KALASALINGAM
ACADEMY OF RESEARCH & EDUCATION
(DEEMED TO BE UNIVERSITY)
Under sec. 3 of UGC Act 1956. Accredited by NAAC with "A" Grade

SCHOOL OF COMPUTING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CURRICULUM

FOR

M.TECH. DEGREE PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

[Regulations 2018]

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CURRICULUM

FOR

M.TECH. DEGREE PROGRAMME IN

COMPUTER SCIENCE AND ENGINEERING

Programme Educational Objectives (PEO)

1. The post graduates will be proficient in applying contemporary networking theory and practice to problems encountered in real time applications using sustainable and inclusive technology.
2. The post graduates will be contributing effectively as a network administrator and researcher using common modern tools and techniques in networking.
3. The post graduates will possess a solid foundation for engaging in lifelong learning and professional development in network engineering.

Programme Objectives (PO)

1. Ability to apply the knowledge of mathematics and network engineering fundamentals to deploy, analyze, monitor, test and manage different networks.
2. Ability to investigate complex problems through research and effectively utilize suitable networking tools in tune with state of art of technology to solve network related problems.
3. Ability to design sustainable solutions through use of inclusive technology for considering public health and safety, cultural, societal and environmental factors.
4. Ability to design, conduct experiments, analyze and interpret data by applying appropriate research methodologies, techniques and tools, to solve unfamiliar problems.
5. Ability to create, select, learn and apply modern engineering tools and techniques to solve complex networking activities.
6. Ability to be in a position to communicate effectively in groups involved in collaborative, multidisciplinary research activities.
7. Ability to possess leadership, project management and financial skills with professional ethics.
8. Ability to propose original ideas and design novel solutions and communicate them effectively to the stakeholders verbally as well as in writing.
9. Ability to recognize the need for, and develop confidence in self and life-long learning.

10. Ability to understand the impact of engineering solutions in a contemporary, global, economical, environmental, ethical and societal context for sustainable development.
11. Ability to observe and examine critically to correct themselves without depending on external feedback.

Program Specific Objectives (PSO)

PSO1: Ability to successfully pursue research in the field of Computer Science and Engineering and allied disciplines.

PSO2: Ability to contribute significantly to contemporary research domains in Computer Science and Engineering through publications, innovative products or patents.

PSO3: Ability to establish companies or lead teams/organizations to solve society relevant Problems.

	PO										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
PSO1	**S**	**S**	**S**								
PSO2				**S**	**S**			**M**			
PSO3						**S**	**S**	**S**	**S**	**M**	**M**

KALASALINGAM ACADEMY OF RESEARCH AND EDUCATION
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
M.Tech. Computer Science and Engineering

CURRICULUM STRUCTURE

S.No	Course Category	Credits
1	Core Theory Courses	14
2	Lab Courses	8
3	Supporting Courses (Mathematics and Research Methodology)	4
4	Program Specific Elective Courses	15
5	Open Elective (interdisciplinary / General Elective)	3
6	Mini Project	2
7	Project Work	26
8	Audit course(2 courses)	-
Total Credits		72

Core Courses

Code	Name of the Course	Credit
CSE18R 5001	Multicore Architecture	3
CSE18R5002	Advanced Data structure	4
CSE18R 5003	Advanced Algorithms	4
CSE18R 5004	Soft Computing	3
Total		14

Lab Courses

Code	Name of the Lab Courses	Credits
CSE18R5081	Advanced Data structures Lab	2
CSE18R5082	Machine Learning Lab	2
CSE18R5083	Wireless Sensor Networks Lab	2
CSE18R5084	Introduction to Intelligent Systems Lab	2
CSE18R5085	Data Science Lab	2
CSE18R5086	Distributed Systems Lab	2
CSE18R5087	Advanced Wireless and Mobile Networks Lab	2
CSE18R5088	Soft computing Lab	2
CSE18R5089	Data Preparation and Analysis Lab	2
CSE18R5090	Secure Software Design Lab	2
CSE18R5091	Enterprise Computing Lab	2
CSE18R5092	Computer Vision Lab	2
CSE18R5093	Human and Computer Interaction Lab	2
CSE18R5094	GPU Computing Lab	2
CSE18R5095	Digital Forensics Lab	2
Total (any 4)		8

Supporting Courses

Code	Name of the Courses	Credits
MAT18R5001	Applied Mathematics	3
PGM18R5001	Research Methodology	1
Total		4

Program Specific Elective Courses

S.No	Code	Name of the Course	T	L	P	Credit
1.	CSE18R5005	Machine Learning	3	0	0	3
2.	CSE18R 5007	Secure Software Design & Enterprise Computing	3	0	0	3
3.	CSE18R 5008	Data Preparation and Analysis	3	0	0	3
4.	CSE18R5009	Computational game theory	3	0	0	3
5.	CSE18R5010	Bio informatics	3	0	0	3
6.	CSE18R5011	Embedded Systems	3	0	0	3
7.	CSE18R5012	Image Processing and Analysis	3	0	0	3
8.	CSE18R5013	Natural Language Processing	3	0	0	3
9.	CSE18R5014	Adhoc and Wireless Sensor Networks	3	0	0	3
10.	CSE18R5015	Mobile Application Development	3	0	0	3
11.	CSE18R5016	Bio inspired Artificial Intelligence	3	0	0	3
12.	CSE18R5017	Nano Computing	3	0	0	3
13.	CSE18R5018	Data Science	3	0	0	3
14.	CSE18R5019	Network Forensics	3	0	0	3
15.	CSE18R5020	Social Network Analysis	3	0	0	3
16.	CSE18R5021	Software Defined Networking	3	0	0	3
17.	CSE18R5022	Green Computing	3	0	0	3
18.	CSE18R5023	Medical Imaging and Radio Therapy	3	0	0	3
19.	CSE18R5024	Pattern Recognition	3	0	0	3
20.	CSE18R5025	Compiler for HPC	3	0	0	3
21.	CSE18R5026	Video Analytics	3	0	0	3
22.	CSE18R5027	Information Retrieval Techniques	3	0	0	3
23.	CSE18R5028	Wireless Technology	3	0	0	3
24.	CSE18R5029	GPU Computing	3	0	0	3
25.	CSE18R 5030	Distributed Systems	3	0	0	3
26.	CSE18R 5031	Network on chip	3	0	0	3
27.	CSE18R 5032	Secure Software Design and Enterprise computing	3	0	0	3
28.	CSE18R5033	Digital Forensics	3	0	0	3
29.	CSE18R5034	Wireless Sensor networks	3	0	0	3
30.	CSE18R5035	Introduction to Intelligent System	3	0	0	3
31.	CSE18R5036	Advanced Wireless and Mobile networking	3	0	0	3
32.	CSE18R5037	Human And Computer Interaction	3	0	0	3

List of Interdisciplinary Electives:

S.No	Code No	Course Title	T	L	P	C
1.	ICE18R5009	Robotics And Automation	3	0	0	3
2.	ECE17R5141	Basics Of VLSI Design	3	0	0	3
3.	ECE17R6042	Data Compression Techniques	3	0	0	3
4.	EEE18R6015	Embedded C	3	0	0	3
5.	EEE18R5007	Smart Grid Technology	3	0	0	3
6.	INT17R6023	Deep Learning Techniques	3	0	0	3

List of General Electives:

S.No	Code No	Course Title	T	L	P	C
1.	CSE18R5051	Internet of Things	3	0	0	3
2.	CSE18R5052	Big Data Analytics	3	0	0	3
3.	CSE18R5053	Cloud Computing	3	0	0	3
4.	EEE18R5020	Soft Computing Techniques	3	0	0	3
5.	EEE18R6013	Evolutionary Computation Techniques	3	0	0	3
6.	EEE18R5021	Optimization techniques	3	0	0	3

Open Elective

Code	Name of the Course	Credits
1	Business Analytics	3
2	Industrial Safety	3
3	Operations Research	3
4	Cost Management of Engineering Projects	3
5	Composite Materials	3
6	Waste to Energy	3

S.No	Content	credits
1	Mini Project	2
2	Project Work	26
Total		28

Audit Course

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

SEMESTER 1

Code No.	Course Title	L	T	P	C	Course Type
MAT18R5001	Applied Mathematics	3	0	0	3	Supporting course
CSE18R5001	Multicore Architecture	3	0	0	3	Core
CSE18R5002	Advanced Data structures	3	1	0	4	Core
*******	Elective – I	3	0	0	3	Elective
*******	Elective – II	3	0	0	3	Elective
PGM5001	Research Methodology	1	0	0	1	Supporting course
	Audit Course	2	0	0	0	
CSE18R5081	Advanced Data structures Lab	0	0	3	2	Practical
CSE18R5082-87	…..	0	0	3	2	Practical
				Total	21	

Elective I and II Lab Courses

Code No.	Course Title	L	T	P	C	Course Type
CSE18R5082	Machine Learning Lab	**0**	**0**	**3**	**2**	Practical
CSE18R5083	Wireless Sensor Networks Lab	**0**	**0**	**3**	**2**	Practical
CSE18R5084	Introduction to Intelligent Systems Lab	**0**	**0**	**3**	**2**	Practical
CSE18R5085	Data Science Lab	**0**	**0**	**3**	**2**	Practical
CSE18R5086	Distributed Systems Lab	**0**	**0**	**3**	**2**	Practical
CSE18R5087	Advanced Wireless and Mobile Networks Lab	**0**	**0**	**3**	**2**	Practical

SEMESTER 2

Code No.	Course Title	L	T	P	C	Course Type
CSE18R5003	Advance Algorithms	3	1	0	4	Core
CSE18R5004	Soft computing	3	0	0	3	Core
*******	Elective – III	3	0	0	3	Elective
*******	Elective – IV	3	0	0	3	Elective
	Audit Course	2	0	0	0	
CSE18R5088	Soft computing Lab	0	0	3	2	Practical
CSE18R5089-95	Lab (Based on Elective)	0	0	3	2	Practical
	Mini Project with Seminar	2	0	0	2	
				Total	19	

Elective III and IV Lab Courses

Code No.	Course Title	L	T	P	C	Course Type
CSE18R5089	Data Preparation and Analysis Lab	**0**	**0**	**3**	**2**	Practical
CSE18R5090	Secure Software Design Lab	**0**	**0**	**3**	**2**	Practical
CSE18R5091	Enterprise Computing Lab	**0**	**0**	**3**	**2**	Practical
CSE18R5092	Computer Vision Lab	**0**	**0**	**3**	**2**	Practical
CSE18R5093	Human and Computer Interaction Lab	**0**	**0**	**3**	**2**	Practical
CSE18R5094	GPU Computing Lab	**0**	**0**	**3**	**2**	Practical
CSE18R5095	Digital Forensics Lab	**0**	**0**	**3**	**2**	Practical

SEMESTER 3

Code No.	Course Title	L	T	P	C	Course Type
*******	Elective - V	3	0	0	3	Elective
*******	Open Elective	3	0	0	3	
CSE18R5098	Dissertation-I /Industrial Project	0	0	20	10	IE
				Total	16	

SEMESTER 4

Code No.	Course Title	T	L	P	C	Course Type
CSE18R5099	Project Phase II	0	0	30	16	Project
				Total	16	

List of Programme Specific Electives:

S.No	Code	Name of the Course	T	L	P	Credit
1.	CSE18R 5005	Machine Learning	3	0	0	3
2.	CSE18R 5007	Secure Software Design & Enterprise Computing	3	0	0	3
3.	CSE18R 5008	Data Preparation and Analysis	3	0	0	3
4.	CSE18R5009	Computational game theory	3	0	0	3
5.	CSE18R5010	Bio informatics	3	0	0	3
6.	CSE18R5011	Embedded Systems	3	0	0	3
7.	CSE18R5012	Image Processing and Analysis	3	0	0	3
8.	CSE18R5013	Natural Language Processing	3	0	0	3
9.	CSE18R5014	Adhoc and Wireless Sensor Networks	3	0	0	3

10.	CSE18R5015	Mobile Application Development	3	0	0	3
11.	CSE18R5016	Bio inspired Artificial Intelligence	3	0	0	3
12.	CSE18R5017	Nano Computing	3	0	0	3
13.	CSE18R5018	Data Science	3	0	0	3
14.	CSE18R5019	Network Forensics	3	0	0	3
15.	CSE18R5020	Social Network Analysis	3	0	0	3
16.	CSE18R5021	Software Defined Networking	3	0	0	3
17.	CSE18R5022	Green Computing	3	0	0	3
18.	CSE18R5023	Medical Imaging and Radio Therapy	3	0	0	3
19.	CSE18R5024	Pattern Recognition	3	0	0	3
20.	CSE18R5025	Compiler for HPC	3	0	0	3
21.	CSE18R5026	Video Analytics	3	0	0	3
22.	CSE18R5027	Information Retrieval Techniques	3	0	0	3
23.	CSE18R5028	Wireless Technology	3	0	0	3
24.	CSE18R5029	GPU Computing	3	0	0	3
25.	CSE18R 5030	Distributed Systems	3	0	0	3
26.	CSE18R 5031	Network on chip	3	0	0	3
27.	CSE18R 5032	Secure Software Design and Enterprise computing	3	0	0	3
28.	**CSE18R5033**	Digital Forensics	3	0	0	3
29.	**CSE18R5034**	Wireless Sensor networks	3	0	0	3
30.	**CSE18R5035**	Introduction to Intelligent System	3	0	0	3
31.	**CSE18R5036**	Advanced Wireless and Mobile networking	3	0	0	3
32.	**CSE18R5037**	Human And Computer Interaction	3	0	0	3

Core Courses

CSE18R5001	MULTICORE ARCHITECTURE	L	T	P	Credit
		3	1	0	4
Course Category : Theory		**Course Type :** Core			

PRE-REQUISITE

- Computer Network
- Computer Architecture

COURSE OBJECTIVES

The primary objective of this course is to provide an understanding of the fundamentals of architecture and design of multicore processors.

COURSE OUTCOMES

CO1: Understand the need for multicore architecture
CO2: Evaluate the various multiprocessor issues
CO3: Creating the multi core architecture
CO4: Design the memory hierarchy.
CO5: Applying the multicore programming model.

	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S		S	S			S					S	
CO3			S					S		S	M			S
CO4		S		S	S						S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I NEED FOR MULTICORE ARCHITECTURES

Fundamentals of Computer Design - Measuring and Reporting Performance - Instruction Level Parallelism and its Exploitation - Concepts and Challenges – Limitations of ILP – Multithreading – SMT and CMP Architectures – The Multicore era.

UNIT II MULTIPROCESSOR ISSUES

Symmetric and Distributed Shared Memory Architectures – Cache Coherence Issues – Performance Issues – Synchronization Issues – Models of Memory Consistency - Interconnection Networks – Buses, Crossbar and Multi-stage Interconnection Networks.

UNIT III MULTICORE ARCHITECTURES

Homogeneous and Heterogeneous Architectures – Intel Multicore Architectures – SUN CMP architecture – IBM Cell Architecture – GPGPU Architectures.

UNIT IV MEMORY HIERARCHY DESIGN

Introduction - Optimizations of Cache Performance - Memory Technology and Optimizations Protection: Virtual Memory and Virtual Machines - Design of Memory Hierarchies - Case Studies.

UNIT V MULTICORE PROGRAMMING

Parallel Programming models – Shared Memory Programming – Message Passing Interface Open MP Program Development and Performance Tuning.

REFERENCES

1. John L. Hennessey and David A. Patterson, " Computer Architecture – A Quantitative Approach",Morgan Kaufmann / Elsevier, 5th. edition, 2012.
2. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan Kaufmann, Elsevier, 2011.
3. Michael J Quinn, Parallel Programming in C with MPI and OpenMP, Tata McGraw Hill, 2003.
4. Darryl Gove, "Multicore Application Programming: For Windows, Linux, and Oracle Solaris", Pearson, 2011.
5. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture : A Hardware/ Software Approach" , Morgan Kaufmann / Elsevier, 1997

CSE18R5002	ADVANCED DATA STRUCTURES	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Core			

PREREQUISITE

Data structure and algorithm

COURSE OBJECTIVES

- The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
- Students should be able to understand the necessary mathematical abstraction to solve problems
- To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
- Student should be able to come up with analysis of efficiency and proofs of correctness.

COURSE OUTCOMES

CO1: Understand the implementation of symbol table using hashing techniques
CO2: Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
CO3: Develop algorithms for text processing applications
CO4: Identify suitable data structures and develop algorithms for computational geometry problems.

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S			S	M		S					S	
CO3			S	M				S		S	M	S		
CO4		S		S	S		M				S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.
Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

UNIT II

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

UNIT III

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees, Recent Trands in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem

UNIT IV

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer- Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem

UNIT V

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees.

REFERENCES

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

CSE18R5003	ADVANCED ALGORITHMS	L	T	P	Credit
		3	1	0	4
Course Category : Theory		**Course Type :** Core			

PREREQUISITE

Design and Analysis of Algorithms

COURSE OBJECTIVES

- Introduce students to the advanced methods of designing and analyzing algorithms.
- The student should be able to choose appropriate algorithms and use it for a specific problem.
- To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
- Students should be able to understand different classes of problems concerning their computation difficulties
- To introduce the students to recent developments in the area of algorithmic design.

COURSE OUTCOMES

CO1:Analyze the complexity/performance of different algorithms.
CO2: Determine the appropriate data structure for solving a particular set of problems.
CO3: Categorize the different problems in various classes according to their complexity.
CO4: Students should have an insight of recent activities in the field of the advanced data structure.

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S			S	M		S					S	
CO3			S	M				S		S	M	S		
CO4		S		S	S		M				S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I

Sorting: Review of various sorting algorithms, topological sorting **Graph:** Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

UNIT II

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. **Graph Matching:** Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom

algorithm to compute augmenting path.

UNIT III

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. **Matrix Computations:** Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

UNIT IV

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. **Modulo Representation of integers/polynomials:** Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.**Discrete Fourier Transform (DFT):** In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm

UNIT V

Linear Programming: Geometry of the feasibility region and Simplex algorithm **NP-completeness:** Examples, proof of NP-hardness and NP-completeness. **One or more of the following topics based on time and interest** Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm. Recent Trands in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

REFERENCES

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.

CSE18R5004	SOFT COMPUTING	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Core			

PREREQUISITE

Basic knowledge of mathematics

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 an hand-on experience on MATLAB to implement various strategies.

COURSE OUTCOMES

CO1: Identify and describe soft computing techniques and their roles in building intelligent machines

CO2: Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.

CO3: Apply genetic algorithms to combinatorial optimization problems.

CO4: Evaluate and compare solutions by various soft computing approaches for a given problem

	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S			S	M		S					S	
CO3			S	M				S		S	M	S		
CO4		S		S	S		M				S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I

Introduction to Soft Computing and Neural Networks: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics

UNIT II

Fuzzy Logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT III

Neural Networks: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance

architectures, Advances in Neural networks

UNIT IV

Genetic Algorithms: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition

UNIT V

Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.

Matlab/Python Lib: Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic

REFERENCES

1. Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro:Fuzzy and Soft Computing®, Prentice:Hall of India, 2003.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications®, Prentice Hall, 1995.
3. MATLAB Toolkit Manual

Lab Courses

CSE18R5081	ADVANCED DATA STRUCTURES LAB	L	T	P	Credit
		0	0	3	2
Course Category : Lab		**Course Type**	**:** Practical		

PREREQUISITE:

- Programming Language Lab
- Data structure Lab

COURSE OBJECTIVEs

- To learn the implementation of linear data structures for concurrency
- To learn the implementation of advanced data structures such as search trees and heaps
- To explore the advanced concurrent data structures such as hash table, Priority Queue and skip list
- To learn to apply principles of efficient algorithm design and learn various advanced algorithms

COURSE OUTCOMES

CO1: Implement and apply concurrency in linked lists, stacks and queues
CO2: implement advanced search trees such as Red black tree, 2-D tree, splay tree, Trie and skip list
CO3: Perform operations on advanced heaps
CO4: Work with advanced concurrent structures such as hash table, Priority Queue and skip list
COL5: Solve real time applications using advanced algorithms such as approximation, randomized and parallel algorithms

LIST OF EXPERIMENTS

- Implementation and applications of classic linear data structures, namely, linked lists, queues, and stacks.
- Implementation of various locking and synchronization mechanisms for concurrent linked lists.
- Implementation of various locking and synchronization mechanisms for concurrent queues and stacks.
- Implementation of Splay tree / 2-D tree / Red black tree.
- Implementation of skip lists
- Implementation of various heap structures: min heap / Double ended heap / Leftist Heaps.
- Implementation and demonstration of hashing and concurrent hashing
- Implementation of concurrent skip lists / concurrent priority queues.
- Implementation of approximation algorithms / randomized algorithms.
- Implementation of parallel sorting algorithms
- Developing an application involving concurrency in data structures

CSE18R5082	MACHINE LEARNING LAB	L	T	P	Credit
		0	0	3	2
Course Category : Lab		**Course Type :** Practical			

PREREQUISITE:

- Programming Language Lab

COURSE OBJECTIVES

- To learn the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
- To understand the strengths and weaknesses of many popular machine learning approaches.
- To comprehend the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

COURSE OUTCOMES

- CO1: Analyze and employ the use of regression and classification algorithms.
- CO2: Comprehend the usage of supervised and unsupervised learning for the underlying application.
- CO3: Design and implement appropriate machine learning algorithms in a range of real-world applications.
- CO4: Work with prediction based applications by applying the concepts of learning algorithms.

LIST OF EXPERIMENTS

Programming Language: Python

- Implementation of Nearest Neighbor criterion using various distance measures.
- Implementation of Linear regression algorithm.
- Implementation of Logistic regression algorithm.
- Implementation of naïve-bayes algorithm for word count application.
- Implementation of K-means algorithm with reference to gap analysis.
- Implementation of Dimensionality reduction algorithm with Kernel trick.
- Implementation of Support Vector Machines (SVM) technique.
- Implementation of Random forest learning technique.
- Experiment the use of prediction algorithms with statistical data.
- Develop a prediction application using appropriate learning technique.

CSE18R5083	WIRELESS SENSOR NETWORKS LAB	L	T	P	Credit
		0	0	3	2
Course Category : Lab		**Course Type :** Practical			

PREREQUISITE:

- Programming Language Lab
- Computer Networks Lab

COURSE OBJECTIVES

- To understand and employ various algorithms in NS2
- To list various applications of wireless sensor networks, describe the concepts, protocols and differences underlying the design. Implementation and use of wireless sensor networks.
- To implement and evaluate new ideas for solving wireless sensor networks design issues.

COURSE OUTCOMES

- CO1: Comprehend and employ sensor networks algorithms in NS2 for the underlying application.
- CO2: Delineate the requirements and use of various routing, monitoring, sensing protocols.
- CO3: Work with real time sensor applications and apply the necessary algorithm to provide the solution.
- CO4: Design solutions for QOS issues in Wireless Sensor Networks.

LIST OF EXPERIMENTS

- Network Simulator installation of Wireless Sensor Networks.
- Write TCL Scripts for transmission between Mobile nodes.
- Write TCL Scripts for sensor nodes with different parameters.
- Generate TCL Script for UDP and CBR traffic in WSN nodes.
- Generate TCL Script for TCP and CBR traffic in WSN nodes.
- Implementation of routing protocol in NS2 for AODV protocol.
- Implementation of routing protocol in NS2 for DSR protocol.
- Implementation of routing protocol in NS2 for TORA protocol.
- Implementation of Leach protocol in NS2.
- Study Assignment 1: Wireless Sensor Network simulators

CSE18R5084	INTRODUCTION TO INTELLIGENT SYSTEMS LAB	L	T	P	Credit
		0	0	3	2
Course Category : Lab		**Course Type :** Practical			

PREREQUISITE:

- Programming Language Lab
- Data Structure and Algorithms Lab

COURSE OBJECTIVES

- To understand and implement various libraries and function in Prolog.
- To get an insight on Artificial Intelligence and Computational linguistics.
- To comprehend the rule based logical queries, such as searching databases, voice control systems and filling templates.

COURSE OUTCOMES

- CO1: Comprehend and employ prolog for theorem proving, term rewriting, type inference, automated planning and expert systems.
- CO2: Comprehend the usage of various intelligence algorithms and use the algorithms in appropriate situations.
- CO3: Work with various intelligent systems and provide learning, prediction algorithms as solutions to the problems.
- CO4: Determine the need of intelligence or learning requirement for an application and pose a well-formed learning problem.

LIST OF EXPERIMENTS

Programming language: Prolog

- Study of Prolog
- Solve 8 queens problem using Prolog.
- Solve any problem using depth first search with Prolog.
- Solve any problem using breadth first search with Prolog.
- Solve 8-puzzle problem using best first search with Prolog.
- Solve 8-puzzle problem using A* search with Prolog.
- Solve Robot (traversal) problem using means End Analysis.
- Implementation of Traveling salesman problem.
- Demonstration of family relationship using Prolog.
- Program to categorize animal characteristics.

CSE18R5085	DATA SCIENCE LAB	L	T	P	Credit
		0	0	3	2
Course Category : Lab		**Course Type :** Practical			

PREREQUISITE:

- Programming Language Lab
- DBMS Lab

COURSE OBJECTIVES

- To understand and implement various libraries and function in R tool.
- To get an insight on NoSQL databases such as MongoDB.
- To comprehend the process of data analytics and use appropriate Programming languages and framework to accomplish the underlying task.

COURSE OUTCOMES

- CO1: Preprocess and clean the given data depending on the requirements of the application.
- CO2: Comprehend the usage various functions and operations to perform data preparation and analysis in R.
- CO3: Perform data storage of variety and voluminous data in an efficient way using NoSQL databases.
- CO4: Work with stream data and perform real time data analytics using SCALA.

LIST OF EXPERIMENTS

Programming language: R

- Preprocessing of data using R
- Implementation of a program to remove NAs in a given data and extract characteristics of data in the data types such as length, average, etc.
- Implementation of Lexical scoping to cache time consuming computations with a given database as input.
- Ranking of hospitals in various grounds and finding the best hospital in the state using a given Hospital Data, Outcome data, Desc data.
- Creation, insertion, deletion of database in MongoDB
- Implementation of a NoSQL database with multiple data types.
- Develop a web application with MongoDB for registration and login. Registration can take data such as image, text, etc.
- Implementation of word count program in Apache SPARK.
- Implementation of data analysis using SPARK.
- Implementation of stream data analysis using SCALA.

CSE18R5086	DISTRIBUTED SYSTEMS LAB	L	T	P	Credit
		0	0	3	2
Course Category : Lab		**Course Type :** Practical			

PREREQUISITE:

- Programming Language Lab

COURSE OBJECTIVES

- To learn the necessity of Distributed systems with respect to the pitfalls in Centralized architecture.
- To get an insight on Modern Operating Systems and the evolution of Real Time Operating Systems (RTOS).
- To learn the paradigms of various requirements of Distributed Systems such as Synchronization, Transaction Management, Parallel Database Management, etc.

COURSE OUTCOMES

- CO1: Comprehend the working of Synchronization algorithms in Distributed Systems.
- CO2: Design and implement appropriate election algorithms in a given distributed environment.
- CO3: Comprehend and employ transaction management in Distributed database management systems.
- CO4: Work with Parallel databases efficiently using Optimizations and Load balancing.

LIST OF EXPERIMENTS

Programming language: C, C++, Java

- Implementation of Clock Synchronization algorithm using Active Time Server centralized algorithm.
- Implementation of Bankers algorithm.
- Implementation of Local distributed clock synchronization algorithm.
- Implementation of Bully Algorithm for electing a coordinator.
- Implementation of Event ordering using Logical clocks.
- Implementation of Ring Algorithm for electing a coordinator.
- Construction of Wait for graph for the given resources and processes.
- Implementation of two-phase commit protocol.
- Implementation of Atomic transaction in banking application.
- Implementation of parallel database for an application.

CSE18R5087	ADVANCED WIRELESS AND MOBILE NETWORKS LAB	L	T	P	Credit
		0	0	3	2
Course Category : Lab		**Course Type :** Practical			

PREREQUISITE:

- Programming Language Lab
- Computer Networks Lab

COURSE OBJECTIVES

- To understand various algorithms for wireless and mobile networks in NS2.
- To get an insight on wireless and mobile networks such as Bluetooth, WIFI, etc.
- To comprehend the design of Mobile networks application developed using J2ME.

COURSE OUTCOMES

- CO1: Comprehend and employ appropriate protocols in Wireless and Mobile networks.
- CO2: Comprehend the usage of various intelligence algorithms and use the algorithms in appropriate situations.
- CO3: Understand the enterprise scale requirements for mobile application.
- CO4: Design solutions for QOS issues in Wireless and Mobile Networks.

LIST OF EXPERIMENTS

- Implementation of Code Division Multiple Access (CDMA).
- Study of frequency reuse concept.
- Study of basic concept of og J2ME.
- Implementation of TextBox, ChoiceGroup, Drop Down Menus, etc in J2ME.
- Design of simple WML using various WML tags.

- Design of Mobile Network using NS2.
- Study Assignment 1: Detailed study of Bluetooth.
- Study Assignment 2: Detailed study of Wireless Application Protocol.
- Set up and configuration of access point.
- Study Assignment 3: Study of network security softwares.

CSE18R5088	SOFT COMPUTING LAB	L	T	P	Credit
		0	0	3	2
Course Category : Lab		**Course Type :** Practical			

PREREQUISITE

- Programming Language Lab
- Data mining and data warehousing

COURSE OUTCOMES

CO1: Implement Fuzzy operations and algorithms**.**

CO2: Apply Genetic Algorithms to solve optimization problems.

CO3: Design a neural network and neuro fuzzy system

CO4: Apply innovative soft computing based solutions for real world problems

LIST OF EXPERIMENTS

- Implementation of Perceptron Network using MATLAB
- Implementation of BPN using MATLAB
- Implementation of ART algorithm in MATLAB
- Implementation of Fuzzy Operations using MATLAB
- Implementation of Fuzzy arithmetic using MATLAB
- Implementation of defuzzification using MATLAB
- Implementation of Fuzzy inference system using MATLAB
- Solving Economic dispatch problem using GA (MATLAB)
- Solving Travelling Salesman Problem using GA (MATLAB)
- Implementing Fuzzy C-means algorithm (MATLAB)
- Implementing neuro-fuzzy system using Takagi Sugeno (MATLAB

CSE18R5093	HUMAN AND COMPUTER INTERACTION LAB	L	T	P	Credit
		0	0	3	2
Course Category : Lab		**Course Type :** Practical			

PREREQUISITE:

- Programming Language lab.

COURSE OBJECTIVE

- To stress the importance of a good interface design.
- To understand the importance of human psychology in designing good interfaces
- To motivate students to apply HMI in their day to day activity
- To encourage students to indulge into research in Machine Interface Design

COURSE OUTCOMES

CO1: To apply HMI in their day to day activities.
CO2: To analyze user models and develop user centric interfaces
CO3: To understand importance of a good interface design
CO4: To understand need of design principles and guidelines
CO5: To apply the core concepts and implementation guidelines of Human Computer Interaction to improve them

LIST OF EXPERIMENTS

- Design an user interface for welcome screen
- Design an user interface for arthimetic operation of any two numbers
- Design an user interface for printing the number in
  a)Ascending order b)Descending order
- Design an user interface to count the number of digits in a given number
- Design an user interface to check whether the year is leap year or not
- Design an user interface to check whether the given number is armstrong or not
- Design an user interface for registration of a student for admissions
- Design an user interface for semester registration
- Design an user interface for displaying and changing of picture on the form

CSE18R5095	DIGITAL FORENSICS LAB	L	T	P	Credit
		0	0	3	2
Course Category : Lab		**Course Type :** Practical			

PREREQUISITE:

- Cryptography

COURSE OBJECTIVES

- To learn the fundamental issues and challenges of Cyber forensics.
- To understand the strengths and weaknesses of many popular forensics tools and softwares
- To comprehend the underlying Cyber attacks, notion and the counter measure.

COURSE OUTCOMES

- CO1: Analyze and employ various forensics tools in the appropriate situation.
- CO2: Comprehend the usage of forensics tools and interrelate those with the attack patterns took place.
- CO3: Design and implement appropriate model to counter the effects of the cyber attacks.
- CO4: Work with inter-disciplinary applications undergone cyber attack and predict the measures to defy the attack in current and future.

LIST OF EXPERIMENTS

1. **ENCRYPTED MAIL:** A former employee encrypted an email record, address book, and calendar to hide information from an employer. A computer forensics team was hired. The team then successfully cracked the file's encryption and revealed its contents.
2. **FORMER CATALOG DESIGNERS:** A company that had spent years producing a catalog and selling thousands of industry-specific parts found that a competing catalog with identical drawings and designs had been produced in a scant few weeks by a new competitor. A computer forensics team was hired to show that the designs of the new company were stolen from the original company. After the findings were presented to a court showing the original company's artwork and text being used in new catalogue, the new company was enjoined from using designs for several months.
3. **FORENSIC ACCOUNTING:** A multinational manufacturer reported significant losses in the company's distribution division. It was not clear whether this was simply a result of an inequitable transfer pricing policy within the group or whether the company had been defrauded. Accountants from a computer forensics firm set out to investigate how the losses had been incurred, reconstructing incomplete records and unraveling a confusing series of transactions. They discovered that other companies within the group had transferred products to the division at over market value to maintain their own profitability. More disturbingly, the division had sold much of its product at inexplicably low prices to a number of key customers. The business manager was dismissed after the computer forensics firm discovered that he had concealed ownership interests in some of these customers and evidence came to light indicating that he had accepted kickback payments. Poor and missing records prevented legal action from being commenced. In the following period, the division was on track to report profits following tighter controls over transfer pricing and sales invoicing.
4. **BANK SUSPECTS:** An employee of an FDIC-insured bank turned over a computer upon exiting from his employer. The managers suspected that this individual had revealed

confidential information regarding loan clients and credit information. A computer forensics team was hired to inspect the email server records for deleted email files that might cast light on the individual's actions. In short order, the text of the suspect emails, which showed the former employee's culpability, was revealed.

5. **COMPUTER FORENSICS:** The founder and majority shareholder of a consultancy business sold his interest to a multinational communications corporation. The contract of sale contained restraint clauses, prohibitions on the removal of confidential information, and no solicitation of staff and client clauses. After about a year, the client—the multinational became suspicious that he was acting in breach of contract. A computer forensics firm was asked to investigate. At the outset, the firm suggested that the individual's desktop and laptop computers be recovered to copy the hard disks and analyze their contents. Within an encrypted file on his desktop, the firm found a draft business plan for a new enterprise that would compete with his former business. On his laptop, in a deleted file that was restored, the firm recovered details of key clients and revenue streams. It was possible to demonstrate that information had been updated within these files after he had left the company, but before he had returned the computer. Taken together, the evidence was sufficient to initiate criminal proceedings.
6. **DISAPPEARING FILES:** The debtors module of an accounting package has somehow disappeared from the accounting PC. The software-support company is unable to locate the files, and the backup tapes do not restore correctly. The software-support company suggests that the data be rekeyed in—a massive task. Management is assessing their options. They are time-consuming and expensive. The distributor of the software recommends contact be made with a computer forensics firm. The firm finally restores the faulty data in time for the complete end-of-month statement run.
7. **FAMILY MEMBERS BOLT:** Family members bolt, take the IT department and the product design, sabotage the originals, and go into competition. A family-owned product manufacturer and designer on the verge of being bought for many millions of dollars found most of its designs missing after the departure of key managers and designers. A program used for deep file destruction had been implemented to destroy both product designs and evidence of the procedure itself. An outside computer forensics consultant is brought in to recover designs and overwrites evidence instead. A computer forensics team is then brought in and discovers remnants of file destruction utility and data patterns consistent with sabotage by the same utility. The suspects finally admitted to the use of the utility.
8. **LOST FILES:** A set of Word, Excel, and Project files that was created over 18 months relating to a project currently under construction has been maliciously deleted by a departing employee. The PC was not backed up. The action was discovered 3 days later and the IT group endeavored to locate and restore the files. They were unsuccessful. Management is assessing the options available. They are time consuming and expensive. Some data cannot be rekeyed in because the source data is missing. The IT manager contacts a computer forensics firm. The firm finally restores the entire project directory within 4 days from first contact.
9. **DATA RECOVERY:** A computer forensics team was asked to assist an organization that had lost data as a result of a computer virus. The affected laptops were with field personnel and away from the central office when the virus was introduced. Consequently, the data collected over this period had not been backed up. The affected machines were brought to the team's secure laboratory, and, using forensic recovery techniques, they were able to image data from the affected machines, recover all of the data that had been stored since the machines had last been backed up, and eliminate the virus.
10. A Survey of various Computer Forensics tools.

CSE18R5092	COMPUTER VISION LAB	L	T	P	C
		0	0	3	
Course Category : Lab		**Course Type :** Practi			

PREREQUISITE:

- Programming Language lab
- MATLAB basics

COURSE OBJECTIVE

- To learn the basic concepts, terminology, theories, models and methods in the field of computer vision
- To learn the basic describe known principles of human visual system
- To describe basic methods of computer vision related to multiscale representation,edge detection.

COURSE OUTCOMES

CO1: Understand various image translation and tranformation techniques.
CO2: Propose a design of a computer vision system for a specific problem
CO3: Apply principles of efficient algorithm design and learn various advanced algorithms anddetection of other primitives, stereo, motion and object recognition
CO4: Work with real time image types and extract sound features that effectively model the image

LIST OF EXPERIMENTS

- Program to display color content of image(Red Blue Green content).
- Program to Flip the image around the vertical and horizontal line.
- Program for image segmentation
- Implementation of Image filtering using low pass filter
  a) Average filter
  b) Weighted Average filter
  c) Median filter.

- Implementation Implementation of Image filtering using High pass filter
  a)Sobel operator

  b)Laplacian operator.

- Program to find threshold of grayscale image.
- Program to find threshold of RGB image.
- Program to estimate and subtract the background of an image.
- Program to convert color image to gray and hsv.
- Implementation of Edge detection with gradient and convolution of an Image.

Supporting Courses

MAT18R5001	Applied Mathematics	Credits			
		L	T	P	Total
		3	0	0	3
Pre-requisite: Basic knowledge in Algebra and Calculus at the under graduate level		**Course Category:** Supportive Course **Course Type :** Theory			

Course Objective(s)

The main objective of this course is to demonstrate various analytical skills in applied mathematics and extensive experience with the tactics of problem solving and logical thinking applicable for engineering. This course will also help the students to identify, formulate, abstract and solve problems in engineering using mathematical tools from variety of mathematical areas, including matrix theory, probability, random variables, queueing theory, classical optimization and linear programming.

Course Outcome(s):

Upon successful completion of this course, students will be able to

CO1 : Evaluate norms, generalized eigen vector, Pseudo Inverse and QR decomposition of a Matrix.

CO2 : Understand the concept of probability, random variables, various probability distributions and its applications.

CO3 : Apply the techniques of Queueing models in real life situations.

CO4 : Understand the various concepts of classical optimization techniques.

CO5 : Apply graphical method, Simplex method and Dual Simplex method to solve Linear Programming Problems and also solving Transportation problems.

Unit 1 : MATRIX THEORY

Matrix Norms - Jordan Canonical form – Generalized Eigen vectors - Pseudo Inverse – QR-decomposition – QR Algorithm.

Unit 2 : PROBABILITY AND RANDOM VARIABLES

Probability – conditional probability - Random variables – Mathematical Expectation – Moments - Moment Generating function - Binomial, Poisson, Geometric, Uniform, Exponential and Normal Distributions – Function of a random variable.

Unit 3 : QUEUEING MODELS

Markovian Queues - Single and multi server models – Little's formula - Steady state analysis – Queuing applications.

Unit 4 : CLASSICAL OPTIMIZATION TECHNIQUES

Classification – optimization technique - Unconstrained Optimization – Equality constraints – Inequality constraints – Lagrange Multiplier method – Kuhn-Tucker Condition - Indirect search methods – Gradient of a function – Steepest descent method – Conjugate gradient method – Newton's method.

Unit 5 : LINEAR PROGRAMMING

Standard form of Linear programming problem – formation – graphical method - Simplex method – Dual simplex method – Transportation problem - Applications.

TEXT BOOK:

1. Bronson.R. Matrix operations, Second Edn., Schaum's Outline series, McGraw Hill Education, 2011.
2. Gupta S.C. and Kapoor V.K. Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 2014.
3. Taha H A, "Operations Research, An Introduction", 9th Edn., Pearson Education, 2016.
4. Singiresu S.Rao ,Engineering Optimization: Theory and Practice, Fourth Edition, New Age International (P) Ltd, 2009.

REFERENCES :

1. S.D.Sharma, Operations Research, Kedar Nath Ram Nath & co, 2008.
2. Sheldon M. Ross, Probability and Statistics for Engineers and Scientists, Fifth Edn., Elsevier India, 2014.

PGM18R5001	Research Methodology	L	T	P	Credit
		3	0	0	1
Course Category :		**Course Type :** Supporting Course			

COURSE OUTCOMES

CO1 : To understand the basic concepts of research and its methodologies.
CO2 : To select and define appropriate research problems.
CO3 : To solve statistical problems and probability distributions.
CO4 : To process and analysis the methods of data collection.
CO5: To recognize the powerfulness of the soft computing tools and to formulate the optimization problems and write a research report, thesis and proposal.

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.

REFERENCES

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for
2. science & engineering students’”
3. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
   Ranjit Kumar, 2 ndEdition, “Research Methodology: A Step by Step Guide for beginners”

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

Program Specific Electives

CSE18R5005	MACHINE LEARNING	L	T	P	Credit
		0	3	0	3
Course Category : Theory		**Course Type : Elective**			

PREREQUISITE

Soft computing

COURSE OBJECTIVES

1. To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
2. To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
3. Explore supervised and unsupervised learning paradigms of machine learning.
4. To explore Deep learning technique and various feature extraction strategies.

COURSE OUTCOMES

CO1: Extract features that can be used for a particular machine learning approach in various IOT applications.
CO2: 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
CO3: To mathematically analyse various machine learning approaches and paradigms.

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S			S	M		S					S	
CO3			S	M				S		S	M	S		
CO4		S		S	S		M				S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I Supervised Learning (Regression/Classification)

Basic methods: Distance-based methods, Nearest-Neighbours, 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 II: 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 III

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests.

UNIT IV

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning

UNIT V

Scalable Machine Learning (Online and Distributed Learning) - A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference- Reecent trends in various learning techniques of machine learning and classification methods for IOT applications - Various models for IOT applications.

REFERENCES

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

CSE18R5007	SECURE SOFTWARE DESIGN & ENTERPRISE COMPUTING	L	T	P	C
		3	0	0	3
Course Category : Theory		**Course Type : Elective**			

PREREQUISITE

Software Engineering

COURSE OBJECTIVES

To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic

COURSE OUTCOMES

CO1: To fix software flaws and bugs in various software.
CO2: To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic
CO3: Implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
CO4: Design and develop secure software containing minimum vulnerabilities and flaws.

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S			S	M		S					S	
CO3			S	M				S		S	M	S		
CO4		S		S	S		M				S	S	S	

UNIT I Secure Software Design

Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, Perform security testing and quality assurance.

UNIT II Enterprise Application Development

Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

UNIT III Enterprise Systems Administration

Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

UNIT IV

Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

UNIT V

handle insecure exceptions and command/sql injection, defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.

REFERENCES

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley.

CSE18R5008	DATA PREPARATION AND ANALYSIS	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISITE

Mathematics

COURSE OBJECTIVE

To prepare data for analysis, perform exploratory data analysis, and develop meaningful data visualizations. To prepare datasets for analysis by cleaning and reformatting Apply a variety of different data exploration techniques including summary statistics and visualization methods

COURSE OUTCOMES

CO1: Understand the data gathering and preparation
CO2: Evaluate the data cleaning
CO3: Creating exploratory analysis
CO4: Design the visualization.

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2								S						
CO3								S		S	M			S
CO4		S		S	S						S	S		

UNIT I: DATA GATHERING AND PREPARATION

Data formats, parsing and transformation, Scalability and real-time issues

UNIT II: DATA CLEANING

Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation

UNIT III: EXPLORATORY ANALYSIS

Descriptive and comparative statistics, Clustering and association, Hypothesis generation

UNIT IV : VISUALIZATION

Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity

REFERENCES

Making sense of Data : A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt

CSE18R5009	COMPUTATIONAL GAME THEORY	L	T	P	C
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISITE

Computer Networks

COURSE OBJECTIVES

- To introduce the key models and solution concepts of non-cooperative and cooperative game theory;
- To introduce the issues that arise when computing with game theoretic solution concepts, and the main approaches to overcoming these issues, and to illustrate the role that computation plays in game theory;
- To introduce a research-level topic in computational game theory.
- To provides an introduction to the area of computational game theory and economics (and its applications), to study the latest developments in this recent research area, and to identify open problems and opportunities for future research, as well as potential, novel application domains.

COURSE OUTCOMES

CO1: Understand the key concepts of preferences, utility, and decision-making under certainty and uncertainty, and the key computational issues in 1representing and manipulating representations of preferences and utility;

CO2: Understand and be able to apply the key models and solution concepts of non-cooperative game theory, including both strategic form and extensive form games, and the key computational issues that arise when applying these models;

CO3: Understand a contemporary research-level topic at the intersection between game theory and computer science

CO4: Understand and be able to apply the key models and solution concepts of cooperative game theory, including TU and NTU games;

CO5: Apply Vickrey andd VGC mechanism to design Game theory

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S			S		S		S				S		
CO2		S			S									S
CO3				S			M				M	M		
CO4							S	L	L	S		S	S	
CO5		S							L				S	S

UNIT I INTRODUCTION

Introduction – Making rational choices: basics of Games – strategy - preferences – payoffs – Mathematical basics -Game theory –Rational Choice - Basic solution concepts-non-cooperative versus cooperative games - Basic computational issues - finding equilibria and learning in

games- Typical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets).

UNIT II GAMES WITH PERFECT INFORMATION

Games with Perfect Information - Strategic games - prisoner's dilemma, matching pennies- Nash equilibria- theory and illustrations - Cournot's and Bertrand's models of oligopoly- auctions- mixed strategy equilibrium- zero-sum games- Extensive Games with Perfect Information- repeated games (prisoner's dilemma)- subgame perfect Nash equilibrium; computational issues.

UNIT III GAMES WITH IMPERFECT INFORMATION

Games with Imperfect Information - Bayesian Games – Motivational Examples – General Definitions –Information aspects – Illustrations - Extensive Games with Imperfect -Information - Strategies-Nash Equilibrium – Beliefs and sequential equilibrium – Illustrations - Repeated Games – The Prisoner's Dilemma – Bargaining

UNIT IV NON-COOPERATIVE GAME THEORY

Non-cooperative Game Theory - Self-interested agents- Games in normal form - Analyzing games: from optimality to equilibrium - Computing Solution Concepts of Normal-Form Games – Computing Nash equilibria of two-player, zero-sum games -Computing Nash equilibria of two-player, general-sum games - Identifying dominated strategies

UNIT V MECHANISM DESIGN

Aggregating Preferences-Social Choice – Formal Model- Voting - Existence of social functions - Ranking systems - Protocols for Strategic Agents: Mechanism Design - Mechanism design with unrestricted preferences- Efficient mechanisms - Vickrey and VCG mechanisms (shortest paths) - Combinatorial auctions - profit maximization Computational applications of mechanism design -applications in Computer Science - Google's sponsored search - eBay auctions

REFERENCES

1. M. J. Osborne, An Introduction to Game Theory. Oxford University Press, 2004.
2. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani (Editors), Algorithmic Game Theory. Cambridge University Press, 2007.
3. M. J. Osborne and A. Rubinstein, A Course in Game Theory. MIT Press, 1994.
4. A.Dixit and S. Skeath, Games of Strategy, Second Edition. W W Norton & Co Inc, 2004.
5. Yoav Shoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press 2008
6. Zhu Han, Dusit Niyato,Walid Saad,Tamer Basar and Are Hjorungnes, “Game Theory in Wireless and Communication Networks”, Cambridge University Press, 2012

CSE18R5010	BIO INFORMATICS	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

COURSE OBJECTIVE

The basic objective is to give students an **introduction** to the basic practical techniques of bioinformatics. Emphasis will be given to the **application** of bioinformatics and biological databases to problem solving in real research problems.

COURSE OUTCOMES

CO1: Understand the need for bio informatics
CO2: Design the various search engine, visualization and algorithms
CO3: Analyze the statistics and data mining concepts
CO4: Evaluate the various pattern matching techniques
CO5:Applying the various modeling and simulation

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1		S		S			S					S	M	
CO2		S		S			M	S				S		
CO3			S					S		S	M			S
CO4	S	S		S	M						S	S	M	
CO5		S		S	S	S		S	M				M	

UNIT I INTRODUCTORY CONCEPTS

The Central Dogma – The Killer Application – Parallel Universes – Watson's Definition – Top Down Versus Bottom up – Information Flow – Convergence – Databases – Data Management – Data Life Cycle – Database Technology – Interfaces – Implementation – Networks – Geographical Scope – Communication Models – Transmissions Technology – Protocols – Bandwidth – Topology – Hardware – Contents – Security – Ownership – Implementation – Management

UNIT II SEARCH ENGINES, VISUALIZATION AND ALGORITHMS

The search process – Search Engine Technology – Searching and Information Theory – Computational methods – Search Engines and Knowledge Management – Data Visualization – sequence visualization – structure visualization – user Interface –Animation Versus simulation – General Purpose Technologies - Exhaustive search – Greedy – Dynamic programming – divide and conquer – graph algorithms

UNIT III STATISTICS AND DATA MINING

Statistical concepts – Microarrays – Imperfect Data – Randomness – Variability – Approximation –Interface Noise – Assumptions – Sampling and Distributions – Hypothesis Testing – Quantifying Randomness – Data Analysis – Tool selection statistics of Alignment – Clustering and Classification –Data Mining – Methods –Selection and Sampling – Preprocessing and Cleaning – Transformation and Reduction – Data Mining Methods – Evaluation – Visualization – Designing new queries – Pattern Recognition and Discovery – Machine Learning – Text Mining – Tools.

UNIT IV PATTERN MATCHING

Pairwise sequence alignment – Local versus global alignment – Multiple sequence alignment – Computational methods – Dot Matrix analysis – Substitution matrices –Dynamic Programming – Word methods – Bayesian methods – Multiple sequence alignment – Dynamic Programming – Progressive strategies – Iterative strategies –Tools – Nucleotide Pattern Matching – Polypeptide pattern matching– Utilities –Sequence Databases.

UNIT V MODELING AND SIMULATION

Drug Discovery – components – process – Perspectives – Numeric considerations – Algorithms – Hardware – Issues – Protein structure – AbInitio Methods – Heuristic methods – Systems Biology – Tools – Collaboration and Communications – standards -Issues – Security – Intellectual property.

REFERENCES

1. Bryan Bergeron, “Bio Informatics Computing”, Second Edition, Pearson Education, 2003.
2. T.K.Attwood and D.J. Perry Smith, “Introduction to Bio Informatics, Longman Essen,1999.
3. An Introduction to, Bioinformatics Algorithms (Computational Molecular Biology) , “Neil C.Jones,PaveA. Pevzner”, MIT Press 2004.

CSE18R5011	EMBEDDED SYSTEMS	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISITE

Computer Architecture

COURSE OBJECTIVE

The main **objective** of the **course** is to get students familiar with the typical problems and constraints that arise when designing and developing **embedded systems**. .

COURSE OUTCOMES

CO1: Understand the fundamentals of embedded system and hardware
CO2: Analyze the various software architecture for embedded system.
CO3: Developing real time operating system.
CO4: Design the real time operating system using embedded system.
CO5: Testing and debugging an example system.

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S		S	S			S					S	
CO3			S					S		S	M			S
CO4		S		S	S						S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I INTRODUCTION TO EMBEDDED SYSTEM AND HARDWARE FUNDAMENTALS

Examples of Embedded Systems-Typical Hardware- Terminology-Gates-A Few Other Basic Considerations-Timing Diagrams-Memory- Interrupts: Microprocessor Architecture-Interrupt Basics-The Shared-Data Problem-Interrupt Latency.

UNIT II SOFTWARE ARCHITECTURES FOR EMBEDDED SYSTEMS

Round-Robin-Round-Robin with Interrupts-Function-Queue-Scheduling Architecture-Real-Time Operating System Architecture-Selecting an Architecture Forth/Open Firmware: Introducing Forth-. String Words-Stack Manipulation- Creating New Words Comments- if ... else- Loops-. Data Structures-Interacting with Hardware and Memory Forth Programming Guidelines

UNIT III INTRODUCTION TO REAL-TIME OPERATING SYSTEMS

Tasks and Task States-Tasks and Data-Semaphores and Shared Data-Operating System **Services-**Message Queues, Mailboxes, and Pipes-Timer Functions-Events-Memory Management-Interrupt Routines in an RTOS Environment.

UNIT IV BASIC DESIGN USING A REAL-TIME OPERATING SYSTEM

Overview-Principles-An Example-Encapsulating Semaphores and Queues-Hard Real-Time Scheduling Considerations-Saving Memory Space-Saving Power-Embedded Software Development Tools-Host and Target Machines.-Linker/Locators for Embedded Software-Getting Embedded Software into the Target System

UNIT V DEBUGGING TECHNIQUES AND AN EXAMPLE SYSTEM

Testing on Your Host Machine-Instruction Set Simulators-The assert Macro-Using Laboratory Tools-An Example System-What the Program Does-Environment in Which the Program Operates-A Guide to the Source Code-Source Code.

TEXT BOOKS

1. David Simon , An Embedded Software Primer, Addison Wesliey.
2. John Catsoulis, Designing Embedded Hardware, O'Reilly Publications, 2005

REFERENCE

1. Raj Kamal, Embedded Systems: Architecture and Programming ,Mc Graw Hill publications,1st Edition,2003.

CSE18R5012	IMAGE PROCESSING AND ANALYSIS	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISTE

Mathematics III

COURSE OBJECTIVE

To learn and understand the fundamentals of digital image processing, and various image Transforms, Image Enhancement Techniques, Image restoration Techniques and methods, image compression and Segmentation used in digital image processing.

COURSE OUTCOMES

CO1: Elaborate the fundamental concepts of a digital image processing system
CO2: Compare different image transforms techniques
CO3: Apply image enhancement techniques.

CO4: Understand the concept of restoration techniques
CO5: Analyze and compress given images using segmentation techniques.

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S											S		
CO2	S	S											S	
CO3				S								M		S
CO4				M	S							S	S	
CO5				S	S		M			S	S		S	

UNIT I IMAGE PROCESSING FUNDAMENTALS

Introduction – Elements of visual perception, Steps in Image Processing Systems – Digital Imaging System - Image Acquisition – Sampling and Quantization – Pixel Relationships – File Formats – colour images and models - Image Operations – Arithmetic, logical, statistical and spatial operations.

UNIT II IMAGE ENHANCEMENT AND RESTORATION

Image Transforms -Discrete and Fast Fourier Transform and Discrete Cosine Transform,Spatial Domain - Gray level Transformations Histogram Processing Spatial Filtering – Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain – Smoothing and Sharpening filters – Homomorphic Filtering., Noise models, Constrained and Unconstrained restoration models.

UNIT III IMAGE SEGMENTATION AND MORPHOLOGY

Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Motion Segmentation, Image Morphology: Binary

and Gray level morphology operations - Erosion, Dilation, Opening and Closing Operations Distance Transforms- Basic morphological Algorithms. Features – Textures - Boundary representations and Descriptions- Component Labeling – Regional descriptors and Feature Selection Techniques.

UNIT IV IMAGE ANALYSIS AND CLASSIFICATION

Image segmentation- pixel based, edge based, region based segmentation. Active contour models and Level sets for medical image segmentation, Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, feature and statistical image classification.

UNIT V IMAGE REGISTRATION AND VISUALIZATION

Rigid body visualization, Principal axis registration, Interactive principal axis registration, Feature based registration, Elastic deformation based registration, Image visualization – 2D display methods, 3D display methods, virtual reality based interactive visualization.

REFERENCES

1. Alasdair McAndrew, ―Introduction to Digital Image Processing with Matlab,Cengage Learning 2011,India
2. Anil J Jain, ―Fundamentals of Digital Image Processing‖, PHI, 2006.
3. Kavyan Najarian and Robert Splerstor,‖ Biomedical signals and Image processing,CRC – Taylor and Francis, New York, 2006
4. Rafael C.Gonzalez and Richard E.Woods, ―Digital Image Processing‖, Third Edition, Pearson Education, 2008, New Delhi
5. S.Sridhar, ―Digital Image Processing‖, Oxford University Press, 2011

CSE18R5013	NATURAL LANGUAGE PROCESSING	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISITE

Mathematics II

COURSE OBJECTIVE

This course introduces the fundamental concepts and techniques of natural language processing (NLP). Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information. The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.

COURSE OUTCOME

CO1: How key concepts from NLP are used to describe and analyze language
CO2: POS tagging and context free grammar for English language
CO3: Understanding semantics and pragmatics of English language for processing
CO4: Writing programs in Python to carry out natural language processing

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S							S		S	S		
CO2		S		S									S	
CO3		S					S		S	S	M	M		S
CO4					S				S		S	S	S	

UNIT I INTRODUCTION

Introduction: Knowledge in speech and language processing – Ambiguity – Models and Algorithms – Language Thought and Understanding. Regular Expressions and automata: Regular expressions – Finite-State automata. Morphology and Finite-State Transducers: Survey of English morphology – Finite-State Morphological parsing – Combining FST lexicon and rules – Lexicon-Free FSTs: The porter stammer – Human morphological processing.

UNIT II SYNTAX

Constituency – Context-Free rules and trees – Sentence-level constructions – The noun phrase – Coordination – Agreement – The verb phase and sub categorization – Auxiliaries – Spoken language syntax – Grammars equivalence and normal form – Finite-State and Context-Free grammars – Grammars and human processing. Parsing with Context-Free Grammars: Parsing as search – A Basic Top-Down parser – Problems with the basic Top-Down parser – The early algorithm – Finite-State parsing methods.

UNIT III SEMANTIC

Syntax-Driven semantic analysis – Attachments for a fragment of English – Integrating semantic analysis into the early parser – Idioms and compositionality – Robust semantic analysis. Lexical

semantics: relational among lexemes and their senses – WordNet: A database of lexical relations – The Internal structure of words – Creativity and the lexicon

UNIT IV NATURAL LANGUAGE GENERATION

Introduction to language generation – Architecture for generation – Surface realization – Discourse planning – Other issues.

UNIT V MACHINE TRANSLATION

Language similarities and differences – The transfer metaphor – The interlingua idea: Using meaning – Direct translation – Using statistical techniques – Usability and system development.

TEXT BOOK

1. Daniel Jurafsky and James Martin H, Speech and Language Processing, Pearson Education Pvt Ltd., Singapore, 2003.

REFERENCE

1. James Allen, Natural Language Understanding, Pearson Education, 2003.

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CSE18R5014	AD-HOC AND WIRELESS SENSOR NETWORK	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISITE

Computer Network

COURSE OUTCOMES

CO1: Analyze the various issues in Ad Hoc Networks
CO2: Design the solution for QOS issues in Ad Hoc Networks
CO3: Applying the various routing protocols on wireless sensor networks
CO4: Design the solution for QOS issues in wireless sensor networks.
CO5: Design the secure routing protocols for Ad Hoc and sensor networks

PO/PSO	Pos											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S		S	S			S					S	
CO3			S					S		S	M			S
CO4		S		S	S						S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I MAC & ROUTING IN AD HOC NETWORKS

Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – MAC Protocols Using Directional Antennas – Multiple- Channel MAC Protocols – Power-Aware MAC Protocols – Routing in Ad hoc Networks – Design Issues – Proactive, Reactive and Hybrid Routing Protocols

UNIT II TRANSPORT & QOS IN AD HOC NETWORKS

TCP‟s challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions – Network Layer QoS solutions – QoS Model

UNIT III MAC & ROUTING IN WIRELESS SENSOR NETWORKS

Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – Contention-Based protocols – Schedule-Based protocols –Zig bee – Topology Control – Routing Protocols

UNIT IV TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS

Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks –Congestion Control – In-network processing – Operating systems for wireless sensor networks –Examples. **Introduction to ns-3: I**ntroduction to Network Simulator 3 (ns-3), Descriptionof the ns-3 core module and simulation example.

UNIT V SECURITY IN AD HOC AND SENSOR NETWORKS

Security Attacks – Key Distribution and Management – Intrusion Detection – Software based Anti-tamper techniques – Water marking techniques – Defense against routing attacks - Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols SPINS

REFERENCES

1. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, "Ad-Hoc Mobile Wireless Networks", Auerbach Publications, 2007.
2. Holger Karl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", Wiley India Private Limited, 2011.
3. Erdal Çayirci ,Chunming Rong, "Security in Wireless Ad Hoc and Sensor Networks", John Wiley and Sons, 2009.
4. C. Siva Ram Murthy and B.S. Manoj, "Ad Hoc Wireless Networks – Architectures and Protocols",Pearson Education, 2004.
5. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks: Theory and Applications", World Scientific Publishing, Second Edition, 2011.
6. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", Wiley India Private Limited, 2014.
7. Adrian Perrig, J.D. Tygar, "Secure Broadcast Communication: In Wired and Wireless Networks", Kluwer Academic Publishers, Springer, 2002.

CSE18R5015	MOBILE APPLICATION DEVELOPMENT	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISITE

Computer networks, Mobile Computing

COURSE OBJECTIVE

To learn Mobile application development frameworks; Architecture, design and engineering issues, techniques, methodologies for mobile application development.

COURSE OUTCOMES

CO1: Exposed to technology and business trends impacting mobile applications
CO2: Competent with the characterization and architecture of mobile applications.
CO3: Understand the enterprise scale requirements of mobile applications
CO4: design and developing mobile applications using one application development framework
CO5: Build Derby App using IOS

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S											S		
CO2		S												S
CO3				S								M		
CO4							S			S		S	S	
CO5		S							L				S	S

UNIT I INTRODUCTION

Preliminary Considerations – Cost of Development – Importnace of Mobile Strategies in Business World – Mobile Web Presence – Mobile Applications – Marketing – Web Services for Mobile Devices – Creating Example Web Service _ Debugging Web Sevice

UNIT II MOBILE USER INTERFACE DESIGN

Effective Use of Screen Real Estate – Understanding Mobile Application Users – Understanding Mobile Information Design – Understanding Mobile Platforms – Using the Tools for Mobile Interface Design – Choosing a Mobile Web Option – Adaptive Mobile Website – Mobile Web Applications with HTML 5

UNIT III ANDROID APPLICATION DEVELOPMENT

Getting to know the Android User Interfaces – Designing Your User interface using Views – Displaying Pictures and Menus with Views – Using Image views to Display pictures – Using menus with views – Data Persistence – Saving and loading user performances - Persisting data to files – Creating and using Data bases – Content Providers.

UNIT IV ANDROID MESSAGING, NETWORKING, LOCATION BASED SERVICES

SMS Messaging, Sending E-mail – Networking – Downloading Binary Data, Text Files- Accessing Web Services – Performing Asynchronous Calls – Location Based Services – Displaying Maps – Getting Location Data – Creating your own services – Communicating between a service and an activity – Binding activities to Services

UNIT V IOS AND WINDOWS PHONE

Getting started with iOS – iOS Project – Debugging iOS Apps – Objective C Basics – Hello Word App – Building the derby app in iOS – Windows Phone 7 Project – Building Derby App in Windows Phone 7.

REFERENCES

1. Jeff McWherter and Scott Gowell, Professional Mobile Application Development, Wrox 2012.
2. Wei – Meng Lee, Beginning Android Application Development, Wiley 2011
3. Charlie Collins, Michael Galpin and Matthias Kappler, Android in Practice, Dream Tech. 2012
4. James Dovey and Ash Furrow, Beginning Objective C, Apress, 2012
5.David Mark, Jack Nutting, Jeff LaMouche, and Fredric Olsson, Beginning iOS6 Development: Exploring the iOS SDK, Apress, 2013.

CSE18R5016	BIO INSPIRED ARTIFICIAL INTELLIGENCE	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISITE

Artificial Intelligence
Bio informatics

COURSE OBJECTIVE

This course introduces the fundamental concepts and techniques of bio informatics & artificial intelligence. Students will gain an in-depth understanding of the computational properties of artificial intelligence and the commonly used algorithms for bio informatics and the more recent statistical approaches.

COURSE OUTCOME

CO1: How key concepts from AI are used to describe and analyze bio informatics
CO2: POS tagging and evolutionary systems
CO3: Understanding the concepts of neural & fuzzy systems
CO4: Analyze the immune systems and collective systems in bio informatics
CO5: Evaluate the behavioral system based on AI.

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S											S		
CO2		S												S
CO3				S								M		
CO4							S			S		S	S	
CO5		S							L				S	S

UNIT I EVOLUTIONARY SYSTEMS

Evolutionary Systems – Artificial Evolution - Genetic Representations - Evolutionary Measures - Types of Evolutionary Algorithms - Schema Theory. Evolutionary Computation- Representation- Selection- Reproduction. Genetic Algorithms - Canonical Genetic Algorithm – Crossover- Mutation - Control Parameters – Applications. Genetic Programming - Tree-Based Representation – Building Block Genetic Programming –Applications. Evolutionary Programming – Basics –Operators -StrategyParameters -Evolutionary Programming Implementations

UNIT II NEURAL AND FUZZY SYSTEMS

Neural Networks - Biological Nervous Systems - Artificial Neural Learning - Architecture. Unsupervised Learning - Self-Organizing Feature Maps. Supervised Learning – Types- Learning Rules. Radial Basis Function Networks. Reinforcement Learning – Model Free - Neural Networks and Reinforcement Learning. Fuzzy Systems- Fuzzy Sets – Logic and Reasoning – Controllers- Rough Sets.

UNIT III CELLULAR AND DEVELOPMENT SYSTEMS

Cellular Systems - The Basic Ingredients - Cellular Automata -Modeling - Classic Cellular Automata – Other Cellular Systems – Computation - Artificial Life - Complex Systems - Analysis and Synthesis of Cellular Systems. Developmental Systems - Potential Advantages of a Developmental Representation -Rewriting Systems - Synthesis of Developmental Systems - Evolution and Development – Defining Artificial Evolutionary Developmental Systems - Evolutionary Rewriting Systems –Developmental Programs and Processes

UNIT IV IMMUNE SYSTEMS AND COLLECTIVE SYSTEMS

Natural Immune systems - Classical View -Working -Constituents of Biological Immune Systems - Immunity Types - Learning the Antigen Structure - The Network Theory - The Danger Theory –Artificial Immune Systems - Algorithms - Classical View Models - Clonal Selection Theory Models – Network Theory Models - Danger Theory Models - Applications and Other AIS models Applications- Biological Self-Organization - Particle Swarm Optimization - Basics - Social Network Structures – Variations - Basic PSO Parameters - Optimization - Applications. Ant Colony Optimization – Cemetery Organization and Brood Care - Division of Labor – Applications

UNIT V BEHAVIORAL SYSTEMS

Behavioral Systems - Behavior in Cognitive Science - Behavior in Artificial Intelligence – Behavioral Systems – Behavior Based Robots –Evolution - Co-evolution - Learning and Self Reproduction of Behavioral Systems. Cultural Algorithms - Culture and Artificial Culture - Cultural Algorithm – Belief Space – Fuzzy Cultural Algorithms – Applications. Co-evolution – Types - Competitive and Cooperative Co-evolution.

REFERENCES

1. Claudio Mattiussi, Dario Floreano "Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies" (Intelligent Robotics and Autonomous Agents series), MIT Press, 2008
2. Andries P. Engelbrecht, "Computational Intelligence: An Introduction", 2nd Edition , Wiley; 2007
3. Russell C. Eberhart, Yuhui Shi Computational Intelligence: Concepts to Implementations, Morgan Kaufmann; 1 edition 2007

CSE18R5017	NANO COMPUTING	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

COURSE OBJECTIVES

This course is intended to provide the students with the prospects, challenges, Imperfections, reliability and with insight into Nanoscale Quantum Computing and QCA implementation.

COURSE OUTCOMES

CO1: Understand the devices
CO2: Applying the quantum concepts
CO3: Understand the fundamentals of chemistry
CO4: Analyze the quantum computation
CO5: Applying nano technology concepts in real time environment

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S			S	M		S					S	
CO3			S	M				S		S	M	S		
CO4		S		S	S		M				S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I DEVICES

Overview of current research in nano-scale electronics and devices, Semiconductor and Device 1(Materials and building blocks),Semiconductor and Device 2(Photonic Device and Materials),CMOS Device ,Limit of CMOS technology-Scaling Theory

UNIT II QUANTUM CONCEPTS

Nano-Physics-Quantum Mechanics, Quantum Device 1-Length Scales/Transport, Quantum Device 2-Ballistic Electron Transport, Coulomb Blockade, RTD, Electron-Wave Coupling Devices

UNIT III FUNDAMENTALS OF CHEMISTRY

Fundamental of chemistry, Organic Chemistry, Molecular Electronics I,(Molecular Semiconductors and Metals),Molecular Electronics II(Logic Gates),Carbon Nano tube and Its Application, Spintronics I, Spintronics II

UNIT IV QUANTUM COMPUTATION

Quantum Computation I, Quantum Computation II,DNA Computation, Nano-Fabrication 1,-photolithography, Nano- Fabrication 2,: e-beam lithography,: Advanced Nano-lithography

UNIT V NANO CONCEPTS

Nano-Fabrication 3,: Thin Film Technology:-- MBE, CVD, PECVD, - LB and Self Assembly, Spun-Coating - Nano- Characterization 1 - Scanning Probe Microscopy – Electron Microscopy

(TEM, SEM),Nano-Characterization 2 – Photon Spectroscopy - Electron Spectroscopy - Nanomanipulator

TEXT BOOK

1. Rainer Waser , Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices, Wiley- VCH, April 2003.

REFERENCES

1. Sandeep Shukla and R. Iris Bahar, et al, Nano, Quantum and Molecular Computing, Kluwer Academic Publishers, 2004.
2. Poole Jr C.P.., Owens F.J. , Introduction to Nanotechnology, Wiley, 2003.
3. Petty M.C., Bryce , and D. Bloor ,Introduction to Molecular Electronics, Edward Arnold , 1995.

CSE18R5018	Data Science	L	T	P	Credit
		0	3	0	3
Course Category : Theory		**Course Type :** Elective			

COURSE OBJECTIVES

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

COURSE OUTCOMES

CO1: Explain how data is collected, managed and stored for data science;
CO2: Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists;
CO3: Implement data collection and management scripts using MongoDB

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S			S	M		S					S	
CO3			S	M				S		S	M	S		
CO4		S		S	S		M				S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications

UNIT II

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources

UNIT III

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance,Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

UNIT IV

Data visualisation:Introduction, Types of data visualisation,Data for visualisation:Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings

UNIT V

Applications of Data Science,Technologies for visualisation, Bokeh (Python) Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

REFERENCES

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.

CSE18R5019	NETWORK FORENSICS	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISTE

1.Wireless Networks
2.Network Security

COURSE OBJECTIVE

1.Able to understand types of attack and its mitigation strategies.
2.Able to analyze and apply methodologies at different Network behavior
3.Able to understand and differentiate the normal and unusual behavior of Network devices.

COURSEOUTCOME

CO1:Understand the basic Network Forensic methodologies used in data acquisition.
CO2: Analyze the traffic flow characteristics in Networks.
CO3: Analyze the wireless Network attacks and mitigation strategies.
CO4: Understand the functions of Network devices used in Network forensic study.
CO5: Understand the Malware Evolution and its Network behavior.

	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S											S		
CO2		S												S
CO3				S								M		
CO4							S			S		S	S	
CO5		S							L				S	S

UNIT I INTRODUCTION

Practical Investigative Strategies – Real World Class – Footprints – Concepts in Digital Evidence – Challenges relating to Network Evidence – Network Forensics Investigative Methodology – Technical Fundamentals – Sources of Network Based Evidences – Evidence Acquisition – Physical Interception – Traffic Acquisition Software – Active Acquisition.

UNIT II TRAFFIC ANALYSIS

Packet Analysis – Protocol Analysis - Flow Analysis – Higher – Layer Traffic Analysis – Case Study – Statistical Flow Analysis – Sensors – Flow Record Export Protocol – Collection and Aggregation – Analysis – Case Study

UNIT III WIRELESS NETWORK FORENSICS AND IDS

Wireless Access Points – Wireless Traffic Capture and Analysis – Common Attacks – Locating Wireless Devices – Case Study – Network Intrusion Detection and Analysis – Types of NIDS/NIPS – NIDS/NIPS Evidence Acquisition – Comprehensive Packet logging – Snort – Case Study

UNIT IV NETWORK DEVICES AND SERVERS

Event Log Aggregation, Correlation and Analysis – Sources of Logs – Network Log Architecture – Collecting and Analysing Evidences – Case Study – Switches , Routers and Firewalls – Interfaces – Logging – Case Study - Web Proxies – Web Proxy Functionality – Evidence- Squid – Web Proxy Analysis – Encrypted Web Traffic - Case Study

UNIT V ADVANCED TOPICS

Network Tunneling – Tunneling for Functionality - Tunneling for Confidentiality - Covert Tunneling – Case Study – Malware Forensics – Trends in Malware Evolution – Network Behavior of Malware – The future of Malware and Network Forensics – Case Study

REFERENCES

1. Sheri Davidoff and Jonathan Han, Network Forensics – Tracking Hackers through Cyberspace, Prentics Hall, 2012.
2. William J Buchanan, Introduction to Security and Network Forensics, CRC Press, 2011.
3. Kevin Mandia, Chris Prosise, Incident Response and computer forensics, Tata McGrawHill, 2006.
4. Bill Nelson, Amelia Philips and Christopher Steuart, Guide to computer forensics and investigations, course technology, Cengage Learning; 4thedition, ISBN: 1-435-49883-6, 2009.

CSE18R5020	SOCIAL NETWORK ANALYSIS	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PRE-REQUISITE

Computer Network

COURSE OBJECTIVES

- Social Network Analysis(SNA) has become a widely applied method In research and business for inquiring the web of relationships on the individual, organizational and societal level. With Ready access to Computing power,the popularity of social networking websites such as Facebook, and automated data collection technique the demand for solid expertise in SNA has Recently exploded. In this course, students learn how to conduct SNA projects and how to approach SNA with theoretic, methodological, and computational rigor.

COURSE OUTCOMES

CO1**:** Formalize different types of entities and relationships as nodes and edges and represent this information as relational data.
CO2: Plan and execute network analytical computations.
CO3: Use advanced network analysis software to generate visualizations and perform empirical investigations of network data.
CO4: Interpret and synthesize the meaning of the results with respect to a question, goal, or task.
CO5: Collect network data in different ways and from different sources while adhering to legal standards and ethics standards.

	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S		S	S			S					S	
CO3			S					S		S	M			S
CO4		S		S	S						S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I INTRODUCTION TO SOCIAL NETWORK ANALYSIS

Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web - Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis - Electronic discussion networks, Blogs and online communities, Web-based networks - Applications of Social Network Analysis.

UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION

Ontology and their role in the Semantic Web - Ontology-based Knowledge Representation – Ontology languages for the Semantic Web – RDF and OWL **-** Modelling and aggregating social

network data - State-of-the-art in network data representation, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data, Advanced Representations.

UNIT III EXTRACTION AND MINING COMMUNITITES IN WEB SOCIAL NETWROKS

Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Definition of Community - Evaluating Communities - Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Tools for Detecting Communitie Social Network Infrastructures and Communities - Decentralized Online Social Networks- Multi- Relational Characterization of Dynamic Social Network Communities.

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 10

Understanding and Predicting Human Behaviour for Social Communities - User Data Management, Inference and Distribution - Enabling New Human Experiences - Reality Mining - Context-Awareness - Privacy in Online Social Networks - Trust in Online Environment - Trust Models Based on Subjective Logic - Trust Network Analysis - Trust Transitivity Analysis - Combining Trust and Reputation – Trust Derivation Based on Trust Comparisons - Attack Spectrum and Countermeasures.

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 8

Graph Theory- Centrality- Clustering - Node-Edge Diagrams, Matrix representation, Visualizing Online Social Networks, Visualizing Social Networks with Matrix-Based Representations- Matrix + Node-Link Diagrams, Hybrid Representations - Applications - Covert Networks - Community Welfare - Collaboration Networks - Co-Citation Networks.

REFERENCES

1. Peter Mika, “Social networks and the Semantic Web”, Springer, 1st edition 2007.
2. Borko Furht, “Handbook of Social Network Technologies and Applications”, Springer,1st edition, 2010.
3. Guandong Xu , Yanchun Zhang and Lin Li, “Web Mining and Social Networking Techniques and applications”, Springer, 1st edition, 2011.
4. Dion Goh and Schubert Foo, “Social information retrieval systems: emerging technologies and applications for searching the Web effectively”, IGI Global snippet, 2008.
5. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, “Collaborative and social information retrieval and access: techniques for improved user modelling”, IGI Global snippet, 2009.
6. John G. Breslin, Alexandre Passant and Stefan Decker, “The Social Semantic Web”, Springer, 2009.

CSE18R5021	SOFTWARE DEFINED NETWORKING	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISITE

Computer Network

COURSE OBJECTIVES

In this course, students l learn about software defined networking and how it is changing the way communications networks are managed, maintained, and secured.

COURSE OUTCOMES

CO1: Understand the need for software defined networking
CO2: Analyze the various SDN controllers
CO3: Creating network function virtualization
CO4: Applying the various use cases for software defined networking
CO5: Design the openflow in software defined networking

	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1		S			S		S					S		
CO2		S		S			M	S					S	
CO3			S					S		S	M			S
CO4	S	S		S	M						S	S	M	
CO5		S		S	S	S		S	M			M		

UNIT I INTRODUCTION

Introduction – Centralised and Distributed Control and Data Planes – Evolution versus Revolution – The Control Plane – Data Plane – Moving Information between Planes – Distributed Control Planes – IP and MPLS – Creating IP Underlay – Convergence Time – Load Balancing – High availability – creating the MPLS overlay – Replication – Centralised Control Planes – ATM/LANE – Route Servers

UNIT II SDN CONTROLLERS

Introduction – General Concepts – Layer 3 Centric – Plexxi – Cisco OnePK – Network Programmability – The Management Interface – The Application – Network Divide – The Command line Interface – NETCONF and NETMOD- SNMP- Modern Programmatic Interfaces- I2RS – Modern Orchestration – OpenStack- CloudStack- Puppet.

UNIT III NETWORK FUNCTION VIRTUALISATION

The Multitenant Data Centre – The virtualized Multitenant Data Centre – SDN Solutions for the Data Centre Network – VLANs- EVPN – VxLAN – NVGRE – Network Function Virtualisations – Virtualisation snd Data Plane I/O – Services Engineered Path – Service Locations and Chaining – NFV at ETSI – Non- ETSI NFV Work

UNIT IV USE CASES

Use cases for Bandwidth Scheduling, Manipulation, and Calendaring – Bandwidth Calendaring – Big Date and Application Hyper – Virtualisation for Instant CSPF- Use cases for Data Centre Overlays, Big data, and Network Function Virtualisation – Use case for Input Traffic Monitoring, Classification, and Triggered Actions.

UNIT V OPENFLOW

Introduction to OpenFlow – Building Blocks – OpenFlow Messages – Northbound Interface-Implementing OpenFlow Switch – OpenFlow Reference Switch – Hardware Implementations – Software based Switches – Openflow in Cloud Computing.

REFERENCES

1. Thomas D.Nadeau and Ken Gray, Software Defined Networks, O'reilly, 2013
2. Siamak Azodolmolky, Software Defined Networking with OpenFlow, PACKT Publishing, 2013
3. Rajesh Kumar Sundarrajan, Software Defined Networking(SDN)- a definitive guide, e-book, March 2014.

CSE18R5022	GREEN COMPUTING	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

COURSE OBJECTIVES

At the end of the course, delegates will have adequate knowledge and skills to implement, operate and optimize green computing technologies for small, medium and large IT infrastructures.

COURSE OUTCOMES

CO1: Understand the fundamentals of green computing
CO2: Design green assets and modeling
CO3: Applying the grid frame work
CO4: Creating green compliance protocols, standards and audits
CO5: Applying green IT strategies and application to real time environment

	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S		S					S		
CO2		S		S	S			S					S	
CO3			S					S		S	M			S
CO4		S		S	S						S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I FUNDAMENTALS

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

UNIT II GREEN ASSETS AND MODELING

Green Assets: Buildings, Data Centers, Networks, and Devices - Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence Green Supply Chains – Green Information Systems: Design and Development Models.

UNIT III GRID FRAMEWORK

Virtualizing of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting –Materials recycling –Best ways for Green PC –Green Data center –Green Grid framework.

UNIT IV GREEN COMPLIANCE

Socio-cultural aspects of Green IT –Green Enterprise Transformation Roadmap –Green Compliance: Protocols, Standards, and Audits –Emergent Carbon Issues: Technologies and Future.

UNIT V CASE STUDIES

The Environmentally Responsible Business Strategies (ERBS) –Case Study Scenarios for Trial Runs –CASE STUDIES –Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

TEXT BOOKS

1. Bhuvan Unhelkar, Green IT Strategies andApplications-Using Environmental Intelligence, CRC Press, June 2016
2. Woody Leonhard, Katherrine Murray, Green Home computing for dummies, August 2009.

REFERENCES

1. Alin Gales, Michael Schaefer, Mike Ebbers, Green Data Center: steps for the Journey, Shoff/IBM rebook, 2011.
2. John Lamb, The Greening of IT, Pearson Education,2011
3. Jason Harris, Green Computing and Green IT-Best Practices on regulations & industry, Lulu.com, 2008.
4. Carl Speshocky, Empowering Green Initiatives with IT, John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), Green computing: Large Scale energy efficiency, CRC Press, 2012

CSE18R5023	MEDICAL IMAGEING RADIO THERAPY	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PRE-REQUISITE

Basic knowledge of Radiation Sources, Nuclear Physics, Radiobiology

COURSE OBJECTIVES

This course provides the necessary practical and theoretical background for the support of a radiotherapy physics service and medical imaging.

COURSE OUTCOMES

CO1: Demonstrate knowledge on basic operation principles of X-ray and CT imaging

CO2: Elaborate knowledge on basic operation principles of PET and SPECT imaging

CO3: Create knowledge on basic operation principles of MRI imaging

CO4: Understand a new medical imaging technique

CO5: Apply knowledge enough to develop an advanced medical imaging technique

	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S											S		
CO2		S		S			S		S		S			
CO3												M		
CO4		M			M		S			S		S	S	
CO5		S						M	L				S	

UNIT I X – RAYS

Principle and production of soft X – Rays, Selection of anodes, heel pattern, Scattered Radiation, Porter-Bucky systems, Cooling System, Testing for various parameters of the unit, principles of Angiography and Fluoroscopic Techniques, Image Intensifiers, Single plane and bi plane recording units, digital subtraction angiography, mammography, dental X- ray units.

UNIT II TOMOGRAPHY

Principle, Plane of Movement, Multisection Radiography, Computerized Axial Tomography, Type of Detection, image reconstruction, Spiral CT, Transverse Tomography,3D Imaging.

UNIT III EMISSION IMAGING

Alpha, Beta, Gamma Emission, different types of Radiation Detectors, G.M. & Proportional Counters, Pulse Height Analyzers, Isotopic, Scanners, Isotopic Diagnosis of RBC Destruction Rate, GI Bleedings Iron Concentration, Liver Functions, Functions of Gamma Camera, PET,SPECT,PET/CT.

UNIT IV MAGNETIC RESONANCE IMAGING

Principle of MRI, MRI instrumentation, Imaging Different Sections of the Body, Tissue Characterization, MR Spectroscopy, Functional MRI.

UNIT V THERAPY USING X – RAYS AND ISOTOPES

Direct and Indirect effects of high energy radiation, Units for radiation Exposure, Depth Dose curves, Linear Accelerator Betatron, Cobalt and Cesium Therapy, Computation of Absorbed Dose Level, Automatic Treatment Planning, Hazardous Effects of Radiation, Radiation measuring units, Allowed Levels, ICRP regulation Protection Methods.

REFERENCES:

1. Chesney D.N~ and Chesney M.O., X-Ray Equipments for Students Radiographer, Blackwell Scientific Publications, Oxford, 1971
2. Alexander, Kalender and Linke, Computer Tomography, John Wiley, Chich~ster, 1986.
3. Steve Webb, The Physics of Medical Imaging, Adam Hilger, Philadelpia,1988.
4. Peggy. W, Roger.D.Ferimarch, MRI for Technologists, Mc Graw Hill Publications, New York, 1995.
5. Donald Graham, Paul Cloke, Martin Vosper -Principles of Radiological physics, Churchill Livingston, 5th Edition 2005
6. Donald W.McRobbice, Elizabeth A.Moore, Martin J.Grave and Martin R.Prince MRI from picture to proton ,Cambridge University press, New York 2006.
7. Jerry L.Prince and Jnathan M.Links," Medical Imaging Signals and Systems"- Pearson Education Inc. 2006

CSE18R5024	PATTERN RECOGNITION	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISITE

Mathematics II and III

COURSE OBJECTIVE

Pattern recognition techniques are used to design automated systems that improve their own performance through experience. This course covers the methodologies, technologies, and algorithms of statistical pattern recognition from a variety of perspectives. Topics including Bayesian Decision Theory, Estimation Theory, Linear Discrimination Functions, Nonparametric Techniques, Support Vector Machines, Neural Networks, Decision Trees, and Clustering Algorithms etc. will be presented.

COURSE OUTCOMES

CO1. Understand basic concepts in pattern recognition
CO2. Gain knowledge about state-of-the-art algorithms used in pattern recognition research
CO3. Understand pattern recognition theories, such as Bayes classifier, linear discriminant analysis.
CO4. Apply pattern recognition techniques in practical problems.

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2								S						
CO3	S		S			S		S		S	M		S	S
CO4		S		S	S						S	S		

UNIT I PATTERN CLASSIFIER

Overview of pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum likelihood estimation – Bayesian parameter estimation – Perceptron algorithm – LMSE algorithm – Problems with Bayes approach – Pattern classification by distance functions – Minimum distance pattern classifier.

UNIT II UNSUPERVISED CLASSIFICATION

Clustering for unsupervised learning and classification – Clustering concept – C-means algorithm – Hierarchical clustering procedures – Graph theoretic approach to pattern clustering – Validity of clustering solutions.

UNIT III STRUCTURAL PATTERN RECOGNITION

Elements of formal grammars – String generation as pattern description – Recognition of syntactic description – Parsing – Stochastic grammars and applications – Graph based structural representation.

UNIT IV FEATURE EXTRACTION AND SELECTION

Entropy minimization – Karhunen – Loeve transformation – Feature selection through functions approximation – Binary feature selection.

UNIT V RECENT ADVANCES

Neural network structures for Pattern Recognition – Neural network based Pattern associators – Unsupervised learning in neural Pattern Recognition – Self-organizing networks – Fuzzy logic – Fuzzy pattern classifiers – Pattern classification using Genetic Algorithms.

REFERENCES

1. Robert J.Schalkoff, Pattern Recognition Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 1992.
2. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.
3. Duda R.O., and Har P.E., Pattern Classification and Scene Analysis, Wiley, New York, 1973.
4. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.

CSE18R5025	COMPILER FOR HPC	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PREREUISITE

Compiler design

COURSE OJECTIVE

The objective of this course is to introduce structure of compilers and high performance compiler design for students. Concepts of cache coherence and parallel loops in compilers are included.

COURSE OUTCOMES

CO1: Familiar with the structure of compiler.

CO2: Parallel loops, data dependency and exception handling and debugging in compiler.

UNIT I

High Performance Systems, Structure of a Compiler, Programming Language Features, Languages for High Performance

UNIT II

Data Dependence: Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph. **Scalar Analysis with Factored Use-Def Chains:** Constructing Factored Use- Def Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, Data Dependence for Scalars. Data Dependence Analysis for Arrays.

UNIT III

Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls, Inter-procedural Analysis **Loop Restructuring:** Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-procedural Transformations.**Optimizing for Locality:** Single Reference to Each Array, Multiple References,General Tiling, Fission and Fusion for Locality

UNIT IV

Concurrency Analysis: Concurrency from Sequential Loops, Concurrency from Parallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers.

Vector Analysis: Vector Code, Vector Code from Sequential Loops, Vector Code from For all Loops, Nested Loops, Round off Error, Exceptions, and Debuggers, Multi-vector Computers

UNIT V

Message-Passing Machines: SIMD Machines, MIMD Machines, Data Layout, Parallel Code for Array Assignment, Remote Data Access, Automatic Data Layout, Multiple Array Assignments, Other Topics - **Scalable Shared-Memory Machines:**

Global Cache Coherence, Local Cache Coherence, Latency Tolerant Machines. Recent trends in compiler design for high performance computing and message passing machines and scalable shared memory machine

REFERENCES

1. Michael Wolfe, High-Performance Compilers for Parallel Computing, Pearson

CSE18R5026	VIDEO ANALYTICS	L	T	P	Credit
		3	0	0	3
Course Category :Theory		**Course Type**		**:** Elective	

PREREQUISITE

Digital image Processing

COURSE OBJECTIVE

The goal of machine vision is to develop methods that enable a machine to "understand" or analyze images and videos. This course will address the research issues towards developing algorithms that can perform high-level visual recognition tasks on real-world images and videos. This course will review and discuss current approaches to high-level visual recognition problems, such as background modeling, object recognition and categorization, tracking, scene understanding, human motion understanding, etc.

COURSE OUTCOMES

CO1: To have a better knowledge about videos
CO2: To enrich students with data analytics
CO3:To understand the video content analysis
CO4: To expose the student to various applications and case studies of Video analytics.

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2								S						
CO3								S		S	M			S
CO4		S		S	S						S	S		

UNIT I INTRODUCTION TO BIG DATA AND DATA ANALYSIS

Introduction to Big Data Platform – Challenges of Conventional Systems – Web Data – Evolution of Analytic Scalability – Analytic Processes and Tools – Analysis Vs Reporting – Modern Data Analytic Tools – Data Analysis: Regression Modeling – Bayesian Modeling – Rule Induction.

UNIT II MINING DATA STREAMS

Introduction to Stream Concepts – Stream Data Model And Architecture – Stream Computing – Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream– Estimating Moments – Counting Oneness in a Window – Decaying Window – Real Time Analytics Platform(RTAP) Applications – Case Studies.

UNIT III VIDEO ANALYTICS

Introduction – Video Basics – Fundamentals for Video Surveillance – Scene Artifacts – Object Detection and Tracking: Adaptive Background Modelling and Subtraction – Pedestrian Detection and Tracking – Vehicle Detection and Tracking – Articulated Human Motion Tracking in Low Dimensional Latent Spaces.

UNIT IV BEHAVIOURAL ANALYSIS AND ACTIVITY RECOGNITION

Event Modelling – Behavioural Analysis – Human Activity Recognition – Complex Activity Recognition – Activity modeling using 3D shape - Video summarization – shape based activity models – Suspicious Activity Detection.

UNIT V HUMAN FACE RECOGNITION AND GAIT ANALYSIS

Introduction: Overview of Recognition algorithms – Human Recognition using Face: - Face Recognition from still images – Face Recognition from video – Evaluation of Face Recognition Technologies – Human Recognition using gait: HMM Framework for Gait Recognition – View Invariant Gait Recognition – Role of Shape and Dynamics in Gait Recognition.

REFERENCES

1. Michael Berthold, David J.Hand, “Intelligent Data Analysis”, Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
3. Yunqian Ma, Gang Qian, “Intelligent Video Surveillance: Systems and Technology”, CRC Press (Taylor and Francis Group), 2009.
4. Rama Chellappa, Amit K.Roy– Chowdhury, Kevin Zhou.S, “Recognition of Humans and their Activities using Video”, Morgan & Claypool Publishers, 2005.

CSE18R5027	INFORMATION RETRIEVAL TECHNIQUES g	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Core			

COURSE OBJECTIVE

The **objective** of this **course** is to elaborate on the fundamentals of **information retrieval** (IR), study of indexing, search, relevance, classification, organisation, storage, browsing, visualisation, etc. Focus on prominent computer algorithms and methods used in the field from a computer scientist's perspectives.

COURSE OUTCOMES

CO1: Understanding the various issues for information retrieval
CO2: Applying the various models for information retrieval
CO3: Analyze the various indexing techniques
CO4: Evaluate the various classification clustering techniques
CO5: Apply the searching methodologies in web

	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S		S					S		
CO2		S		S	S			S					S	
CO3			S					S		S	M			S
CO4		S		S	S						S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I INTRODUCTION: MOTIVATION

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval – Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics– The impact of the web on IR —IR Versus Web Search–Components of a Search engine

UNIT II MODELING

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models - Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing

UNIT III INDEXING

Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching - Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency

UNIT IV CLASSIFICATION AND CLUSTERING

Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering –Matrix decompositions and latent semantic indexing – Fusion and Meta learning

UNIT V SEARCHING THE WEB

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries

REFERENCES

1. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, "Modern Information Retrieval: The concepts and Technology behind Search" (ACM Press Books), Second Edition, 2011.
2. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, "Introduction to Information Retrieval", Cambridge University Press, First South Asian Edition, 2008.
3. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information Retrieval mplementing and Evaluating Search Engines", The MIT Press, Cambridge, Massachusetts London, England, 2010.

CSE18R5028	NETWORK TECHNOLOGIES	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISITE

1.Wireless Networks

COURSE OBJECTIVES

1.Able to understand the design of Network Architecture.
2.Able to analyze and design Network interfaces.
3.Able to solve design issues in Network Architecture.

COURSEOUTCOMES

CO1: Undersatnd the Network Architecture.
CO2: Analyze the technologies used in Wireless Networks.
CO3: Understand the 4G architecture and interconnection with other Networks.
CO4: .Understand the NoC Architecture and its design issues.
CO5: Understand the data plane and control plane structure used in SDN.

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S		S	S			S					S	
CO3			S					S		S	M			S
CO4		S		S	S						S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT – I NETWORK ARCHITECTURE AND QoS

Overview of TCP/IP Network Architecture – Integrated Services Architecture – Approach – Components – Services – Queuing Discipline – FQ – PS – BRFQ – GPS – WFQ – Random Early Detection-Differentiated Services.

UNIT – II WIRELESS NETWORKS

IEEE802.16 and WiMAX – Security – Advanced 802.16 Functionalities – Mobile WiMAX - 802.16e – Network Infrastructure – WLAN – Configuration – Management Operation – Security – IEEE 802.11e and WMM – QoS – Comparison of WLAN and UMTS – Bluetooth – Protocol Stack – Security – Profiles

UNIT – III CELLULAR NETWORKS

GSM – Mobility Management and call control – GPRS – Network Elements – Radio Resource Management – Mobility Management and Session Management – Small Screen Web Browsing over GPRS and EDGE – MMS over GPRS – UMTS – Channel Structure on the Air Interface – UTRAN –Core and Radio Network Mobility Management – UMTS Security

UNIT – IV 4G NETWORKS

LTE – Network Architecture and Interfaces – FDD Air Interface and Radio Networks – Scheduling – Mobility Management and Power Optimization – LTE Security Architecture – Interconnection with UMTS and GSM – LTE Advanced (3GPPP Release 10) - 4G Networks and Composite Radio Environment – Protocol Boosters – Hybrid 4G Wireless Networks Protocols – Green Wireless Networks – Physical Layer and Multiple Access – Channel Modelling for 4G – Introduction to 5G

UNIT – V SOFTWARE DEFINED NETWORKS

Introduction – Centralized and Distributed Control and Data Planes – Open Flow – SDN Controllers – General Concepts – VLANs – NVGRE – Open Flow – Network Overlays – Types – Virtualization – Data Plane – I/O – Design of SDN Framework

REFERENCES:

1. William Stallings, "High Speed Networks and Internets: Performance and Quality oFService", Prentice Hall, Second Edition, 2002.
2. Martin Sauter, "From GSM to LTE, An Introduction to Mobile Networks and Mobile Broadband", Wiley, 2014.
3. Savo G Glisic, "Advanced Wireless Networks – 4G Technologies", John Wiley & Sons, 2007.
4. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", Wiley, 2015.
5. Martin Sauter, "Beyond 3G - Bringing Networks, Terminals and the Web Together: LTE, WiMAX, IMS, 4G Devices and the Mobile Web 2.0", Wiley, 2009.
6. Naveen Chilamkurti, Sherali Zeadally, Hakima Chaouchi, "Next-Generation Wireless Technologies", Springer, 2013.
7. Erik Dahlman, Stefan Parkvall, Johan Skold, "4G: LTE/LTE-Advanced for Mobile Broadband", Academic Press, 2013.
8. Thomas D.Nadeau and Ken Gray, "SDN – Software Defined Networks", O"Reilly Publishers, 2013.

CSE18R5029	GPU COMPUTING	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Core			

COURSE OBJECTIVE

To learn parallel programming with Graphics Processing Units (GPUs).

COURSE OUTCOMES

CO1: Understand the concepts in parallel programming
CO2: implementation of programs on GPUs,
CO3:Debugging and profiling parallel programs.
CO4:Evaluate the various synchronization concepts
CO5: Applying the case studies in real time environment

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S		S	S			S					S	
CO3			S					S		S	M			S
CO4		S		S	S						S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I

Introduction: History, Graphics Processors, Graphics Processing Units,GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA OpenCL /OpenACC,Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps / Wavefronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D/ 3D thread mapping, Device properties, Simple Programs

UNIT II

Memory: Memory hierarchy, DRAM / global, local / shared, private / local,textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories

UNIT III

Synchronization: Memory Consistency, Barriers (local versus global), Atomics,Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU **Functions**: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.

UNIT IV

Support: Debugging GPU Programs. Profiling, Profile tools, Performance aspects **Streams**: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream,

Synchronization with streams. Events, Event-based-Synchronization - Overlapping data transfer and kernel execution, pitfalls.

UNIT V

Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning **Advanced topics**: Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing

REFERENCES

1. Programming Massively Parallel Processors: A Hands-on Approach; David Kirk, Wen-mei Hwu;Morgan Kaufman; 2010 (ISBN: 978-0123814722)
2. CUDA Programming: A Developer's Guide to Parallel Computing with GPUs; Shane Cook :Morgan Kaufman; 2012 (ISBN: 978-0124159334)

CSE18R5030	DISTRIBUTED SYSTEMS	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Core			

PREREUISITE

Operating system

COURSE OBJECTIVE

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

COURSE OUTCOMES

CO1: Design trends in distributed systems.
CO2: Apply network virtualization.
CO3: Apply remote method invocation and objects.

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S				M			S		
CO2		S		S	S			S					S	
CO3			S		M			S		S	M			S

UNIT 1: INTRODUCTION

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

UNIT II

DISTRIBUTED DATABASE DESIGN

Alternative design strategies; Distributed design issues; Fragmentation; Data allocation **SEMANTICS DATA CONTROL** View management; Data security; Semantic Integrity Control **QUERY PROCESSING ISSUE** Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data

UNIT III DISTRIBUTED QUERY OPTIMIZATION

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

UNIT IV RELIABILITY

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

UNIT V PARALLEL DATABASE SYSTEMS

Parallel architectures; parallel query processing and optimization; load balancing

ADVANCED TOPICS Mobile Databases, Distributed Object Management, Multi-databases

REFERENCES

1. Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991.
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

CSE18R5031	NETWORK ON CHIP	L	T	P	Credit
		3	0	0	3
Course Category : Theory		**Course Type :** Elective			

PRE-REQUISITE:

- Computer Architecture

COURSE OBJECTIVE

1.Able to understand the architecture and basic operation of ICN.
2.Able to apply the routing principles with different ICN.
3.Able to understand and solve issues in design of ICN.

COURSEOUTCOME

CO1: Analyze the performance of ICN Architecture.
CO2: Understand the basic operations of Switching Techniques.
CO3: Apply the Routing Algorithm in Switch based Network.
CO4: Understand the NoC Architecture and its design issues.
CO5: Understand the interconnection technologies used in Network –on-Chip.

	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S											S		
CO2		S												S
CO3				S								M		
CO4							S			S		S	S	
CO5		S							L				S	S

UNIT I ICN ARCHITECTURES

Introduction - Classification of ICNs - Topologies - Direct networks - Indirect networks- Performance analysis.

UNIT II SWITCHING TECHNIQUES

Basic switching techniques - Virtual channels - Hybrid switching techniques Optimizing switching techniques - Comparison of switching techniques - Deadlock, livelock and Starvation.

UNIT – III ROUTING ALGORITHMS

Taxonomy of routing algorithms - Deterministic routing algorithms - Partially adaptive algorithms - Fully adaptive algorithms - Routing in MINs - Routing in switch-based networks with irregular topologies - Resource allocation policies- Flow control.

UNIT IV NETWORK-ON-CHIP

NoC Architectures - Router architecture - Area, energy and reliability constraints - NoC design lternatives – Quality-of Service (QoS) issues in NoC architectures

UNIT V EMERGING TRENDS

Fault-tolerance issues - Emerging on-chip interconnection technologies- 3D NoC- Simulation.

REFERENCES

1. J. Duato, S. Yalamanchili, and Lionel Ni, "Interconnection Networks: An Engineering Approach", Morgan Kaufmann Publishers 2004.
2. William James Dally and Brian Towles, "Principles and Practices of Interconnection Networks", ISBN: 0122007514, Morgan Kaufmann, 2003.
3. Giovanni De Micheli and Luca Benini, "Networks on Chips: Technology and Tools", ISBN:0123705215, Morgan Kaufmann, 2006
4. Natalie Enright Jerger and Li-Shiuan Peh, "On-ChipNetworks", Synthesis lectures on computer architecture #8, Morgan and Claypool Publishers 2009.
5. Fayez Gebali, Haytham Elmiligi, Mohamed Wathed and El-Kharashi "Networks-on-Chips: Theory and Practice", CRC Press, Taylor and Francis

CSE18R5032	Secure Software Design and Enterprise computing	L	T	P	Credit
		0	3	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISITE

Computer Programming, Software Engineering

COURSE OBJECTIVES

- To fix software flaws and bugs in various software.
- To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic
- Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
- Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

COURSE OUTCOMES

CO1: Differentiate between various software vulnerabilities
CO2: Software process vulnerabilities for an organization
CO3: Monitor resources consumption in a software
CO4: Interrelate security and software development process .

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S			S	M		S					S	
CO3			S	M				S		S	M	S		
CO4		S		S	S		M				S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I

Secure Software Design

Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, Perform security testing and quality assurance.

UNIT II

Enterprise Application Development

Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and

develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

UNIT III

Enterprise Systems Administration

Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

UNIT IV

Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them

UNIT V

Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws. Case study of DNS server, DHCP configuration and SQL injection attack.

REFERENCES

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley.

CSE18R5033	Digital Forensics	L	T	P	Credit
		0	3	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISITE

Cybercrime and Information Warfare, Computer Networks

COURSE OBJECTIVES

- Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
- Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
- Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools
- E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics
- To fix software flaws and bugs in various software.
- To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic
- Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
- Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

COURSE OUTCOMES

CO1: Understand relevant legislation and codes of ethics
CO2: Computer forensics and digital detective and various processes, policies and procedures
CO3: E-discovery, guidelines and standards, E-evidence, tools and environment
CO4: Email and web forensics and network forensics

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S			S	M		S					S	
CO3			S	M				S		S	M	S		
CO4		S		S	S		M				S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I

Digital Forensics Science: Forensics science, computer forensics, and digital forensics.

Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics

UNIT II

Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

UNIT III

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause

UNIT IV

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, **Network Forensics:** open-source security tools for network forensic analysis, requirements for preservation of network data.

UNIT V

Mobile Forensics: mobile forensics techniques, mobile forensics tools. **Legal Aspects of Digital Forensics:** IT Act 2000, amendment of IT Act 2008 Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

REFERENCES

1. John Sammons, The Basics of Digital Forensics, Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications

CSE18R5034	Wireless Sensor Networks	L	T	P	Credit
		0	3	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISITE

Wireless communication

COURSE OBJECTIVES

- Architect sensor networks for various application setups.
- Devise appropriate data dissemination protocols and model links cost.
- Understanding 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

CO1: Describe and explain radio standards and communication protocols for wireless sensor networks
CO2: Explain the function of the node architecture and use of sensors for various applications.
CO3: Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S			S	M		S					S	
CO3			S	M				S		S	M	S		
CO4		S		S	S		M				S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I

Introduction to Wireless Sensor Networks: Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors **Network Architecture:** Traditional layered stack, Cross-layer designs, Sensor Network Architecture **Hardware Platforms:** Motes, Hardware parameters

UNIT II

Introduction to ns-3: Introduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example

UNIT III

Medium Access Control Protocol design: Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled **Introduction to Markov Chain:** Discrete time Markov Chain definition, properties, classification and analysis **MAC Protocol Analysis:** Asynchronous duty-cycled. X-MAC Analysis (Markov Chain)

UNIT IV

. **Security**: Possible attacks, countermeasures, SPINS, Static and dynamic key distribution

UNIT V

Routing protocols: Introduction, MANET protocols **Routing protocols for WSN**: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast **Opportunistic Routing Analysis**: Analysis of opportunistic routing (Markov Chain) Advanced topics in wireless sensor networks. Recent development in WSN standards, software applications

REFERENCES

1. W. Dargie and C. Poellabauer, "Fundamentals of Wireless Sensor Networks – Theory and Practice", Wiley 2010
2. KazemSohraby, Daniel Minoli and TaiebZnati, "wireless sensor networks - Technology, Protocols, and Applications", Wiley Interscience 2007
3. Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, "Wireless Sensor Network Technologies for the Information Explosion Era", springer 2010

CSE18R5035	Introduction to Intelligent System	L	T	P	Credit
		0	3	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISITE

Data Structures and Data Management or Data Structures

COURSE OBJECTIVES

- The aim of the course is to introduce to the field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach. It explores the essential theory behind methodologies for developing systems that demonstrate intelligent behaviour including dealing with uncertainty,

COURSE OUTCOMES

CO1: Able to Demonstrate knowledge of the fundamental principles of intelligent systems
CO2: Able to analyse and compare the relative merits of a variety of AI problem solving techniques
CO3: Able to implement various search methods
CO4: Able to understand knowledge representation and logical inferences
CO5: Able to analyze the uncertainty in data and reasoning

PO/PSO	Pos											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S			S	M		S					S	
CO3			S	M				S		S	M	S		
CO4		S		S	S		M				S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I

Biological foundations to intelligent systems I: Artificial neural networks, Back- propagation networks, Radial basis function networks, and recurrent networks.

UNIT II

Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks

UNIT III

Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hill- climbing search. Optimisation and search such as stochastic annealing and genetic algorithm.

UNIT IV

Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures.

UNIT V

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning Recent trends in Fuzzy logic, Knowledge Representation

REFERENCES

1. Luger G.F. and Stubblefield W.A. (2008). Artificial Intelligence: Structures and strategies for Complex Problem Solving. Addison Wesley, 6th edition.
2. Russell S. and Norvig P. (2009). Artificial Intelligence: A Modern Approach. Prentice-Hall, 3rd edition

CSE18R5036	Advanced Wireless and Mobile networking	L	T	P	Credit
		0	3	0	3
Course Category : Theory		**Course Type :** Elective			

COURSE OBJECTIVES

- The students should get familiar with the wireless/mobile market and the future needs and challenges.
- To get familiar with key concepts of wireless networks, standards, technologies and their basic operations
- To learn how to design and analyse various medium access
- To learn how to evaluate MAC and network protocols using network simulation software tools.
- The students should get familiar with the wireless/mobile market and the future needs and challenges.

COURSE OUTCOMES

CO1: Demonstrate advanced knowledge of networking and wireless networking and understand various types of wireless networks, standards, operations and use cases
CO2: Be able to design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.
CO3: Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks
CO4: Design wireless networks exploring trade-offs between wire line and wireless links.
CO5: Develop mobile applications to solve some of the real world problems.

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S			S	M		S					S	
CO3			S	M				S		S	M	S		
CO4		S		S	S		M				S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I

INTRODUCTION:
Wireless Networking Trends, Key Wireless Physical Layer Concepts, Multiple Access Technologies -CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy etc.

WIRELESS LOCAL AREA NETWORKS:
IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF & PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues

UNIT II

WIRELESS CELLULAR NETWORKS:
1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, Spread spectrum Technologies.

UNIT III

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview
WIRELESS SENSOR NETWORKS
Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Tiny OS Overview

UNIT IV

WIRELESS PANs
Bluetooth AND Zigbee, Introduction to Wireless Sensors,.

UNIT V

SECURITY
Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication
ADVANCED TOPICS
IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Adhoc Networks

REFERENCES

1. Schiller J., Mobile Communications, Addison Wesley 2000
2. Stallings W., Wireless Communications and Networks, Pearson Education 2005
3. Stojmenic Ivan, Handbook of Wireless Networks and Mobile Computing, John Wiley and Sons Inc 2002
4. Yi Bing Lin and Imrich Chlamtac, Wireless and Mobile Network Architectures, John Wiley and Sons Inc 2000
5. Pandya Raj, Mobile and Personal Communications Systems and Services, PHI 200

CSE18R5037	HUMAN AND COMPUTER INTERACTION	L	T	P	Credit
		0	3	0	3
Course Category : Theory		**Course Type :** Elective			

PREREQUISITE

Linear algebra, vector calculus, Data structures and Programming.

COURSE OBJECTIVES

COURSE OBJECTIVE
• Learn the foundations of Human Computer Interaction
• Be familiar with the design technologies for individuals and persons with disabilities
• Be aware of mobile Human Computer interaction.
• Learn the guidance for user interaction

COURSE OUTCOMES
After completion of course, students would be able to:
• Understand the structure of models and theries of human computer interaction and vision.\
• Design an interactive web interface on the basis of models studied.

PO/PSO	POs											PSOs		
CO'S	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S			S	M		S					S	
CO3			S	M				S		S	M	S		
CO4		S		S	S		M				S	S	S	
CO5		S		S	S	S		S	M				S	

UNIT I

Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

UNIT II

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT III

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture,
Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools

UNIT V

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies
Recent Trends: Speech Recognition and Translation, Multimodal System

REFERENCES

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I , II & III)
2. Brian Fling, "Mobile Design and Development", First Edition , O®Reilly Media Inc., 2009 (UNIT – IV)
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O®Reilly, 2009.(UNIT-V)

Inter Disciplinary Courses:

ICE18R5009	**ROBOTICS AND AUTOMATION**	L	T	P	C
		3	0	0	3

Unit 1: INTRODUCTION **09 Hours**

Geometric configuration of robots – Manipulators – Drive systems – Internal and external sensors – End effectors – Control systems – Robot programming languages and applications – Introduction to robotic vision

Unit 2: ROBOT ARM KINEMATICS **09 Hours**

Direct and inverse kinematics – Rotation matrices – Composite rotation matrices – Euler angle representation – Homogenous transformation – Denavit Hattenberg representation and various arm configuration

Unit 3: ROBOT ARM DYNAMICS **09 Hours**

Lagrange – Euler formulation, joint velocities – Kinetic energy – Potential energy and motion equations – Generalised D'Alembert equations of motion

Unit 4:PLANNING OF MANIPULATOR TRAJECTORIES **09 Hours**

General consideration on trajectory planning joint interpolation & Cartesian path trajectories

Unit 5: CONTROL OF ROBOT MANIPULATORS **09 Hours**

PID control computed, torque technique – Near minimum time control – Variable structure control – Non-linear decoupled feedback control – Resolved motion control and adaptive control

TEXT BOOKS

1. Wesley, E. Sryda, Industrial Robots: Computer interfacing and Control PHI, 1985
2. Saeed B. Niku, Introduction to Robotics, Analysis, systems and Applications, Pearson Education, 2002

REFERENCE BOOKS

1. Lee, C. S. G., et al ,Robotics (Control, Sensing, Vision and Intelligence), McGraw-Hill, 1968
2. Asada, Slotine, Robot Analysis and Control, John Wiley and Sons, 1986
3. Groover M. P. Mitchell Wesis., Industrial Robotics Technology Programming and Applications, Tata McGraw-Hill, 1986

ECE17R5141 BASICS OF VLSI DESIGN	Credits			
	L	T	P	Total
	3	0	0	3
	Course Category: Interdisciplinary Elective Course Type: Theory			

COURSE OBJECTIVE(S):

This course describes about the present and possible near future processing technologies, delays, power and interconnects engineering of CMOS, combinational and sequential circuit design, array sub systems and special purpose systems

COURSE OUTCOME(S):

After completing this course, the student will be able to:

1. Explain the characteristics of CMOS transistors
2. To learn the MOS process technology
3. To learn the basic CMOS circuit design and system design

COURSE TOPICS:

UNIT I: MOS TRANSISTOR THEORY 9 Hours

CMOS logic, CMOS fabrication layout, Design partitioning, Logic design, circuit design, physical design, MOS transistor theory, CV characteristics, Non-ideal IV effects, DC transfer characteristics, pitfalls and fallacies

UNIT II: CMOS PROCESSING TECHNOLOGY 9 Hours

CMOS design rules, CMOS process enhancement, and technology related CAD issues, manufacturing issues. Delay –Transient response, RC delay model and linear delay model, logical efforts of path, Timing analysis and delay fault models.

UNIT III: POWER AND INTERCONNECT 9 Hours

Dynamic power, static power, energy delay optimization, Low power optimization, Interconnect – Wire geometry, Interconnect modelling, Interconnect Engineering, Logical effort with wires, Robustness – variability, Reliability, Scaling, statistical Analysis of variability, variation in tolerant design

UNIT IV: CIRCUIT DESIGN USING CMOS 9 Hours

Combinational circuit design – circuit families, circuit pitfalls, SOI circuit design, threshold circuit design, Sequential circuit design- sequential static circuits, circuit design of latches and flip flops, static sequential element methodology, sequencing dynamic circuits.

UNIT V: SYSTEM DESIGN USING CMOS 9 Hours

Array sub systems – SRAM, DRAM, Read only memory, Serial access memory, CAM, PLA, Robust memory design, Special purpose systems- Overview, packages and cooling, Power distribution, clocks, PLLs and DLLs, I/Os, High speed links, random circuits

REFERENCE(S):

1. Neil H.E. Weste and David Mani Harris CMOS VLSI Design, A circuit and system perceptive, PEARSON publication, 2017.
2. Douglas A. Pucknell and Kamran Eshraghian, BASIC VLSI Design., PHI publication, 2012.
3. Kiran V. G. and Nagesh H.R. Fundamentals of CMOS VLSI Design., Pearson, 2011.

ECE17R6042- DATA COMPRESSION TECHNIQUES	Credits			
	L	T	P	Total
	3	0	0	3
Pre-requisite: --	**Course Category: Interdisciplinary Elective** **Course Type: Theory**			

COURSE OBJECTIVE(S):

The course aims at providing students with theoretical and technical understanding on multimedia components and systems. The course covers contemporary, interactive multimedia technology systems, focusing on types, applications, and theories of operation. Basic technologies such as multimedia data representation, compression, retrieval and communication will be covered in an integrated manner. On the completion of the course, students should be able to understand the fundamental concepts and make critique to the technologies associated with various multimedia data types such as image, video, audio, graphics and animation.

COURSE OUTCOME(S):

At the end of the course, the students will be able to:

1. explain approaches to represent multimedia data in digital format and identify their properties;
2. derive the rational of the multimedia representation format and compression algorithms based on the human visual and auditory perception;
3. analyse image, video and audio in the frequency domain to identify important components to be encoded;
4. explain the major steps in some of the image, video and audio compression standards;
5. apply lossless and lossy compression techniques on multimedia data.

COURSE TOPICS:

UNIT I: INTRODUCTION 9 Hours

Special features of Multimedia – Graphics and Image Data Representations – Fundamental Concepts in Video and Digital Audio – Storage requirements for multimedia applications -Need for Compression - Taxonomy of compression techniques – Overview of source coding, source models, scalar and vector quantization theory – Evaluation techniques – Error analysis and methodologies

UNIT II: TEXT COMPRESSION 9 Hours

Compaction techniques – Huffman coding – Adaptive Huffman Coding – Arithmetic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

UNIT III: AUDIO COMPRESSION 9 Hours

Audio compression techniques - μ- Law and A- Law Companding. Speech compression- waveform codecs-source codecs- hybrid codecs-Shorten compressor, Frequency domain and filtering –Basic sub-band coding – Application to speech coding – G.722 –Application to audio coding –MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders.

UNIT IV: IMAGE COMPRESSION 9 Hours

Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization– Contour based compression – Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders –JPEG 2000 standards – JBIG, JBIG2 Standards

UNIT V: VIDEO COMPRESSION 9 Hours

Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

REFERENCE(S)

1. Khalid Sayood: Introduction to Data Compression, Morgan Kauffman Harcourt India, 2nd Edition, 2000.
2. David Salomon: Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001.
3. Yun Q. Shi, Huifang Sun: Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards, CRC press, 2003.
4. Peter Symes: Digital Video Compression, McGraw Hill Pub., 2004.
5. Mark Nelson: Data compression, BPB Publishers, New Delhi, 1998.
6. Mark S. Drew, Ze-Nian Li: Fundamentals of Multimedia, PHI, 1st Edition, 2003.
7. Watkinson, J: Compression in Video and Audio, Focal press, London. 1995.

EEE18R6015 EMBEDDED C	Credits			
	L	*T*	*P*	*Total*
	3	*0*	*0*	*3*
Course Category: Interdisciplinary Elective Courses - Theory				

Course Outcome(s):

After Successful completion of course, the students will be able,

CO1	:	Describe the basic Embedded C concepts
CO2	:	Understand knowledge of Embedded hardware and its peripherals Programming
CO3	:	Design real time embedded systems using IDE tool
CO4	:	Analyze basic serial communication devices of embedded systems
CO5	:	Analyze advanced examples of embedded systems for Power Electronics application

Course Topics:

UNIT 1: INTRODUCTION

C concepts and programming- data types, C and Assembly - Programming Style - Declarations and Expressions - Arrays, Qualifiers and Reading Numbers - Decision and Control Statements - Programming Process - More Control Statements - Variable Scope and Functions - C Preprocessor - Advanced Types - Simple Pointers - Debugging and Optimization – In-line Assembly.

UNIT 2: INPUT AND OUTPUT DEVICE PROGRAMMING

I/O ports, I/O bit manipulation programming, timers/counters, programming to generate delay and wave form generation, I/O programming, LEDs, 7segment led's,-Keyboard basics – Keyboard scanning algorithm – Multiplexed LED displays – Character LCD modules – LCD module display – Configuration – Time-of-day clock – Timer manager - Interrupts - Interrupt service routines – IRQ - ISR - Interrupt vector or dispatch table multiple-point - Interrupt- driven pulse width modulation, Device Driver, Timer Driver, Watchdog Timers.

UNIT 3: EMBEDDED C PROGRAMMING TOOLS

Real-Time Characteristics, Selection Process. Design and Development : Embedded System development environment - IDE, Types of file generated on cross compilation, disassemble / decompile, simulator, emulator and debugging, embedded product development life-cycle, trends in embedded industry

UNIT 4: SERIAL COMMUNICATION PROGRAMMING

Asynchronous serial communication – RS-232 – RS-485 –I2C-USB-XIGBEE-WiFi Sending and receiving data – Serial ports on PC – Low level PC serial I/O module - Buffered serial I/O.

UNIT 5: CASE STUDIES :ADVANCED PROGRAMMING

Multiple closure problems – Controlling motors – Bi-directional control of motors – H bridge –– Stepper control – Inventory control systems. Serial port communication, interrupts ,ADC,DAC and sensor interfacing, interfacing external memory, interfacing slave IC,RTC interfacing , Relay, PWM, AC and DC Grid integration.

Text Book(s):

1. Programming Embedded Systems in C and C++, First Edition January, Michael Barr, O'
Reilly ,2006
2. Introduction to embedded systems, Shibu K V Tata McGraw-Hill,2016
3. The 8051 Microcontroller and Embedded systems using Assembly and C ,second edition ,Muhammad Ali Mazidi,JaniceGillispieMazidi,RolinD.McKinlaym,2008

Reference(s):

1. Embedded Systems, Rajkamal, TataMcGraw-Hill,2008
2. Jean J. Labrosse, "Embedded Systems Building Blocks: Complete and Ready To Use Modules in C", CMP Books 2000.
3. Daniel W. Lewis, "Fundamentals of Embedded Software where C and Assembly meet", PHI, 2002.

EEE18R5007 SMART GRID TECHNOLOGY	Credits			
	L	*T*	*P*	*Total*
	3	*0*	*0*	*3*
Course Category: Interdisciplinary Elective Courses - Theory				

COURSE OUTCOMES:

After successful completion of course, the students will be able,

CO1 - To understand the challenges and the benefits of the smart grid system.

CO2 - To apply the knowledge of PMU and WAMS in the power system operation.

CO3 - To understand the benefits, standards and initiatives of AMI, IoT in smart grid system.

CO4 - To apply the high performance computing techniques in the smart grid environment.

CO5 – To acquire knowledge in the communications and measurement technologies, from the power-line communications to wireless.

Unit 1: INTRODUCTION TO SMART GRID

Evolution of Electric Grid - Concept, Definitions and Need for Smart Grid - Smart grid drivers, functions, opportunities, challenges and benefits - Difference between conventional & Smart Grid- Microgrid and Smart Grid Comparison - Concept of Resilient &Self-Healing Grid - Present development & International policies in Smart Grid - Smart Grid Roadmap for India.

Unit 2: PMU, SAS, DAS and WIDE AREA MONITORING

Phasor Measurement Unit (PMU): Requirements, RTU limitations, GPS Time Synchronization, Location & Placement, Features - Wide Area Monitoring Systems (WAMS) - Sub-station Automation Systems (SAS) - Distribution Automation Systems (DAS)

Unit 3: SMART METERS AND ADVANCED METERING INFRASTRUCTURE

Introduction to Smart Meters - Advanced Metering infrastructure (AMI) drivers and benefits - AMI protocols - standards and initiatives - AMI needs in the smart grid – smart meter data analytics, Big Data, IoT

Unit 4: HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS

Local Area Network (LAN) - House Area Network (HAN) - Wide Area Network (WAN) - Broadband over Power line (BPL) - IP based Protocols - Basics of Web Service and CLOUD Computing to make Smart Grids smarter - Cyber Security for Smart Grid.

Unit 5: SMART GRID COMMUNICATIONS AND MEASUREMENT TECHNOLOGY

Communication and Measurement - Monitoring, PMU, Smart Meters, and Measurements Technologies - GIS and Google Mapping Tools - Multiagent Systems (MAS) Technology

REFERENCE BOOKS

1. Smart Grid: Fundamentals of design and analysis, James Momoh, John Wiley & sons Inc, IEEE press 2012.
2. Smart Grid: Technology and Applications, Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, John Wiley & Sons, 2012
3. Smart Grid: Technology and Applications, Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, John Wiley & sons inc, 2012.

General Electives

CSE18R5051	INTERNET OF THINGS	L	T	P	Credit
		3	0	0	3
Course Type : General Elective					

PREREQUISITE

Big data analysis, computer networks

COURSE OBJECTIVE

This course provides a way to understand the concepts and the basics of big data analytics and their role in Internet of things

COURSE OUTCOMES

CO1: Identify requirements from emerging WSN applications on WSN platforms, communication systems, protocols and middleware

CO2: Understand, compare and evaluate communication and network protocols used in WSNs

CO3: Discuss and evaluate mechanisms and algorithms for time synchronization and localization in WSNs

CO4: Understand and discuss requirements for the design of security mechanisms and middleware systems to be used in WSNs

PO/PSO	POs											PSOs		
CO	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S						S	S		
CO2		S		S	S			S					S	
CO3			S			M	L	S		S	M	M		S
CO4		S		S	S						S	S	S	

UNIT I INTRODUCTION

Introduction and Applications:smart transportation, smart cities, smart living, smart energy, smart health, and smart learning. Examples of research areas include for instance: Self-Adaptive Systems, Cyber Physical Systems, Systems of Systems, Software Architectures and Connectors, Software Interoperability, Big Data and Big Data Mining, Privacy and Security

UNIT II IOT PROTOCOLS

IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints-Introduction, Technical Design constraintshardware, Data representation and visualization, Interaction and remote control.

UNIT III WEB OF THINGS

Industrial Automation- Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation- Introduction, Case study: phase one-

commercial building automation today, Case study: phase two- commercial building automation in the future.

UNIT IV INTEGRATED

Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium Access Control, Topology and Coverage Control, Routing: Transport Protocols, Network Security, Middleware, Databases

UNIT V APPLICATIONS

IOT Physical Devices & Endpoints: What is an IOT Device, Exemplary Device Board, Linux on Raspberry , Interface and Programming & IOT Device, Recent trends in sensor network and IOT architecture, Automation in Industrial aspect of IOT

REFERENCES

- Mandler, B., Barja, J., Mitre Campista, M.E., Cagá_ová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publishing

CSE18R5052	BIG DATA ANALYTICS	L	T	P	Credit
		3	0	0	3
	Course Type : General Elective				

PREREQUISITE

Cloud Computing

COURSE OBJECTIVES:

- Understand the Big Data Platform and its Use cases
- Provide an overview of Apache Hadoop
- Understand Map Reduce Jobs
- Apply analytics on Structured, Unstructured Data.
- Exposure to Data Analytics with R.

COURSE OUTCOMES

CO1: Describe big data and use cases from selected business domains
CO2: Explain NoSQL big data management
CO3: Install, configure, and run Hadoop and HDFS
CO4: Perform map-reduce analytics using Hadoop
CO5: Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

PO/PSO	POs											PSOs		
CO	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S	S			S							S		
CO2		S		L	L			S						M
CO3			S					S		S	M			S
CO4		S		S	S						S	S	S	
CO5		S		S	S	S		S	M				N	

UNIT I INTRODUCTION TO BIG DATA

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

UNIT II DATA ANALYSIS

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peerpeer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

UNIT III STREAM COMPUTING

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures

UNIT IV PREDICTIVE ANALYTICS AND VISUALIZATION

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats

UNIT V FRAMEWORKS AND APPLICATIONS

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration. Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.

REFERENCES

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of
4. Polyglot Persistence", Addison-Wesley Professional, 2012.
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
6. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
7. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
8. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
9. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
10. Alan Gates, "Programming Pig", O'Reilley, 2011.

CSE18R5053	CLOUD COMPUTING	L	T	P	Credit
		3	0	0	3
Course Type : General Elective					

PREREQUISITE

Mobile Computing

COURSE OBJECTIVE:

- To familiarize with the types of virtualization.
- To understand the concept of cloud and utility computing.
- To understand the various system models and issues in cloud computing.
- To familiarize with the cloud programming model.
- To appreciate the emergence of cloud as the next generation computing paradigm and the need for cloud security.

COURSE OUTCOMES

CO1: Identify security aspects of each cloud model
CO2: Develop a risk-management strategy for moving to the Cloud
CO3: Implement a public cloud instance using a public cloud service provider
CO4: Apply trust-based security model to different layer
CO5: Evaluate the security issues using GRC

PO/PSO	POs											PSOs		
CO	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S											S		
CO2	S	S												
CO3				S								M		
CO4				S			S			S		S	S	
CO5		S							L				S	

UNIT I: INTRODUCTION TO CLOUD COMPUTING

Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing

UNIT II: CLOUD COMPUTING ARCHITECTURE

Cloud Computing Architecture Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model Cloud Deployment Models Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise.

UNIT III: SECURITY ISSUES IN CLOUD COMPUTING

Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security Identity and Access Management Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management

UNIT IV: SECURITY MANAGEMENT IN THE CLOUD

Security Management in the Cloud Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS Privacy Issues Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations

UNIT V: AUDIT AND COMPLIANCE

Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud

REFERENCES

1. Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publicatio Date: November 2, 2009
2. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice), Tim Mather, ISBN-10: 0596802765,O'Reilly Media, September 2009

EEE18R5020 SOFT COMPUTING TECHNIQUES	Credits			
	L	T	P	Total
	3	0	0	3
Course Category: General Elective - Theory				

Course Outcome(s):

After completing this course, the student will be able to:

CO1: To understand the basic concepts of soft computing techniques
CO2: To solve real world problems using neural network
CO3: To analyse the functioning of recurrent neural network
CO4: To apply genetic algorithm to solve the optimization problem
CO5: To develop fuzzy logic controller and ANN for the given system

Course Topics:

Unit 1: INTRODUCTION AND FEEDFORWARD NEURAL NETWORK

Introduction to soft computing -soft computing vs hard computing-various types of soft computing techniques-applications of soft computing-Neuron-Nerve structure and synapse-Artificial Neuron and its model-activation functions-Neural network architecture-single layer and multilayer feed forward networks-McCullochPitts neuron model-perceptron model -Adaline and Madaline-multilayer perception model-back propagation learning algorithm-Implement back propagation learning algorithm using Matlab Toolbox.

Unit 2: RECURRENT NEURAL NETWORKS

Counter propagation network-architecture-functioning & characteristics of counter-Propagation network-Hopfield/ Recurrent network-configuration-stability constraints-associative memory-and characteristics-limitations and applications-Hopfield v/s Boltzman machine-Adaptive Resonance Theory-Architecture-classifications-Implementation and training-Associative Memory- Design of multilayer feed forward network using MATLAB Toolbox..

Unit 3: FUZZY LOGIC SYSTEM

Introduction to crisp sets and fuzzy sets-basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control-Fuzzification-inferencing and defuzzification-Fuzzy knowledge and rule bases-Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control-Fuzzy logic control for nonlinear time delay system-Development of Neuro fuzzy system using MATLAB tool box.

Unit 4: GENETIC ALGORITHM

Basic concept of Genetic algorithm and detail algorithmic steps-adjustment of free Parameters-Solution of typical control problems using genetic algorithm-Concept on some other search techniques like tabu search and ant colony search techniques for solving optimization problems-Implementation of optimization problem using MATLAB Toolbox.

Unit 5: APPLICATIONS

GA application to power system optimization problem-Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab-Neural Network toolbox. Stability

analysis of Neural Network interconnection systems-Implementation of fuzzy logic controller using Matlab fuzzy logic toolbox-Stability analysis of fuzzy control systems.

Text Book(s):

1. S.N. Sivanandam, S.N.Deepa, "Principles of Soft Computing" 2nd Edition, Wiley, 2011.
2. Fakhreddine O. Karray and Clarence De Silva, "Soft Computing & Intelligent System: Theory, Tools and Applications", First edition, Pearson Education, 2009.

Reference(s):

1. Laurene V. Fausett, Fundamentals of Neural Networks: Architectures, Algorithms And Applications, Pearson Education. 2004
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India., 2010.

EEE18R6013 EVOLUTIONARY COMPUTATION TECHNIQUES	Credits			
	L	T	P	Total
	3	0	0	3
Course Category: General Elective - Theory				

Course Outcome(s):

After successful completion of course, the students will be able,

CO1 - To understand the working principle of evolutionary computation.

CO2 - To apply Genetic Algorithm to solve optimization problems.

CO3 - To recognize the powerfulness of EC Techniques and the ability to apply EC algorithms to solve optimization problem.

CO4 - To understand the principle of PSO and to solve optimization problems.

CO5 - To understand the principle of ACO and to solve optimization problems.

Course Topics:

Unit 1: EVOLUTIONARY COMPUTATION (EC): THE BACKGROUND

Outline of Evolutionary Algorithms (EA) – EA Terminologies – Robust adaptation and Machine Intelligence – Principles of Evolutionary Processes – Principles of Genetics – No-free Lunch theorem for EA – Advantages of EA over other approaches.

Unit 2: GENETIC ALGORITHM (GA)

Binary GA – genetic operators – Tournament, Proportionate and Ranking Selection – Single point, two-point and uniform crossover – Elitism – Real Parameter GA – Linear, naïve, blend and Simulated Binary Crossover – Random, Non-uniform, Normally distributed and Polynomial Mutation – Constraint Handling Techniques in GA.

Unit 3: EVOLUTIONARY STRATEGIES (ES) & EVOLUTIONARY PROGRAMMING (EP)

Non-Re combinative ES – Re combinative ES – Self Adaptive ES – Connection between RGA and Self adaptive ES – Evolutionary Programming(EP) – EP and ES: Similarities and Differences – Genetic Programming (GP) – Population size and Dynamics – Convergence and Stopping Criteria – Exploration and Exploitation.

Unit 4: PARTICLE SWARM OPTIMIZATION (PSO)

Concepts and formulation – Simulating the Social behavior – PSO algorithm – Topology – Parameter Selection and Improvements for Convergence – Maximum Velocity – Acceleration Constants - Constriction factor - Inertia weight – Advantages of PSO.

Unit 5: ANT COLONY OPTIMIZATION (ACO)

Ants' ForagingBehavior – Stigmergy – Double Bridge Experiment – Real Ants to Artificial Ants – Behavioral Differences – Properties of Artificial Ants – ACO Algorithms – Ant System - MAX−MIN Ant System – Ant Colony System (ACS) – Advances of ACO.

Text Book(s):

1. S.N. Sivanandam, S.N.Deepa, "Principles of Soft Computing" 2nd Edition, Wiley, 2011.
2. Fakhreddine O. Karray and Clarence De Silva, "Soft Computing & Intelligent System: Theory, Tools and Applications", First edition, Pearson Education, 2009.

Reference(s):

1. Kalyanmoy Deb, "Multi-Objective Optimization using Evolutionary Algorithms", 3rd Edition, John Wiley & Sons, 2008.
2. Thomas Back, David BFogel and ZbigniewMichalewicz, "Evolutionary Computation 1 &2 : Basic/advanced Algorithms and Operators", Institute of Physics Publishing, 2000.
3. Marco Dorigo and Thomas Stutzle, "Ant Colony Optimization", MIT Press, 2004.
4. JurgenBranke, Kalyanmoy Deb, KaisaMiettinen and Roman Slowinski (Eds.), "MultiObjective Optimization: Interactive and Evolutionary Approaches", Springer-Verlag, 2008.

EEE18R5021 OPTIMIZATIONTECHNIQUES	*Credits*			
	L	*T*	*P*	*Total*
	3	*0*	*0*	*3*
Course Category: General Elective - Theory				

Course Outcome(s):

After successful completion of course, the students will be able,

CO1- To understand the importance of optimization for solving engineering applications.

CO2 - To solve the linear optimization problems using conventional mathematical methods.

CO3 - To understand the NewtonsMethod, Sequential quadratic programming and Penalty function method for solving the nonlinear optimization problems.

CO4 - To solve optimality problems using dynamic programming methods.

CO5 - To formulate genetic algorithm to solve optimization problems.

Course Topics:

Unit 1: INTRODUCTION

Definition, Classification of optimization problems, Classical Optimization Techniques, Single and Multiple Optimization with and without inequality constraints.

Unit 2: LINEAR PROGRAMMING (LP)

Simplex method of solving LPP, revised simplex method, duality, constrained optimization,Theorems and procedure, Linear programming, mathematical model, solution technique, duality.

Unit 3: NON LINEARPROGRAMMING

Steepest descent method, conjugates gradient method, NewtonsMethod, Sequential quadratic programming, Penalty function method, augmented Lagrange multiplier method.,

Unit 4:DYNAMIC PROGRAMMING (DP)

Multistage decision processes, concept of sub-optimization and principle of optimality, Recursive relations, Integer Linear programming, Branch and bound algorithm

Unit 5: GENETIC ALGORITHM

Introduction to genetic Algorithm, working principle, coding of variables, fitness function, GA operators; Similarities and differences between Gas and traditional methods; Unconstrained and constrained optimization using genetic Algorithm, real coded gas, Advanced Gas, global optimization using GA, Applications to power system.

Reference(s):

1. Computational methods in Optimization, Polak, Academic Press, 1971.
2. Optimization Theory with applications, Pierre D.A.,WileyPublications, 1969.
3. Taha, H. A., Operations Research: An Introduction, Seventh Edition, Pearson Education Edition, Asia, New Delhi ,2002.
4. S.S.Rao,"Optimization–Theoryand Applications",Wiley-Eastern Limited, 1984.
5. G.Luenberger," Introduction of Linear and Non-Linear Programming",Wesley Publishing Company, 2011

Open Elective

BUSINESS ANALYTICS	*Credits*			
	L	***T***	***P***	***Total***
	3	***0***	***0***	***3***
Course Category:				

COURSE OBJECTIVES

- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Mange business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

COURSE OUTCOMES

CO1 : Students will demonstrate knowledge of data analytics.

CO2: Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.

CO3: Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.

UNIT I:

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview

UNIT II

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT III

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution

of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization..

UNITIV

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT V

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

REFERENCES

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education

INDUSTRIAL SAFETY	Credits			
	L	T	P	Total
	3	0	0	3
Course Category:				

COURSE OBJECTIVE

- Understand the role of industrial safety within an environment.

COURSE OUTCOME

CO1 : Students will demonstrate knowledge of safety.

CO2: Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.

CO3: Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.

UNIT I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT III

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT IV

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision

tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

REFERENCES

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

OPERATIONS RESEARCH	Credits			
	L	T	P	Total
	3	0	0	3
Course Category:				

COURSE OBJECTIVE

To gain an understanding of how managers use business analytics to formulate and solve business problems using operations management.

COURSE OUTCOMES

CO1 **:** Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.

CO2: Students should able to apply the concept of non-linear programming

CO3: Students should able to carry out sensitivity analysis

CO4: Student should able to model the real world problem and simulate it insights

PO/PSO	POs											PSOs		
CO	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	S		S		S			S				S	S	S
CO2		S		S			S			S			S	
CO3	S		M		M		M					M		
CO4		S		M			M					M		

UNIT I

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT II

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

UNIT III

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

UNIT IV

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT V

Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

REFERENCES

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

COST MANAGEMENT OF ENGINEERING PROJECTS	Credits			
	L	T	P	Total
	3	0	0	3
Course Category:				

COURSE OBJECTIVE

To become familiar with processes needed to develop, report, and analyze business data for development of projects.

COURSE OUTCOME

CO1 : Students will demonstrate knowledge of management concepts

CO2: Students will demonstrate the ability of think critical making decisions based on projects.

CO3: Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support cost management during the projects.

UNIT I

Introduction and Overview of the Strategic Cost Management Process

UNIT II

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT III

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

UNIT IV

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT V

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

REFERENCES

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd

COMPOSITE MATERIALS	Credits			
	L	*T*	*P*	*Total*
	3	*0*	*0*	*3*
Course Category:				

COURSE OBJECTIVE

To become familiar with composite materials to do work in composite platform.

COURSE OUTCOMES

CO1 : Students will demonstrate knowledge of composite materials.

CO2: Students will demonstrate the ability of think to do the work in composite platform.

CO3: Students will demonstrate the ability o support composite materials during the projects.

UNIT I INTRODUCTION

Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT II REINFORCEMENTS

Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT III Manufacturing of Metal Matrix Composites:

Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT IV Manufacturing of Polymer Matrix Composites:

Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT V Strength:

Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-

insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

REFERENCES

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

WASTE TO ENERGY	Credits			
	L	*T*	*P*	*Total*
	3	*0*	*0*	*3*
Course Category:				

COURSE OBJECTIVE

To gain an understanding of how managers use energy analytics to formulate and solve waste management problems and to support managerial decision making.

COURSE OUTCOMES

CO1 : Students will demonstrate knowledge of waste management.

CO2: Students will demonstrate the ability of think to do the work in energy platform.

CO3: Students will demonstrate the ability o support energy materials during the projects.

UNIT I Introduction to Energy from Waste:

Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT II Biomass Pyrolysis:

Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT III Biomass Gasification:

Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT IV Biomass Combustion:

Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT V Biogas:

Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol

production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

REFERENCES

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Audit Course

ENGLISH FOR RESEARCH PAPER WRITING	*Credits*			
	L	***T***	***P***	***Total***
				-
Course Category:				

COURSE OBJECTIVE

1. Understand that how to improve your writing skills and level of readability
2. 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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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 V:

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.

REFERENCES

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.

Highman'sbook.

4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

DISASTER MANAGEMENT	Credits			
	L	T	P	Total
				-
Course Category:				

COURSE OBJECTIVES

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. critically understand the strengths and weaknesses of disaster management approaches,
5. planning and programming in different countries, particularly their home country or the countries they work in

UNIT I **Introduction**

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude

UNIT II **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 III: **Disaster Prone Areas In India**

Study O f 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

UNIT IV **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 V:**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. Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

REFERENCES

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

SANSKRIT FOR TECHNICAL KNOWLEDGE	Credits			
	L	*T*	*P*	*Total*
				-
Course Category:				

COURSE OBJECTIVES

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

COURSE OUTCOMES

CO1: Understanding basic Sanskrit language
CO2: Ancient Sanskrit literature about science & technology can be understood
CO3: Being a logical language will help to develop logic in students

UNIT I

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

UNIT II

Order - Introduction of roots -Technical information about Sanskrit Literature

UNIT III:

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

REFERENCES

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

VALUE EDUCATION	Credits			
	L	*T*	*P*	*Total*
				-
Course Category:				

COURSE OBJECTIVES

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character
4.

COURSE OUTCOMES

CO1: Knowledge of self-development
CO2: Learn the importance of Human values
CO3: Developing the overall personality

UNIT I

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

UNIT II

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 III

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

UNIT IV

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

REFERENCES

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

CONSTITUTION OF INDIA	Credits			
	L	*T*	*P*	*Total*
				-
Course Category:				

COURSE OBJECTIVES

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. 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.
3. 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

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.
CO2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
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.
CO4: Discuss the passage of the Hindu Code Bill of 1956.

UNIT I :**History of Making of the Indian Constitution:**

History Drafting Committee, (Composition & Working)

UNIT II :Philosophy of the Indian Constitution:
Preamble Salient Features

UNIT III: 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 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 & Election Commission

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- 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.

REFERENCES

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

PEDAGOGY STUDIES	Credits			
	L	*T*	*P*	*Total*
				-
Course Category:				

COURSE OBJECTIVES

- 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

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

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. Teachers' 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.

REFERENCES

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

STRESS MANAGEMENT BY YOGA	*Credits*			
	L	***T***	***P***	***Total***
				-
Course Category:				

COURSE OBJECTIVES

1. To achieve overall health of body and mind
2. To overcome stress

COURSE OUTCOMES

1. Develop healthy mind in a healthy body thus improving social health also Improve efficiency

UNIT I

Definitions of Eight parts of yog. (Ashtanga)

UNIT II:

Yam and Niyam. Do`s and Don't's in life-Ahins satya astheya, bramhacharya and aparigraha Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT III:

Asan and Pranayam- Various yog poses and their benefits for mind & bodyRegularization of breathing techniques and its effects-Types of pranayam

REFERENCES

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur.
2. Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata.

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