support Vector Machines.

Experiment-3:

Exploratory Data Analysis for Classification using Pandas and Matplotlib.

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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.

Experiment-12:
Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Experiment-13:
For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

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Experiment-14:
Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

Experiment-15:
Solve optimal relay coordination as a linear programming problem using Genetic Algorithm.

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M.Tech (CSE)-II Semester

MEAN Stack Technologies Lab

Code: R19MCS1256

Course Objectives:

From the course the student will

- Learn the core concepts of both the frontend and backend programming course.
- Get familiar with the latest web development technologies.
- Learn all about SQL and Mongo databases.
- Learn complete web development process.

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

CO	Description	Knowledge Level (K)#
CO1	Identify the Basic Concepts of Web & Markup Languages.	K3
CO2	Develop web Applications using Scripting Languages & Frameworks.	K3
CO3	Creating & Running Applications using JSP libraries.	K6
CO4	Creating Our First Controller Working with and Displaying in Angular Js and Nested Forms with ng-form.	K2
CO5	Working with the Files in React JS and Constructing Elements with Data.	K6

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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

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Experiment-2:
Write an 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.

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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.

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M.Tech (CSE)-II Semester

Constitution of India

Code: R19MCS1258

Course Objectives:

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	K6
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	K6
CO3	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.	K6
CO4	Discuss the passage of the Hindu Code Bill of1956.	K6

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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UNIT – I: History of Making of the Indian Constitution: History, Drafting Committee, (Composition& Working), **Philosophy of the Indian Constitution:** Preamble, Salient, Features.

UNIT – II: 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.

UNIT – III: 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.

UNIT – IV: 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.

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

TEXT BOOKS:

1. The Constitution of India, 1950 (Bare Act), Government Publication
2. Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, Dr. S. N. Busi, 2015

REFERENCES:

1. Indian Constitution Law, 7th Edn. M. P. Jain, Lexis Nexis, 2014.
2. Introduction to the Constitution of India, Lexis Nexis, D.D. Basu, 2015.

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M.Tech (CSE)-II Semester

Pedagogy Studies

Code: R19MCS1258

Course Objectives:

Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?	K1
CO2	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?	K1
CO3	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?	K1

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT – I: 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.

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

UNIT – III: 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. Teacher's attitudes and beliefs and Pedagogic strategies.

UNIT – IV: 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

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

Text Books:

1. Classroom interaction in Kenyan primary schools, Ackers J, Hardman F Compare, 31 (2): 245-261,2001
2. Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, Agrawal M, 36 (3):361-379, 2004
3. Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID, Akyeampong K,2003

Reference books:

1. Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3):272–282, Akyeampong K, Lussier K, Pryor J and Westbrook J ,2013
2. Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell, Alexander RJ,2001

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M.Tech (CSE)-II Semester

Stress Management by Yoga

Code: R19MCS1258

Course Objectives:

- To achieve overall health of body and mind
- To overcome stress

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Develop healthy mind in a healthy body thus improving social health also	K4
CO2	Improve efficiency	K2
CO3	achieve overall health of body	K3
CO4	Overcome stress and to maintain peace of mind	K5

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT – I: Definitions of Eight parts of yoga. (Ashtanga).

UNIT – II: Yam and Niyam. Do`s and Don'ts in life.

UNIT – III: Ahinsa, satya, astheya, bramhacharya and aparigrahaShaucha, santosh, tapa, swadhyay,ishwarpranidhan.

UNIT –IV: Asan and Pranayam, Various yoga poses and their benefits for mind &body.

UNIT –V: Regularization of breathing techniques and its effects-Types of pranayam.

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Text Books:

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur

Reference Books:

1. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda,Advaita Ashrama(Publication Department),Kolkata

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M.Tech (CSE)-II Semester

Personality Development through Life Enlightenment Skills

Code: R19MCS1258

Course Objective:

- To learn to achieve the highest goal happily.
- To become a person with stable mind, pleasing personality and determination.
- To awaken wisdom in students.

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life	K2
CO2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity	K3
CO3	Study of Neetishatakam will help in developing versatile personality of students.	K5

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT – I: Neetishatakam-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 (don'ts), Verses- 71,73,75,78 (do's).

UNIT – II: Approach to day to day work and duties. Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47, 48.

UNIT – III: Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5, 13, 17, 23, 35, Chapter 18-Verses 45, 46, 48.

UNIT – IV: Statements of basic knowledge, Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68, Chapter 12 -Verses 13, 14, 15, 16, 17 and 18.

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UNIT – V: Personality of Role model. Shrimad Bhagwad Geeta. Verses 17, Chapter 3-Verses36, 37, 42, Chapter 4-Verses18, 38, 39, Chapter18 – Verses37, 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,

Reference Books:

1. Rashtriya Sanskrit Sansthanam, New Delhi.

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M.Tech (CSE)-III Semester

Deep Learning

Code: R19MCS2351

Course Objectives:
At the end of the course, the students will be expected to:

- Learn deep learning methods for working with sequential data,
- Learn deep recurrent and memory networks,
- Learn deep Turing machines,
- Apply such deep learning mechanisms to various learning problems.
- Know the open issues in deep learning, and have a grasp of the current research directions.

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

CO	Description	Knowledge Level (K)#
CO1	Demonstrate the basic concepts fundamental learning techniques and layers.	K2
CO2	Discuss the Neural Network training, various random models.	K6
CO3	Explain different types of deep learning network models.	K5
CO4	Classify the Probabilistic Neural Networks.	K2
CO5	Implement tools on Deep Learning techniques.	K3

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT I: Introduction: Various paradigms of learning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques. **Feed forward neural network:** Artificial Neural Network, activation function, multi-layer neural network.

UNIT II: Training Neural Network: Risk minimization, loss function, back propagation, regularization, model selection, and optimization.

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Conditional Random Fields: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.

UNIT III: Deep Learning: Deep Feed Forward network, regularizations, training deep models, dropouts, Convolution Neural Network, Recurrent Neural Network, and Deep Belief Network.

UNIT IV: Probabilistic Neural Network: Hopfield Net, Boltzmann machine, RBMs, Sigmoid net, Auto encoders.

UNIT V: Applications: Object recognition, sparse coding, computer vision, natural language processing. **Introduction to Deep Learning Tools:** Caffe, Theano, Torch.

Text Books:

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016..
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 1st edition-2006.

Reference Books:

1. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, first edition-2009.
2. Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,3rd edition-2013.
3. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education, 3rd edition-2004.

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M.Tech (CSE)-III Semester

Social Network Analysis

Code: R19MCS2351

Course Objectives:

- The learning objective of the course Social Network Analysis is to provide students with essential knowledge of network analysis applicable to real world data, with examples from today's most popular social networks.

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Demonstrate social network analysis and measures.	K2
CO2	Analyze random graph models and navigate social networks data	K4
CO3	Apply the network topology and Visualization tools.	K3
CO4	Analyze the experiment with small world models and clustering models.	K4
CO5	Compare the application driven virtual communities from social network Structure.	K5

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT I: Social Network Analysis: Preliminaries and definitions, Erdos Number Project, Centrality measures, Balance and Homophily.

UNIT II: Random graph models: Random graphs and alternative models, Models of network growth, Navigation in social Networks, Cohesive subgroups, Multidimensional Scaling, Structural equivalence, roles and positions.

UNIT III: Network topology and diffusion, Contagion in Networks, Complex contagion, Percolation and information, Navigation in Networks Revisited.

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UNIT IV: Small world experiments, small world models, origins of small world, Heavy tails, Small Diameter, Clustering of connectivity, The ErdosRenyi Model, Clustering Models.

UNIT V: Network structure -Important vertices and page rank algorithm, towards rational dynamics in networks, basics of game theory, Coloring and consensus, biased voting, network formation games, network structure and equilibrium, behavioral experiments, Spatial and agent-based models.

Text Books:

1. S. Wasserman and K. Faust. Social Network Analysis: Methods and Applications (Cambridge, Cambridge University Press, 1994)
2. D. Easley and J. Kleinberg, Networks, Crowds and Markets: Reasoning about a highly connected world-2010

Reference Books:

1. Social Network Analysis: Methods and Applications (Structural Analysis in the Social Sciences)by Stanley Wasserman , Katherine Faust ,1994.

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M.Tech (CSE)-III Semester

MOOCs-1 (NPTEL/SWAYAM)

Code: R19MCS2351

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M.Tech (CSE)-III Semester

Open Elective

Code: R19MCS2352

1. MOOCs-2 (NPTEL/SWAYAM)-Any 12 Week Course on Engineering/ Management/ Mathematics offered by other than parent department.

2. Course offered by other departments in the college.

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M.Tech (CSE)-III Semester

Dissertation-I/Industrial Project

Code: R19MCS2353

Note: *Students going for Industrial Project/Thesis will complete these courses through MOOCs.

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M.Tech (CSE)-III Semester

Dissertation-II

Code: R19MCS2451

Dept of Computer Science & Engineering
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Open Electives offered by the Department of CSE for other Department Students:

1. Python Programming
2. Principles of Cyber Security
3. Internet of Things
4. Artificial Intelligence and Machine Learning.

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M.Tech (CSE)-III Semester

Python Programming

Code: R19MCS2352

Course Objectives:

From the course the student will learn

- To acquire programming skills in core Python.
- To acquire Object Oriented Skills in Python.
- To develop the skill of designing Graphical user Interfaces in Python.
- To develop the ability to write database applications in Python.

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.	K2
CO2	Express proficiency in the handling of strings and functions.	K2
CO3	Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.	K3
CO4	Identify the commonly used operations involving file systems and regular expressions.	K2
CO5	Articulate the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python, NumPy, Pandas	K3

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT I :Parts of Python Programming Language, Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and

Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type() Function and Is Operator, Dynamic and Strongly Typed Language, **Control Flow Statements,** The if Decision Control Flow Statement, The if…else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements, Catching Exceptions Using try and except Statement, **Functions**, Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

UNIT II: Strings, Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings, Lists, Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, The del Statement.

UNIT III: Dictionaries, Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement, Tuples and Sets, Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Tuple Methods, Using zip() Function, Sets, Set Methods, Traversing of Sets, Frozen set.

UNIT IV: Files, Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Python os and os. path Modules, Regular Expression Operations, Using Special Characters, Regular Expression Methods, Named Groups in Python Regular Expressions, Regular Expression with glob Module.

UNIT V: Object-Oriented Programming, Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, The Polymorphism. Numpy with Python, Pandas

Text Books:

1) "Introduction to Python Programming",1st Edition, Gowrishankar S, Veena A, CRC Press/Taylor & Francis,ISBN-13: 978-0815394372,2018
2) Introduction to Programming Using Python by Y Daniel Liang, Pearson Publishers 1st edition-2012

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Reference Books:

1) "Python Data Science Handbook: Essential Tools for Working with Data", 1st Edition, Jake VanderPlas, O'Reilly Media, 2016
2) "Core Python Applications Programming", 3rdEdition, Wesley J Chun Pearson Education India, 2015

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M.Tech (CSE)-III Semester

Principles of cyber security

Code: R19MCS2352

Course Objectives:

- Cyber security course is to create a strong foundation and detailed technical knowledge in security, privacy, and cryptography applied to computer systems networks and web applications.

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Understand key terms and concepts in security, intellectual property and cyber crimes, trademarks and domain theft.	K4
CO2	Determine computer technologies, digital evidence collection, and evidentiary reporting in forensic acquisition	K3
CO3	Secure both clean and corrupted systems, protecting personal data, securing simple computer networks, and safe Internet usage.	K4
CO4	Incorporate approaches for incident analysis and response	K6

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT– I: Introduction to Cyber security- Cyber security objectives**,** Cyber security roles**,** Differences between Information Security & Cyber security.
Cyber security Principles-Confidentiality, integrity & availability Authentication & non repudiation.

UNIT–II: Information Security (IS) within Lifecycle Management-Lifecycle management landscape, Security architecture processes, Security architecture tools, Intermediate lifecycle management concepts. **Risks & Vulnerabilities-** Basics of risk management**,** Operational threat environments**,** Classes of attacks.

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UNIT–III: Incident Response- Incident categories**,** Incident response Incident recovery. **Operational security protection**: Digital and data assets, ports and protocols, Protection technologies, Identity and access Management, configuration management.

UNIT – IV: Threat Detection and Evaluation (DE): Monitoring**-** Vulnerability Management, Security Logs and Alerts, Monitoring Tools and Appliances**. Analysis-** Network traffic Analysis, packet capture and analysis

UNIT – V: Introduction to backdoor System and security-Introduction to metasploit, Backdoor, demilitarized zone(DMZ),Digital Signature, Brief study on Harding of operating system.

Text Books:

1. Security Analyst Student Hand Book , NASSCOM: Dec 2015
2. Information Security Management Principles Updated Edition by David Alexander, Amanda Finch, David Sutton ,Published by BCS, June 2013

Reference Books:

1. CSX- cyber security fundamentals 2nd edition, Published by ISACA, Cyber security, Network Security, Data Governance Security

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M.Tech (CSE)-III Semester

Internet of Things

Code: R19MCS2352

Course Objectives:

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

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Summarize on the term 'internet of things' in different contexts.	K2
CO2	Analyze various protocols for IoT.	K4
CO3	Design a PoC of an IoT system using Rasperry Pi/Arduino	K6
CO4	Apply data analytics and use cloud offerings related to IoT.	K3
CO5	Analyze applications of IoT in real time scenario	K4

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(Please fill the above with Levels of Correlation, viz., L, M, H)

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

UNIT II: IoT PROTOCOLS: IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and

Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT

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

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

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

Text Books:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry,Cisco Press, 2017
2. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015

Reference Books:

1. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi Wiley, 2012 (for Unit 2)
2. “From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence”,Jan Ho¨ ller, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, Elsevier, 2014
3. Architecting the Internet of Things,Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), Springer, 2011

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M.Tech (CSE)-III Semester

Artificial Intelligence and Machine learning

Code: R19MCS2352

Course Objectives:

The learning objectives of this course are:

- To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
- To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- Understanding fuzzy logic, ANN and Understanding GA & EP

Course Outcomes:

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

CO	Description	Knowledge Level (K)#
CO1	Learn the concepts of biological foundations of artificial neural networks	K2
CO2	Identifications of fuzzy and neural network	K3
CO3	Extract features that can be used for a particular machine learning approach in various IOT applications	K4
CO4	To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.	K3
CO5	To mathematically analyze various machine learning approaches and paradigms.	K2

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3											
CO4											
CO5											

(**Please fill the above with Levels of Correlation, viz., L, M, H)**

Unit 1: Biological foundations to intelligent System, Artificial Neural Networks, Single layer and Multilayer Feed Forward NN ,LMS and Back Propagation Algorithm, Feedback networks and Radial Basis Function Networks.

Unit-2: Fuzzy Logic, Knowledge Representation and Inference Mechanism, Defuzzification Methods, Fuzzy Neural Networks, some algorithms to learn the parameters of the network like GA. System Identification using Fuzzy and Neural Network.

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Unit-3: Supervised Learning (Regression/Classification): Basic methods: Distance-based methods, Nearest-Neighbors', Decision Trees, Naive Bayes, Linear models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Nonlinearity and Kernel Methods, Beyond Binary Classification: Multi-class/Structured Outputs, Ranking.

Unit-4: Unsupervised Learning: Clustering: K-means/Kernel K-means, Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative Models (mixture models and latent factor models).

Unit-5: Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging and Random).

Text Books:

1. "An Introduction to ANN",J M Zurada , Jaico PublishingHouse-2012
2. "Neural Networks", Simon Haykins, Prentice Hall,2nd edition-1998
3. Machine Learning: A Probabilistic Perspective,Kevin Murphy, MIT Press, 2012
4. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer 2009 (freely availableonline)

Reference Books:

1. "An Introduction to Fuzzy Control", Driankov, Dimitra, NarosaPublication
2. "Genetic Algorithms",Golding, Addison-Wesley PublishingCom
3. Pattern Recognition and Machine Learning,Christopher Bishop, Springer,2007.