ANNAMALAI UNIVERSITY

Annamalainagar

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.E. Computer Science and Engineering

Choice Based Credit System

(Full – Time & Part -Time)

2019

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.E., COMPUTER SCIENCE & ENGINEERING

revised regulations & syllabi

(Students Admitted From the Academic Year 2018-2019)

VISION

To provide congenial academic environment for individuals to develop and blossom as academically superior, nationally responsible and socially conscious citizens.

MISSION

To impart high quality computer knowledge to the students by conducting education programmes

To provide exposure to the students about the emerging technological advancements for meeting the demands of the industry

To advance discipline of computing through internationally recognized research and development

To foster an environment that promotes extension activities and continuing education

PROGRAMME EDUCATIONAL OBJECTIVES

M. E. (Computer Science and Engineering) graduates will have a sufficient understanding in the field of Computer Science and Engineering including scientific principles, analysis, techniques and design methodologies to

Demonstrate ability to adapt to hastily rising advanced areas of computer science to achieve greater height in their profession through lifelong learning

Develop creative computer systems for solving social, technical, environmental real time problems that exhibit ethical responsibility

Apply their skills in clear communication, teamwork and time management for administering a team/project, working on multidisciplinary team with other stakeholders

Exhibit professional attitudes by assisting in proficient development, participating in professional societies and contributing an employer's efforts to comply with software licensing, protecting privacy, assure quality and safety

PROGRAMME OUTCOMES

After the successful completion of the M.E. (Computer Science and Engineering) degree programme, the students will be able to:

PO 1: ANALYTICAL SKILLS:
Narrate familiarity in the knowledge of computing, mathematical concepts, algorithmic principles in computer science and engineering theory to fabricate computer based systems of varying complexity.

PO 2: PROBLEM SOLVING SKILLS:
Analyze, generate, and interpret data to choose relevant procedures, resources and contemporary tools in computer science and engineering considering current and future trends.

PO 3: CREATIVE SKILLS:
Investigate and devise a computer based system to meet the necessary requirements within the realistic constraints such as economic, environmental, societal, ethical, safety and sustainability in the field of computer science and engineering.

PO 4: TEAM WORK AND PROFESSIONAL INTEGRITY:
Effectively function as a leader in multi-disciplinary teams and entrust on professional responsibilities to achieve a common objective.

PO 5: SPEAKING / WRITING SKILLS:
Correspond efficiently on intricate computing problems with all type of audiences and engrave valuable reports, documentation and oral presentations.

PO 6: ASSESSMENT SKILLS:
Broad analyzing capability on local and global impact of computing on individuals, organizations and society.

PO 7: SOCIAL AND CONTINUING EDUCATION PERCEPTION:
Express capability for sustainable professional development and life-long learning with a knowledge of contemporary issues for the growth of computer science and engineering field.

PO 8: CAREER AND IMMEDIATE EMPLOYMENT:
Recognize the significance of proficient perfection by pursuing studies to face competitive examinations and the ability to propose innovative methods in research for real-life problems that offer demanding and gratifying careers in computing.

PO 9: SELF MOTIVATED LEARNING:
Develop the ability of self-determined life-long learning in the scientific/technical perspective.

	Mapping PO with PEO								
PEOs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
PEO1	✓	✓	✓	✓				✓	
PEO2	✓	✓	✓	✓	✓	✓			
PEO3			✓	✓	✓	✓		✓	
PEO4				✓	✓	✓	✓		✓

SEMESTER I									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CSCSPC11	**PC-I**	Advanced Data Structures	3	-	-	25	75	100	3
CSCSPC12	**PC-II**	Machine Learning	3	-	-	25	75	100	3
CSCSPE13	**PE-I**	Program Elective-I	3	-	-	25	75	100	3
CSCSPE14	**PE-II**	Program Elective-II	3	-	-	25	75	100	3
CSCSMC15	**MC-I**	Research Methodology and IPR	2	-	-	25	75	100	2
CSCSCP16	**CP-I**	Advanced Data Structures Lab	-	-	3	40	60	100	2
CSCSCP17	**CP-II**	Machine Learning Lab	-	-	3	40	60	100	2
CSCSAC18	**AC-I**	Audit Course-I	2	-	-	-	-	-	0
			Total			205	495	700	18

SEMESTER II									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CSCSPC21	**PC-III**	Analysis of Algorithms	3	-	-	25	75	100	3
CSCSPC22	**PC-IV**	Embedded Control Systems and Internet of Things (IoT)	3	-	-	25	75	100	3
CSCSPE23	**PE-III**	Program Elective-III	3	-	-	25	75	100	3
CSCSPE24	**PE-IV**	Program Elective-IV	3	-	-	25	75	100	3
CSCSOE25	**OE-I**	Open Elective	3	-	-	25	75	100	3
CSCSCP26	**CP-III**	Embedded Control Systems and Internet of Things (IoT) Lab	-	-	3	40	60	100	2
CSCSTS27	**TS-I**	Industrial Training and Seminar / Mini project		Tr	S	40	60	100	2
				2	2				
CSCSAC28	**AC-II**	Audit Course-II	2	-	-	-	-	-	0
			Total			205	495	700	19

PC	**Program Core**	**CP**	**Core Practical**	**AC**	**Audit Course**
PE	Program Elective	**TS**	Industrial Training and Seminar/Mini Project	**PV**	Project work & Viva-voce
OE	Open Elective	**MC**	Mandatory Learning Course	**CS**	Branch code
				CS	M.E Specialization Code

SEMESTER III										
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CSCSPE31	**PE-V**	Program Elective-V	3	-	-	25	75	100	3
CSCSOE32	**OE-II**	Open Elective	3	-	-	25	75	100	3
CSCSPV33	**PV-I**	Project work & viva-voce Phase-I	-	Pr 16	S 4	40	60	100	10
			Total			90	210	300	16

SEMESTER IV									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CSCSPV41	**PV-II**	Project work & viva-voce Phase-II	-	Pr 24	S 6	40	60	100	15
			Total			40	60	100	15

L- Lecture ;**P**- Practical; **T**- Thesis; **CA**- Continuous Assessment; **FE**- Final Examination

Course Code EXAMPLE

Branch Code		**M.E Specialization**		**Category**		**Sem No.**	**Course No.**
Computer Science and Engineering		Computer Science and Engineering		Program Core / Program Elective/ Open Elective / Core Practical			
X	**X**	**Y**	**Y**	**P**	**C**	**1**	**1**
C	**S**	**C**	**S**	**P**	**C**	**1**	**1**

SEMESTER – I											
S.No	**Course Code**	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent Course Code in M.E. Full Time**
SEMESTER – I											
1	PCSC SPC11	**PC-I**	Advanced Data Structures	3	-	-	25	75	100	3	CSCS PC11
2	PCSC SPC12	**PC-II**	Machine Learning	3	-	-	25	75	100	3	CSCS PC12
3	PCSC SMC13	**MC-I**	Research Methodology and IPR	2	-	-	25	75	100	2	CSCS MC15
4	PCSC SCP14	**CP-I**	Advanced Data Structures Lab	-	-	3	40	60	100	2	CSCS CP16
	Total						115	285	400	10	

SEMESTER - II											
S.No	**Course Code**	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent Course Code in M.E. Full Time**
1	PCSC SPC21	**PC-III**	Analysis of Algorithms	3	-	-	25	75	100	3	CSCS PC21
2	PCSC SPC22	**PC-IV**	Embedded Control Systems and Internet of Things (IoT)	3	-	-	25	75	100	3	CSCS PC22
3	PCSC SOE23	**OE-I**	Open Elective –I	3	-	-	25	75	100	3	CSCS OE25
4	PCSC SCP24	**CP-II**	Embedded Control Systems and Internet of Things (IoT) Lab	-	-	3	40	60	100	2	CSCS CP17
	Total						115	285	400	11	

SEMESTER - III											
S.No	**Course Code**	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent Course Code in M.E. Full Time**
1	PCSC SPE31	**PE-I**	Program Elective – I	3	-	-	25	75	100	3	CSCS PE13
2	PCSC SPE32	**PE-II**	Program Elective – II	3	-	-	25	75	100	3	CSCS PC14
3	PCSC SCP34	**CP-III**	Machine Learning Lab	-	-	3	40	60	100	2	CSCS CP26
	Total						90	210	300	8	

SEMESTER – IV

S.No	Category	Course Code	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
1	PE-III	**PCSC SPE41**	Program Elective – III	3	-	-	25	75	100	3	CSCS PE23
2	PE-IV	**PCSC SPE42**	Program Elective - IV	3	-	-	25	75	100	3	CSCS PE24
3	TS-I	**PCSC STS44**	Industrial Training and Seminar/Mini Project	-	Tr 2	S 2	40	60	100	2	CSCS TS27
	Total						90	210	300	8	

SEMESTER – V											
S.No	**Category**	**Course Code**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent Course Code in M.E. Full Time**
1	PE-V	**PCSC SPE51**	Program Elective – V	3	-	-	25	75	100	3	CSC SPE31
2	OE-II	**PCSC SOE52**	Open Elective-II	3	-	-	25	75	100	3	CSC SOE32
3	PV-I	**PCSCS PV53**	Project Work and Viva-Voce Phase I	-	Pr 16	S 4	40	60	100	10	CSC SPV33
	Total						90	210	300	16	

SEMESTER – VI											
S.No	**Category**	**Course Code**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent Course Code in M.E. Full Time**
1	PV-II	**PCSC SPV61**	Project Work and Viva-Voce Phase II	-	Pr 24	S 6	40	60	100	15	CSCS PV41
	Total						40	60	100	15	

L- Lecture ;**P**- Practical; **T**- Thesis; **CA**- Continuous Assessment; **FE**- Final Examination

PC	Program Core	**CP**	Core Practical	**AC**	Audit Course
PE	Program Elective	**TS**	Industrial Training and Seminar	**PV**	Project work & Viva-voce
OE	Open Elective	**MC**	Mandatory Learning Course	**CS**	Branch code
				CS	M.E Specialization Code

LIST OF PROGRAM ELECTIVES

S. No.	**Program Electives**
	Wireless and Mobile Networks
1.	Computer Vision
2.	Advanced Image Processing
3.	Wireless Sensor Networks
4.	Knowledge based Systems
5.	Distributed Systems
6.	Web Engineering
7.	Data Preparation and Analysis
8.	Secure Software Design & Enterprise Computing
9.	Graphics Processing Unit (GPU) Computing
10.	Digital Forensics
11.	Mobile Applications and Services
12.	Optimization Techniques
13.	Data Mining and Warehousing
14.	Speech and Audio Signal Processing
15.	Networks and Information Security
16.	Digital Video Processing
17.	Medical Image Processing
18.	Mobile adhoc Networks
19.	Computer Network Engineering and Management

LIST OF OPEN ELECTIVES

S. No.	Open Electives
1	Data Science
2	Internet of Things (IoT)
3	Big Data Analytics
4	Cloud Computing Technologies
5	Advanced Web Design
6	Human and Computer Interaction
7	Soft Computing

LIST OF AUDIT COURSES

S. No.	Audit Course I and II
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

LIST OF VALUE-ADDED COURSES

S. No.	Value Added Course
1	Introduction to Data Science
2	Advanced Data Science

CSCSPC11	ADVANCED DATA STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

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.

Skip Lists: Need for randomizing data structures and algorithms, search and update operations on skip lists, probabilistic analysis of skip lists, deterministic skip lists. Trees: Binary search trees, AVL trees, red black trees, 2-3 trees, B-Trees, Splay trees.

Text Processing: String 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.

Computational Geometry:One Dimensional Range Searching, Two-Dimensional Range Searching, constructing a Priority Search Tree, Searching a Priority Search Tree, PriorityRange Trees, Quad Trees, k-D Trees. Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem.

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.
3. Peter Brass, “Advanced Data structures”, Cambridge University Press, 2008.
4. A.A. Puntambekar, “Advanced Data Structures”, Technical Publications, 2007.

COURSE OUTCOMES:

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

1. Understand the implementation of symbol table using hashing techniques.
2. Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
3. Build algorithms for text processing applications.

4. Identify suitable data structures and develop algorithms for computational geometry problems.
5. Implement algorithms related to computational geometry problems.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓				✓		✓		
CO2			✓			✓			
CO3				✓			✓		
CO4		✓			✓			✓	✓
CO5	✓		✓			✓		✓	

CSCSPC12	**MACHINE LEARNING**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the fundamental concepts of machine learning and its applications.
- To learn the classification, clustering and regression based machine learning algorithms
- To understand the deep learning architectures.
- To understand the methods of solving real life problems using the machine learning techniques.

Bayesian Decision Theory and Normal Distribution: Machine perception - feature extraction - classification, clustering, linear and logistic regression. Types of learning. Bayesian decision theory - classifiers, discriminant functions, and decision surfaces - univariate and multivariate normal densities - Bayesian belief networks.

Component analysis and Clustering Algorithms: Principal component analysis - Linear discriminant analysis - Independent component analysis. k-means clustering - fuzzy k-means clustering - Expectation-maximization algorithm-Gaussian mixture models – auto associative neural network.

Classification Algorithms: Perceptron and back propagation neural network - radial basis function neural network - probabilistic neural network - k-nearest-neighbor rule. Support vector machine: multi-category generalizations - Regression. Decision trees: classification and regression tree - random forest.

Deep Learning Architectures and Applications: Convolution neural networks (CNN) - Layers in CNN - CNN architectures. Recurrent Neural Network. Applications: Speech-to-text conversion-image classification-time series prediction.

Combining Multiple Learners: Generating diverse learners - model combination schemes - voting - error-correcting output codes - bagging - boosting - mixture of experts revisited - stacked

generalization - fine-tuning an ensemble – cascading. Recent trends in various learning techniques of machine learning and classification methods for solving real world problems.

REFERENCES:

1. R. O. Duda, E. Hart, and D.G. Stork, "Pattern classification", Second edition, John Wiley & Sons, Singapore, 2003.
2. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.
3. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
4. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
5. Francois Chollet, "Deep Learning with Python, Manning Publications, Shelter Island, New York, 2018. (freely available online)
6. Navin Kumar Manaswi, Deep Learning with Applications using Python, Apress, New York, 2018. (freely available online)

COURSE OUTCOMES:

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

1. Understand the basic concepts of machine learning.
2. Employ the classification, clustering and regression algorithms.
3. Apply the deep learning architectures.
4. Implement a method for solving real life problem using a suitable machine learning technique.
5. Apply recent in various learning techniques of machine learning and classification methods for solving real world problems.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓						
CO2	✓	✓							
CO3							✓	✓	
CO4							✓	✓	
CO5	✓		✓			✓			✓

CSCSMC15	**RESEARCH METHODOLOGY AND IPR**	**L**	**T**	**P**	**C**
		2	0	0	2

COURSE OBJECTIVES:

- To understand the scope, characteristics and objectives of the research problem.
- To analyse and investigate the research problem.
- To write the research proposal and to present before a committee.
- To understand the nature of grants and patents.

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.

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

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.

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. IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

REFERENCES:

1. C. R. Kothari, Research Methodology – Methods and Techniques, Third Ed., New Age International Publishers, New Delhi, 2014.
2. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”, Juta and Company, 1996.

3. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction", Juta, 2001.
4. Ranjit Kumar, "Research Methodology: A Step by Step Guide for beginners", 2nd edition, Pearson Longman, 2005.
5. Halbert, "Resisting Intellectual Property", Taylor& Francis Ltd, 2007.
6. Mayall, "Industrial Design", McGraw Hill, 1992.

COURSE OUTCOMES:

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

1. Understand research problem formulation. Analyze research related information.
2. Follow research ethics.
3. Understand IPR and to promote among students.
4. Create investment in R & D, which leads to creation of new and better products, and in turn to bring economic growth and social benefits.
5. Generate novel developments in IPR systems.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓			✓		✓	✓	
CO2			✓	✓					✓
CO3						✓	✓		
CO4		✓		✓	✓			✓	✓
CO5	✓		✓			✓		✓	

CSCSCP16	**ADVANCED DATA STRUCTURES LAB**	**L**	**T**	**P**	**C**
		0	0	3	2

COURSE OBJECTIVES:

- To implement the advanced data structure techniques using C++.
- 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.
- To Gain knowledge in practical applications of data structures.

LIST OF EXERCISES

CYCLE – I

Write a C++ program to implement the following:

1. Hashing with chaining.
2. Skip Lists.
3. Binary Search Tree.
4. AVL Trees.
5. B-Trees.

CYCLE – II

1. String matching using Boyer-Moore algorithm.
2. Trie structure.
3. Huffman coding algorithm.
4. One dimensional range searching.
5. Two dimensional range searching.

COURSE OUTCOMES:

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

1. Understand to design and analyze the time and space efficiency of the data structure.
2. Understand and capable to identity the appropriate data structure for given problem.
3. Understand the practical knowledge on the application of data structures.
4. Understand the need of developing graphics applications.
5. Learned algorithmic development of graphics primitives like: line, circle, ellipse, polygon etc. and the representation and three-dimensional transformations.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓		✓		✓		✓
CO2	✓	✓		✓		✓		✓	✓
CO3	✓	✓	✓			✓			✓
CO4	✓		✓		✓		✓		✓
CO5	✓	✓		✓		✓	✓	✓	✓

CSCSCP17	**MACHINE LEARNING LAB**	**L**	**T**	**P**	**C**
		0	0	3	2

COURSE OBJECTIVES:

- To implement the basic machine learning techniques using Python.
- To implement the convolution neural network architecture using Python.
- To solve the challenging research problems in the area of Speech and Image processing.

LIST OF EXERCISES

CYCLE – I

Write a PYTHON program to implement the following:

1. Linear and logistic regression with error estimation.
2. Univariate and multivariate Gaussian densities.
3. Dimensionality reduction using Principal Component Analysis (PCA).
4. Clustering using
    a) k-means.
    b) Gaussian mixture modeling (GMM).
5. Classification using
    a) Back propagation neural network (BPNN).
    b) Support vector machine (SVM).
6. Construction of decision tree and random forest.

CYCLE – II

7. Convolution neural network (CNN).

8. Sequence prediction using recurrent neural network (RNN).

9. Isolated-word speech recognition.

10. Face detection and tracking.

COURSE OUTCOMES:

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

1. Understand the basic concepts of machine learning.
2. Devise and implement the classification, clustering and regression algorithms.
3. Implement the deep learning architectures.
4. Design and implement methods for solving real life problems using a suitable machine learning technique.
5. Apply the machine learning algorithms in real life problems.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓						
CO2	✓	✓						✓	
CO3							✓		✓
CO4							✓		✓
CO5	✓		✓			✓			

CSCSPC21	**ANALYSIS OF ALGORITHMS**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To introduce students the advanced methods of designing and analyzing algorithms.
- To enable the students 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.
- To understand different classes of problems concerning their computation difficulties.
- To introduce the students to get familiarity in recent developments in the area of algorithmic design.

Sorting: Review of various sorting algorithms, topological sorting. Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkstra'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.

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.

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.

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.

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 Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein “Introduction to Algorithms”, Second Edition, MIT Press, McGraw Hill, 2001.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey d. Ullman, “The Design and Analysis of Computer Algorithms”, Addison-Wesley Publishing Company, 1974.
3. Jon Kleinberg, Eva Tardos, “Algorithm Design”, Pearson Addison Wesley, 2005.
4. Robert Sedgewick, Philippe Flajolet, “An Introduction to the Analysis of Algorithms”, 2nd Edition, Addison Wesley, 2013.

COURSE OUTCOMES:

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

1. Analyze the complexity/performance of different algorithms.
2. Determine the appropriate data structure for solving a particular set of problems.
3. Categorize the different problems in various classes according to their complexity.
4. Have an insight of recent activities in the field of the advanced data structure.

5. Analyze the feasibility of the linear programming techniques by applying recently proposed data structures.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓				✓		✓		✓
CO2			✓			✓			
CO3	✓		✓		✓		✓		
CO4				✓				✓	✓
CO5	✓	✓			✓		✓		

CSCSPC22	**EMBEDDED CONTROL SYSTEMS AND INTERNET OF THINGS (IoT)**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To expose the students about the fundamentals of Embedded System.
- To educate about Firmware design and development.
- To discuss on aspects required in Embedded system design techniques.
- To understand the fundamentals of Internet of Things.
- To build a small low-cost embedded system using Arduino / Raspberry Pi or equivalent boards and to apply the concept of Internet of Things in the real world scenario.

Embedded System Vs General Computing System - Classification of Embedded System, Purpose of Embedded system, Quality Attributes of Embedded System -Typical Embedded System- Core of Embedded System, Memory, Sensors and Actuators, Communication Interface- Onboard communication interface, External communication interface.

Embedded Firmware Design Approaches- Embedded Firmware Development Languages - Embedded System Development Environment - IDE, Compiler, Linker - Types of File Generated on Cross Compilation-Simulator, Emulator and Debugging- Fundamental issues in Hardware Software Co-design- Integration and Testing of Embedded Hardware and Firmware.

Introduction-Characteristics - Physical design - protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoT vs M2M. IoT systems management – IoT Design Methodology – Specifications Integration and Application Development.

Physical device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web services. Intel Galileo Gen2 with Arduino- Interfaces - Arduino IDE – Programming - APIs and Hacks.

Various Real time applications of IoT- Connecting IoT to cloud – Cloud Storage for IoT – Data Analytics for IoT – Software & Management Tools for IoT.

IoE – Overview – Architecture-Smart objects and LLNs-Secure mobility. Home automation – Cities: Smart parking – Environment: Weather monitoring – Agriculture: Smart irrigation – Data analytics for IoT – Software & management tools for IoT cloud storage models & Communication APIs – Cloud for IoT – Amazon Web Services for IoT.

REFERENCES:

1. Shibu K.V, “Introduction to Embedded System”, Tata McGraw-Hill, 2014.
2. David E. Simon, “An Embedded Software Primer”, Pearson Education Asia, Addison Wesley, 2001.
3. Marilyn Wolf, Computers as Components, Principles of Embedded Computing System Design”, Morgan Kaufmann Publishers, Third edition, 2012.
4. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.
5. Manoel Carlos Ramon, “Intel Galileo and Intel Galileo Gen 2: API Features and Arduino Projects for Linux Programmers”, Apress, 2014.
6. Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014.

COURSE OUTCOMES:

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

1. Recognize the key features of embedded systems in terms of computer hardware and be able to discuss their functions.
2. Aware of the key factors in embedded system design and development.
3. Explain the special extra-functional that are imposed on embedded systems.
4. Design a portable IoT using Arduino/ equivalent boards and relevant protocols.
5. Develop web services to access/control IoT devices.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		✓			✓				
CO2	✓		✓	✓			✓		
CO3				✓				✓	
CO4			✓			✓			✓
CO5	✓	✓			✓		✓		

CSCSCP26	EMBEDDED CONTROL SYSTEMS AND INTERNET OF THINGS (IoT) LAB	L	T	P	C
		0	0	3	2

COURSE OBJECTIVES:

- To introduce IoT concepts and techniques and support their ability in designing suitable procedure for a specified scenario in Python.
- To employ IoT based solutions for real-world problems.
- To give students knowledge on humanoid PC software, humanoid android App, Arduino, BISOFT PC software GUI programming toolkit for Python.
- To provide the student hand-on experience on Python to implement various IoT techniques.

LIST OF EXERCISES

CYCLE I

1. Programming and Simulation of 8051 in Keil IDE [Finding average of numbers].
2. Alphanumeric LCD interface using 8051.
3. Study of ARM evaluation system.
4. Flashing of LEDs using ARM (LPC2148).
5. Interfacing keyboard and LCD using ARM (LPC2148).
6. Temperature sensor interface using ARM (LPC2148).
7. Study of FPGA evaluation system.
8. Design of logic gates using FPGA.
9. Design of UP/Down counter using FPGA.

CYCLE II

1. Automatic street light control.
2. Control raspberry Pi using local server.
3. Connect with RTC.
4. Rasberry Pi as Server.
5. Transfer data using serial communication.
6. Smart Jacket with interactive display.
7. Accident alert with location information over Internet.
8. Personalized toy for kids – voice based.
9. Live air pollution monitor over Internet.
10. Interactive humanoid.

11. Smart gloves for gaming.
12. Interactive learning kit with touch sensor.
13. Google voice recognition assisted remote control robot.
14. Learn electronics the smart way – TROPS and Beak kit.

COURSE OUTCOMES:

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

1. Understand the basic concepts of IoT.
2. Design and implement IoT techniques to solve the real world problems.
3. Implement solution methods on humanoid PC software, humanoid android App, Arduino, BISOFT PC software.
4. Develop applications in 8051 in Keil IDE.
5. Design and implement embedded solution using ARM (LPC2148).

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓		✓	✓	✓		
CO2	✓	✓						✓	
CO3				✓	✓		✓		✓
CO4	✓			✓				✓	
CO5		✓			✓		✓		

CSCSTS27	INDUSTRIAL TRAINING AND SEMINAR / MINI PROJECT	L	Tr	S	C
		0	2	2	2

Note: * Students should be encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break.

COURSE OBJECTIVES:

- To train the students in the field work related to Computer Science and Engineering and to have a practical knowledge in carrying out the Computer Science and Engineering related problems.
- To train and develop skills in solving problems during execution of the problems related to Computer Science and Engineering.
- To work on a technical topic related to Computer Science and Engineering and acquire the ability of written and oral presentation.
- To acquire the ability of writing technical papers for Conferences and Journals.

The students will individually undertake a training program in reputed concerns in the field of Computer Science and Engineering during summer vacation (at the end of second semester for Full Time / Fifth semester for Part – Time) for a minimum stipulated period of four weeks. At the end of training the student has to submit the detailed report on the training undertaken within ten days from the commencement of the third semester for Full Time / Fifth semester for Part – Time. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva-voce examination.

For seminar/mini project, the students will work for two periods per week guided by a faculty. They will be asked to give a presentation of not less than 15 minutes and not more than 30 minutes (on any technical topic for seminar and on the project title for mini project). They will defend their presentation. A brief copy of their presentation also should be submitted. Evaluation will be done by the examiners based on the technical presentation, the report and also on the interaction shown during the seminar/viva for seminar and mini project respectively.

COURSE OUTCOMES:

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

1. Analyze a given Computer Science and Engineering problem and to identify and implement appropriate problem-solving methodology to propose a meaningful solution.
2. Face the audience and to interact with them confidently.
3. Tackle any problem during group discussion in the corporate interviews.
4. Acquire the ability to work in the actual environment and to use the technical resources.
5. Analyse any short coming while implementing a technical problem and to handle the same.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓		✓		✓	✓	✓
CO2	✓	✓		✓		✓	✓		
CO3	✓		✓	✓	✓		✓	✓	✓
CO4		✓			✓	✓			✓
CO5	✓			✓			✓		✓

CSCSPV33	**PROJECT WORK AND VIVA-VOCE PHASE-I**	**L**	**Pr**	**S**	**C**
		0	16	4	10

COURSE OBJECTIVES:

- To train the students in the current thrust area in Computer Science and Engineering and to have practical knowledge in handling the technical scenario.
- To develop skills on the research topic and to implement the appropriate methods to handle the issue.

The students will individually undertake a research problem in the field of Computer Science and Engineering in the third semester for Full-Time / Fifth semester for Part-Time. The student will be guided by a staff member. The progress of the research will be evaluated every month by a team of staff members. The student has to submit the detailed report on the research problem at the end of Third semester for Full-Time / Fifth semester for Part-Time. The student will be evaluated by a team of examiners nominated by the Head of the Department through a viva-voce examination.

COURSE OUTCOMES:

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

1. Conduct independent empirical research to evaluate and present their results responsibly and critically.
2. Present the conclusions with understandability using appropriate tables and graphs in the form of report.
3. Maintain the ethical standards of scientific research and to follow the basic principles in an academic community that requires constant learning and knowledge updation.
4. Analyse any short coming while implementing a technical problem and to handle the same.
5. Implement any research problem in the current thrust area using the gained practical knowledge.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓		✓	✓	✓		
CO2	✓	✓		✓			✓	✓	✓
CO3	✓	✓		✓	✓		✓		✓
CO4	✓		✓					✓	
CO5		✓			✓	✓			✓

CSCSPV41	**PROJECT WORK AND VIVA-VOCE PHASE-II**	**L**	**Pr**	**S**	**C**
		0	26	6	16

COURSE OBJECTIVES:

- To train the students in the current thrust area in Computer Science and Engineering and to have practical knowledge in handling the technical scenario.
- To develop skills on the research topic and to implement the appropriate methods to handle the issue.

The students will continue the research problem undertaken during third semester for Full-Time / Fifth semester for Part-Time in the field of Computer Science and Engineering. The student will be guided by a staff member. The progress of the research will be evaluated every month by a team of staff members. The student has to submit the detailed report on the research problem at the end of Fourth semester for Full-Time / Sixth semester for Part-Time. The student will be evaluated by a team of examiners nominated by the Head of the Department through a viva-voce examination.

COURSE OUTCOMES:

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

1. Conduct independent empirical research to evaluate and present their results responsibly and critically.
2. Present the conclusions with understandability using appropriate tables and graphs in the form of report.
3. Maintain the ethical standards of scientific research and to follow the basic principles in an academic community that requires constant learning and knowledge updation.
4. Analyse any short coming while implementing a technical problem and to handle the same.
5. Implement any research problem in the current thrust area using the gained practical knowledge.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓		✓	✓	✓	✓	
CO2	✓	✓		✓			✓	✓	✓
CO3	✓	✓		✓	✓		✓		✓
CO4	✓		✓					✓	
CO5		✓			✓	✓			✓

PROGRAM ELECTIVES

CSCSPEXX	**WIRELESS AND MOBILE NETWORKS**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To get familiarity with the wireless/mobile market and the future needs and challenges.
- To know the key concepts of wireless networks, standards, technologies and their basic operations.
- To study the design and analyse various security techniques.
- To evaluate MAC and network protocols using network simulation software tools.
- To get familiar with the wireless/mobile market and the future needs and challenges.

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.

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.

Wireless cellular networks: 1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless 10 Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, Spread spectrum Technologies.

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, Overview on IEEE 802.21 Media Independent Handover. Wireless sensor networks: Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Overview on Tiny OS.

Wireless pans: Bluetooth AND Zigbee, Introduction to Wireless Sensors. 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. Jochen Schiller, "Mobile Communications", 2nd edition, Pearson, 2004.
2. William Stallings, "Wireless Communications and Networks", Pearson Education India, 2009.
3. Stojmenic Ivan, "Handbook of Wireless Networks and Mobile Computing", John Wiley and Sons Inc, 2003.
4. Yi Bing Lin and Imrich Chlamtac, "Wireless and Mobile Network Architectures", John Wiley and Sons Inc, 2008.
5. Pandya Raj, "Mobile and Personal Communications Systems and Services", Wiley-IEEE Press, 2004.

COURSE OUTCOMES:

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

1. Demonstrate advanced knowledge of networking and wireless networking and understand various types of wireless networks, standards, operations and use cases.
2. Be able to design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.
3. Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
4. Design wireless networks exploring trade-offs between wire line and wireless links. Develop mobile applications to solve some of the real world problems.
5. Devise network and security applications by applying recent techniques.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		✓	✓	✓	✓				✓
CO2	✓						✓	✓	
CO3		✓	✓	✓		✓			✓
CO4	✓			✓	✓	✓	✓	✓	
CO5	✓		✓		✓				✓

CSCSPEXX	COMPUTER VISION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To make the students familiar with both the theoretical and practical aspects of computing with images.
- To describe the foundation of image formation, measurement and analysis.
- To understand the geometric relationships between 2D images and the 3D world.
- To grasp the principles of state-of-the-art deep neural networks.

Nature of Vision – Images and imaging operations: Introduction – Image processing operations – Basic image filtering operations: Noise suppression by Gaussian smoothing – Median filters – Color in image filtering – Corner and interest point detection.

Binary shape analysis: connectedness – Object labelling – Size filtering – Distance functions – Skelton and thinning. Boundary pattern analysis: Boundary tracking – Centroidal profiles – Occlusion problems.

Pattern matching techniques: Graph-theoretic approach to object location, possibilities for saving computation, Using generalized Hough transform for feature collation, generalizing the maximal Clique and other approaches, relational descriptors, Search.

3D - Vision and variety of methods – Shape and shading – Photometric stereo – Shape and texture. Motion: Introduction, Optical Flow, Interpretation of optical flow fields, using focus of expansion to avoid collision, time-to-adjacency analysis, difficulties with optical flow method, stereo from motion, Kalman filter.

Real-time pattern recognition systems: Case study on location of cereals and insects, Surveillance, In-Vehicle vision systems.

REFERENCES:

1. Hearn D and Baker M.P., “Computer Graphics”, Second Edition, PHI, 1998.
2. E. R. Davies, “Computer and Machine Vision: Theory, Algorithms, Practicalities”, Fourth edition, Academic Press, 2012.
3. Foley J.D., Vandam A., Feiner SK., Hughes JF., “Computer Graphics Principles and Practice”, Addison-Wesley Publishing Company, 1993.
4. David A. Forsyth, Jean Ponce, “ Computer vision: A Modern Approach”, 2nd Edition, Pearson, 2012.
5. Bernd Jahne, Horst HauBecker, “Computer Vision and Applications: A Guide for Students and Practitioners”, Academic Press, 2000.

COURSE OUTCOMES:

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

1. Implement computer graphics techniques required for computer vision.
2. Apply the concepts of visible and illumination methods.
3. Implement 3D vision techniques.
4. Develop computer vision algorithms.
5. Design and implement pattern matching techniques.
6.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓	✓	✓		✓	✓	✓	
CO2	✓		✓	✓	✓	✓		✓	✓
CO3		✓		✓		✓	✓	✓	
CO4	✓	✓	✓		✓		✓	✓	✓
CO5		✓		✓		✓			✓

CSCSPEXX	**ADVANCED IMAGE PROCESSING**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To understand representation of digital images in the spatial and frequency domains.
- To understand Image Compression, Segmentation and image compression standards.
- To provide an in-depth understanding of various concepts related to image Representation and Description.
- To get familiar with image enhancement concepts and image degradation/restoration process.

Digital image representation Fundamental Steps in Digital Image Processing, Components of an Image Processing System-Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sampling and Quantization, Some Basic Relationships between Pixels.

Image enhancement : Spatial Domain – Gray level Transformations – Histogram Processing – Smoothing and Sharpening filters. Frequency Domain - Filtering in Frequency Domain — Smoothing and Sharpening filters – Homomorphic Filtering.

2-D Fourier transform, Fast Fourier transform, Other separable transforms: Walsh Transform, Hadamard Transform, Discrete Cosine Transform, wavelet Transform, Haar function, Gabor Transform, Hotelling transforms, Color Fundamentals. Color Models. Basics of Color Image Processing.

A Model of the Image Degradation/Restoration Process. Noise Models. Restoration in the Presence of Noise Only-Spatial Filtering. Inverse Filtering. Minimum Mean Square Error (Wiener) Filtering. Constrained Least Squares Filtering. Geometric Mean Filter.

Image compression: Redundancies, image compression models, elements of information theory, error-free compression variable length coding, bit plane coding, lossless predictive coding, lossy compression, predictive coding, transform coding, image compression standards- JPEG, MPEG. Image Analysis: Segmentation, detection of discontinuities, edge linking and boundary detection, Edge Operators, thresholding, region-oriented segmentation. Image Representation and Description: Representation schemes, Boundary descriptors, Regional descriptors.

REFERENCES:

1. R.C. Gonzalez and R. E. Woods, Digital image processing, Addison-Wesley Publishing House, 3rd edition, 2008.

A. K. Jain, Fundamentals of digital image processing, Prince-HallIndia, 1988.

2. K. R. Castleman, Digital Image Processing, Prince-Hall International, 1996.
3. A.L.Bovik, Handbook of Image and Video Processing, Academic Press, 2nd edition, 2005.
4. Yao Wang, Joern Ostermann, Ya-Qin Zhang, Video Processing in Communication, Prentice Hall, Pearson Education, 2002.
5. Ze-Nian Li and Mark S. Drew, Fundamentals of Multimedia, Prentice Hall, Pearson Education, 2004.

COURSE OUTCOMES:

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

1. Acquire knowledge of principles of digital image processing.
2. Solve problems pertaining to the field of image acquisition, preprocessing, Fourier domain processing.
3. Perform basic image restoration, image segmentation and image compression.
4. Provide the foundations for life-long learning and continual professional development in the areas of image applications.
5. Interpret various image compression standards.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓					✓		✓	
CO2	✓	✓			✓				✓
CO3			✓					✓	
CO4			✓	✓	✓		✓		✓
CO5	✓	✓				✓		✓	

CSCSPEXX	**WIRELESS SENSOR NETWORKS**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To understand sensor networks for various application setups.
- To devise appropriate data dissemination protocols and model links cost.
- To study the fundamental concepts of wireless sensor networks and to have a basic knowledge of the various protocols at various layers.
- To evaluate the performance of sensor networks and identify bottlenecks.

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

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

Security: Possible attacks, countermeasures, SPINS, Static and dynamic key distribution . 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. Advanced topics: 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 Inderscience 2007.
3. Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, "Wireless Sensor Network Technologies for the Information Explosion Era", Springer 2010.
4. Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks: Technology, Protocols and Applications", John wiley & sons Inc., 2007.

COURSE OUTCOMES:

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

1. Describe and explain radio standards and communication protocols for wireless sensor networks.
2. Explain the function of the node architecture and use of sensors for various applications.
3. Obtain familiarity with architectures, functions and performance of wireless sensor networks systems and platforms.
4. Demonstrate various security related issues in routing protocols.
5. Utilize the knowledge gained in relevant advanced topics in wireless sensor networks.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓			✓	✓		✓		✓
CO2			✓	✓		✓		✓	
CO3		✓	✓		✓				
CO4	✓		✓			✓			✓
CO5		✓		✓				✓	

CSCSPEXX	KNOWLEDGE BASED SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- 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.
- To explore the essential theory behind methodologies for developing systems that demonstrates intelligent behaviour including dealing with uncertainty.
- To learn from experience by following problem solving strategies found in real life.

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

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

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. Optimization and search such as stochastic annealing and genetic algorithm.

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.

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., “Artificial Intelligence: Structures and strategies for Complex Problem Solving”, Addison Wesley, 6th edition, 2008.
2. Russell S. and Norvig P, Artificial Intelligence: A Modern Approach. Prentice-Hall, 3rd edition, 2009.
3. Rajendra Akerkar, Priti Sajja, “Knowledge based Systems”, John Barlett Learning, 2010.
4. Steven Finlay, “Artificial Intelligence and Machine Learning for Business”, Relativistic, 2017.

COURSE OUTCOMES:

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

1. Demonstrate knowledge of the fundamental principles of intelligent systems.
2. Analyze and compare the relative merits of a variety of AI problem solving techniques.
3. Understand the reasoning and learning techniques under uncertainty.
4. Be aware of general competence in implementing knowledge based engineering.

5. Understand the effect of knowledge based engineering and the overall understanding of the whole process.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓			✓	✓		✓		✓
CO2		✓			✓	✓		✓	
CO3			✓	✓	✓		✓		✓
CO4	✓			✓			✓	✓	
CO5		✓			✓	✓		✓	✓

CSCSPEXX	**DISTRIBUTED SYSTEMS**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment.
- To provide insight into related research problems.
- To introduce advanced concepts in mobile and multi databases.

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.

Distributed database design: Alternative design strategies; Distributed design issues; Fragmentation; Data allocation. Semantics data control: View management; Data security; Semantic Integrity Control. Query processing issues: Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data

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.

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

Parallel database systems: Parallel architectures; parallel query processing and optimization; load balancing. Advanced topics: Mobile Databases, Distributed Object Management, Multi-databases.

REFERENCES:

1. M.T. Ozsu and P. Valduriez, "Principles of Distributed Database Systems" , Prentice-Hall, 1991.
2. D. Bell and J. Grimson, " Distributed Database Systems", Addison-Wesley, 1992.
3. Chanda Ray, "Distributed Database Systems", Pearson Education India, 2009.
4. George coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, "Distributed Systems Concepts and Design", 5th edition, Addison Wesley, 2012.

COURSE OUTCOMES:

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

1. Design trends in distributed systems.
2. Apply network virtualization.
3. Employ remote method invocation and objects.
4. Describe the reliability techniques and concurrency control in DDBs.
5. Apply distributed computing environment and parallel architecture techniques.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓		✓		✓		✓	✓
CO2	✓		✓	✓			✓		
CO3			✓		✓	✓			✓
CO4	✓			✓			✓		
CO5		✓			✓			✓	✓

CSCSPEXX	**WEB ENGINEERING**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To understand web engineering principles for web application development.
- To learn to architect and model web applications.
- To design web application using design methods.
- To apply various testing methods and understand web project management.

Introduction to Web Engineering: Web Engineering — Motivation -– Categories of Web Applications — Characteristics of Web Applications — Requirement Specifics in web engineering –

Web engineering: Components; Process; Communication and Planning.

Web Application Architecture and Modelling Web Applications: Introduction – Categorizing architectures – Specifics of Web application architectures – Components of generic web application architecture -– Layered and Data-aspect architectures – Modelling specifics in web engineering—Modelling: Requirements; Content; Hypertext; Presentation and Customization – Modelling Frameworks – Modelling Languages – Analysis modelling of web apps: Content; Interaction and Configuration models.

Web Application Design: Design for web apps – Goals – Design Process – Interactive Design: Principles and Guidelines; Workflow; Preliminaries; Design Steps; Usability and Issues – Design: Information; Navigation; Functional and Presentation.

Testing Web Applications: Testing fundamentals -– Test specifics in Web Engineering -– Test Approaches -– Testing web Apps – Test schemes -– Test methods and techniques — Test automation.

Promoting Web Applications and web project management: Operation and maintenance of web applications: Introduction; Challenges in launching the web application. Promoting web application; Content Management. Usage Analysis –Web project management – Usability of web application – Performance of web application.

REFERENCES:

1. Gerti Kappel, Birgit Proll, "Web Engineering", John Wiley and Sons Ltd, 2006.
2. Roger S. Pressman, David Lowe, "Web Engineering", Tata McGraw Hill Publication, 2007.
3. Gustavo Rossi, Oscar Pastor, Daniel Schwabe, Luis Olsina, "Web Engineering: Modelling and ImplementingWeb Applications", Springer, 2007.
4. San Murugesan, Yogesh Deshpande, "Web Engineering: Managing Diversity and Complexity of Web Application Development", Springer, 2001.

COURSE OUTCOMES:

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

1. Understand web engineering concepts.
2. Compare different web application architectures and models.
3. Apply design technique to develop web applications.
4. Compare various testing approaches.
5. Apply guidelines to manage web applications.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		✓		✓	✓		✓		
CO2	✓		✓	✓	✓	✓			✓
CO3		✓	✓					✓	✓
CO4	✓	✓		✓	✓	✓	✓	✓	

CO5	✓			✓		✓	✓		✓

CSCSPEXX	**DATA PREPARATION AND ANALYSIS**	**L**	**T**	**P**
		3	0	0

COURSE OBJECTIVES:

- To prepare the data for analysis and develop meaningful Data Visualizations.
- To work with a variety of real-world data sets.
- To learn how to prepare data sets for analysis by cleaning and reformatting.
- To apply a variety of different data exploration techniques including summary statistics and visualization methods.

Introduction: Sources of data, process for making sense of data. Describing Data: Observations and variables, types of variables, central tendency, distribution of the data, confidence intervals, hypothesis tests.

Preparing data tables: Cleaning the data, removing observations and variables, Removing Observations and Variables, Generating Consistent Scales Across Variables, New Frequency Distribution, Converting Text to Numbers, Converting Continuous Data to Categories, Combining Variables, Generating Groups, Preparing Unstructured Data.

Exploratory Analysis, Descriptive and comparative statistics, clustering and association, hypothesis generation. Identifying and understanding groups: Learning Decision Trees from Data.

Visualization, Designing visualizations, time series, geolocated data, correlations and connections, hierarchies and networks, interactivity. Understanding relationships: Visualizing Relationships Between Variables, Calculating Metrics About Relationships.

Building models from data: Overview, Linear Regression, Logistic Regression, k-Nearest Neighbors, Classification and Regression Trees, Ethics in the profession: Cases in computing, statistics and communication.

REFERENCES:

1. Glenn J. Myatt, Wayne P. Johnson, "Making Sense of Data: A Practical Guide to Exploratory Data Analysis and Data Mining", 2nd Edition, Wiley, 2014.
2. Edward R. Tufte, "The Visual display of Quantitative Information", 2nd Edition, Graphics Press Cheshire, 2001.
3. Ben Fry, "Visualizing Data: Exploring and Explaining Data with the Processing Environment", O'Reilly Media Inc., First Edition, 2007.
4. Tamraparni Dasu, Theodore Johnson, "Exploratory Data Mining and Data Cleaning", John Wiley & Sons Inc., Wiley Series in Probability and Statistics, 2003.

COURSE OUTCOMES:

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

1. Work in a business environment in which data preparation occurs.
2. Prepare data marts for statistical analysis.
3. Read data from databases and clean the data for statistical analysis.
4. Develop strategies for dealing with imperfect real world data.
5. Understand ethics in the profession.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		✓		✓	✓		✓		
CO2	✓		✓	✓	✓	✓			✓
CO3		✓	✓					✓	✓
CO4	✓	✓		✓	✓	✓	✓	✓	
CO5	✓		✓			✓			✓

CSCSPEXX	**SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING**	**L**	**T**	**P**	**C**
		3	0	0	3

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.
- To learn techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
- To design methodologies and tools to develop secure software containing minimum vulnerabilities and flaws.

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.

Enterprise Application Development: Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for thepresentation, 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.

Enterprise Systems Administration: Design, implement and maintain a directory-based server infrastructure in an 8 heterogeneous systems environment, monitor server resource utilization for system reliability and availability, Install and administer networkservices (DNS/DHCP/Terminal Services/Clustering/Web/ Email).

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.

Handle insecure exceptions and command/SQL injection, defendweb 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, 2013.
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, "Enterprise Software Security: A Confluence of Disciplines", Addison Wesley, 2014.
3. William R. Simpson, "Enterprise level security: Securing Information Systems in an Uncertain world", 1st edition, CRC Press, 2016.
4. Qing Li, Gregory Clark, "Security Intelligence: A Practitioner's Guide to Solving Enterprise Security Challenges", Wiley, 2010.

COURSE OUTCOMES:

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

1. Differentiate various software vulnerabilities.
2. Understand software process vulnerabilities for an organization.
3. Monitor resources consumption in a software.
4. Interrelate security and software development process.
5. Manage and troubleshoot a enterprise network and to manage them.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓				✓	✓		✓	✓
CO2	✓	✓			✓		✓	✓	
CO3		✓	✓	✓		✓		✓	✓
CO4	✓	✓	✓	✓	✓		✓		✓
CO5	✓		✓			✓		✓	

CSCSPEXX	**GRAPHICS PROCESSING UNIT (GPU) COMPUTING**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To learn parallel programming with Graphics Processing Units (GPUs).
- To understand GPU computer architecture.
- To learn GPU programming environments.
- To program and debug GPU programs.

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 / Wave fronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D / 3D thread mapping, Device properties, Simple Programs.

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.

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.

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.

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. David Kirk, Wen-mei Hwu, "Programming Massively Parallel Processors: A Hands-on Approach", 2nd edition, Morgan Kaufman, 2012.
2. Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", Morgan Kaufman; 2013.
3. Cai, Yiyu, See, Simon (Eds), "GPU Computing and Applications, Springer, 2015.
4. Jason Sanders, Edward Kandrot, "CUDA By Example: An Introduction to General Purpose GPU Programming", Addison Wesley, 2011.

COURSE OUTCOMES:

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

1. Implement concepts in parallel programming.
2. Synchronize CPU and GPU Functions.
3. Debug and profile parallel programs.
4. Apply multi GPU concepts.
5. Design programs for concurrent Data Structures such as Worklists

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓			✓		✓		✓
CO2			✓	✓		✓	✓		
CO3	✓	✓			✓	✓		✓	✓
CO4	✓	✓		✓	✓		✓	✓	
CO5		✓	✓			✓			✓

CSCSPEXX	DIGITAL FORENSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide an in-depth study of the rapidly changing and fascinating field of computer forensics.
- To combine both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
- To obtain knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools.
- To collect and preserve E-evidence, investigate operating systems and file systems, network forensics, art of steganography and mobile device forensics.

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.

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.

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.

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.

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", 2nd edition, Syngress, 2014.
2. John Vacca, "Computer Forensics: Computer Crime Scene Investigation", 2nd edition, Charles River Media, 2005.
3. Cory Altheide, Harlan Carvey, "Digital Forensics with Open Source Tools", Elsevier, 2011.
4. Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics and Investigations, 4th Edition, Course Technology, 2010.

COURSE OUTCOMES:

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

1. Understand relevant legislation and codes of ethics.

2. Appreciate Computer forensics, digital detective and various processes.
3. Apply policies and procedures in E-discovery, guidelines and standards, E-evidence, tools and environment.
4. Design web forensics and network forensics.
5. Understand the legal aspects of digital forensics.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		✓	✓		✓	✓	✓		✓
CO2	✓		✓					✓	
CO3				✓		✓	✓	✓	✓
CO4	✓	✓		✓	✓		✓		
CO5	✓		✓		✓	✓	✓		✓

CSCSPEXX	**MOBILE APPLICATIONS AND SERVICES**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To present the three main mobile platforms and their ecosystems, namely Android, IOS, and Phone Gap/WebOS.
- To explore the emerging technologies and tools used to design and implement feature-rich mobile applications for smart phones and tablets.
- To take into account both the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile.

Introduction: Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User.

More on UIs: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal UIs. Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider.

Communications via Network and the Web: State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony. Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics.

Putting It All Together: Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services. Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia.

Platforms and Additional Issues: Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking, Active Transactions, More on Security, Hacking Android Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents-based communications in IOT.

REFERENCES:

1. Wei-Meng Lee, "Beginning Android Application Development", John Wiley &Sons, 2012.
2. Asoke K. Talukder, Roopa R. Yavagal, "Mobile Computing: Technology, Applications,and Service Creation", McGraw-Hill Communications Engineering, 2007.
3. Devi Kamal, "Mobile Computing", 2nd edition, Oxford University Press, 2012.
4. Mahesh Panhale, "Beginning Hybrid Mobile Application Development", après, 2016.

COURSE OUTCOMES:

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

1. Identify the target platform and users and be able to define and sketch a mobile application.
2. Understand the fundamentals, frameworks, and development lifecycle of mobile application platforms including iOS, Android, and PhoneGap.
3. Design and develop a mobile application prototype in one of the platforms (challenge project).
4. Select appropriate data transmission standards in terms of social competence.
5. Understand the need for continuous improvement of his/her skills due to the rapidly changing environment of mobile devices.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		✓	✓		✓		✓	✓	✓
CO2	✓			✓	✓	✓	✓		✓
CO3		✓		✓		✓		✓	
CO4	✓			✓		✓	✓		
CO5		✓	✓		✓			✓	✓

CSCSPEXX	**OPTIMIZATION TECHNIQUES**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To provide insight to the mathematical formulation of real-world problems.
- To understand the need and origin of the optimization methods.

- To optimize these mathematical problems using nature-based algorithms especially for NP-Hard problems.
- To get a broad picture of the various applications of optimization methods used in engineering.

Engineering application of Optimization, Formulation of design problems as mathematical programming problems.

General Structure of Optimization Algorithms, Constraints, The Feasible Region.

Branches of Mathematical Programming: Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming, Semi Definite Programming.

Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc.

Real life Problems and their mathematical formulation as standard programming problems.Recent trends: Applications of ant colony optimization, genetics, linear and quadratic programming in real world applications.

REFERENCES:

1. Laurence A. Wolsey, "Integer programming", Wiley, 1998.
2. Antoniou, Andreas, Lu, Wu-Sheng, "Practical Optimization: Algorithms and Engineering Applications, Springer, 2007.
3. Edwin K. P. Chong, Stanislaw H. Zak, "An Introduction to Optimization", 4th edition, Wiley, 2013.
4. Dimitris Bertsimas, Robert Weismantel, "Optimization over integers", Dynamic Ideas Publishers, 2005.
5. John K. Karloff, "Integer Programming: Theory and Practice", CRC Press, 2005.

COURSE OUTCOMES:

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

1. Formulate optimization problems.
2. Understand and apply the concept of optimality criteria for various types of optimization problems.
3. Solve various constrained and unconstrained problems in Single variable as well as multivariable.
4. Evaluate and measure the performance of an algorithm.
5. Investigate, study, develop and organise innovative solutions for various applications.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓	✓			✓	✓	
CO2		✓			✓	✓			✓
CO3	✓	✓		✓	✓		✓	✓	✓

CO4	✓		✓	✓		✓	✓		✓
CO5		✓	✓		✓			✓	

CSCSPEXX	**DATA MINING AND WAREHOUSING**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To Understand Data mining principles and techniques.
- To study the overview of Visualization and Statistical Perspectives and clustering techniques in details for better organization and retrieval of data.
- To understand the concept of Predictive Modelling for the retrieval purposes.
- To expose the students to the concepts of Data warehousing Architecture and Implementation.
- To identify Business applications and Tools of Data mining.

Introduction - Relation to statistics, databases, machine learning – Taxonomy of data mining tasks – Steps in data mining process – Overview of data mining techniques.

Visualization and Statistical Perspectives - Visualization – Dimension reduction techniques – Data summarization methods – Statistical perspective – Probabilistic – Deterministic models – Clustering – Regression analysis – Time series analysis – Bayesian learning.

Predictive Modelling - Classification – Decision trees – Patterns – Association rules – Algorithms, Applications – Tools – Case studies.

Planning the Data warehouse – Fundamentals of data warehousing – Review of Applications – Managing the Data warehouse Project – Integrating data – Infrastructure – Architecture – Technology – metadata management – Data Quality.

Exploiting the data - Data warehouse Applications – Data Access and Exploitation – Looking to the Future – Next Generation Data warehouse – Future Directions in the First Generation of Data warehouse – Second Generation of Data warehouse – Applications - Tools.

REFERENCES:

1. Usama M.Fayyad, Gregory Piatetsky Shapiro, Padhrai Smyth and Ramasamy Uthurusamy, “Advances in Knowledge Discovery and Data Mining”, The MIT Press, 1996.
2. Jiawei Han, Micheline Kamber, “Data Mining: Concepts and Techniques”, Morgan Kaufmann Publishers, 2000.
3. Ralph Kimball, “The Data Warehouse Life Cycle Toolkit”, John Wiley & Sons Inc., 1998.
4. Sean Kelly, “Data Warehousing in Action”, John Wiley & Sons Inc., 1997.
5. Ian.H.Witten, Eibe Frank and Mark.A.Hall, “Data Mining: Practical Machine Learning Tools and Techniques”, Third edition, (Then Morgan Kufmann series in Data Management systems), 2011.

COURSE OUTCOMES:

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

1. Learn about the fundamentals of data mining.
2. Discover the knowledge imbibed in the high dimensional system.
3. Cluster the high dimensional data for better organization of the data.
4. Apply the Predictive Modelling techniques for mining the data.
5. Study the various mining applications and tools.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓								
CO2			✓		✓				
CO3						✓		✓	
CO4		✓							✓
CO5	✓				✓		✓		

CSCSPEXX	**SPEECH AND AUDIO SIGNAL PROCESSING**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic mechanism of speech production and auditory perception.
- To learn the basic concepts of time and frequency domain analysis of speech signal.
- To explain the various parametric representation of speech.
- To acquire knowledge on several applications of speech and audio processing.

Speech production: Mechanism of speech production, Acoustic phonetics - Digital models for speech signals - Representations of speech waveform: Sampling speech signals, basics of quantization, delta modulation, and Differential PCM - Auditory perception: psycho acoustics.

Time domain analysis of Speech signal – Methods for extracting the parameters Energy, Average Magnitude, zero crossing Rate – Silence Discrimination using ZCR and energy – Short Time Auto Correlation Function – Pitch period estimation using Auto Correlation Function.

Frequency domain analysis: Sampling rates – Filter banks - Spectrogram - Pitch and formant extraction - Homomorphic speech processing: Cepstral analysis of Speech, Formant and Pitch Estimation, Audio compression methods and standards, Chroma features, PNCC, LSF, LAR, Sonogram, Tempogram.

Parametric representation of speech: Basic Principles of linear predictive analysis – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's Recursive algorithm – Application of LPC parameters – Pitch detection using LPC parameters – Formant analysis – VELP – CELP - PLP and MFCC Coefficients.

Case study: Automatic speech recognition – Text dependent and text independent speaker identification and verification – Speech synthesis – Audio

segmentation – Music classification and information retrieval – Music emotion recognition.

REFERENCES:

1. L. R. Rabiner and R. W. Schaffer, "Digital Processing of Speech signals", Prentice Hall, 1979.
2. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing, Processing and Perception of Speech and Music", Wiley- India Edition, 2006.
3. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education, 2004.
4. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.
5. Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2002.

COURSE OUTCOMES:

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

1. Acquired knowledge of speech production and auditory perception
2. Understand the time and frequency domain analysis of speech.
3. Acquired knowledge on various parameters of speech.
4. Ability to develop systems for various applications of speech processing.
5. Study and interpret the parametric representation of speech.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓			✓		✓	✓		
CO2	✓				✓			✓	
CO3			✓			✓	✓		
CO4		✓							✓
CO5	✓		✓	✓	✓		✓		

CSCSPEXX	**NETWORK AND INFORMATION SECURITY**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of information security
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To analyze key terms and critical concepts of information security
- To understand the fundamentals of Cryptography

An Overview of Computer Security-Security Services-Security Mechanisms-Security Attacks-Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies.

Classical Cryptography-Substitution Ciphers-permutation Ciphers-Block Ciphers-DES Modes of Operation- AES-Linear Cryptanalysis, Differential

Cryptanalysis- Hash Function - SHA 512- Message Authentication Codes-HMAC - Authentication Protocols

Introduction to Public key Cryptography- Number theory- The RSA Cryptosystem and Factoring Integer- Attacks on RSA-The ELGamal Cryptosystem-Digital Signature Algorithm-Finite Fields-Elliptic Curves Cryptography- Key management – Session and Interchange keys, Key exchange and generation-PKI.

Authentication requirements and functions, MAC and Hash Functions, MAC Algorithms: Secure Hash Algorithm, Whirlpool, HMAC. MD5 MAC, SHA Internet Security Protocol: SSL, SHTPD SET, 3D Protocol.

Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls.

REFERENCES:

1. William Stallings, "Cryptography and Network Security: Principles and Practices", Third Edition, Pearson Education, 2006.
2. Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill, 2nd Edition, 2010.
3. Michael E. Whitman, Herbert J. Mattord, Principles of Information Security", Cengage brain, 4th Edition, 2012.
4. Bernard L. Memezes, "Network Security and Cryptography", Course Technology, 2012.
5. Jason Andress, "The Basics of Information Security: Understanding the Fundamentals of InfoSec in Theory and Practice", Elsevier, 2011.
6. Douglas R. Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC, 2006.

COURSE OUTCOMES:

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

1. Realize basic security algorithms for a computing system.
2. Analyze the vulnerabilities in any computing system and consequently be capable to design a security justification.
3. Recognize the security issues in the network and resolve it.
4. Evaluate security means using exact approaches, together with theoretical root, modeling, and simulations.
5. Understand authentication requirements of various security protocols.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓							
CO2	✓			✓		✓		✓	
CO3		✓				✓			✓
CO4			✓		✓		✓		
CO5	✓	✓		✓		✓		✓	

CSCSPEXX	**DIGITAL VIDEO PROCESSING**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To provide the students with a basic understanding of the theory behind various video processing tasks.
- To learn the most popular and successful algorithms to solve video processing problems.
- To understand and implement video segmentation and compression techniques.

Human Visual System and Color: Color Vision and Models - Contrast Sensitivity -Spatio-Temporal Frequency Response - Stereo/Depth Perception. Analog Video: Progressive vs. Interlaced Scanning-Analog-Video Signal Formats - Analog-to-Digital Conversion. Digital Video: Spatial Resolution and Frame Rate - Color, DynamicRange, and Bit-Depth. Digital-Video Standards: 3D Video - 3D-Display Technologies - Stereoscopic Video - Multi-View Video. Digital-Video Applications.

Motion models: Estimation Criteria- 2D Apparent-Motion Estimation: Sparse Correspondence - Optical-Flow Estimation - Optical-Flow Equation and Normal Flow-Displaced Frame Difference. Motion Estimation algorithms: Global motion estimation-Block Matching-Variable-Size Block-Matching - Hierarchical Block-Matching -Phase-Correlation Method. 3D Motion and Structure Estimation: Camera Calibration- Affine Reconstruction- Projective Reconstruction- Euclidean Reconstruction

Image Segmentation: Thresholding - Clustering - Bayesian Methods - Graph-Based Methods - Active-Contour Models. Change Detection: Shot-Boundary Detection- Background Subtraction. Motion Segmentation: Dominant-Motion Segmentation- Multiple-Motion Segmentation. Motion Tracking: Graph-Based Spatio-Temporal Segmentation and Tracking- Kanade Lucas Tomasi Tracking - Mean-Shift Tracking - Active-Contour Tracking- 2D mesh Tracking.

Theory of Spatio-Temporal Filtering: Frequency Spectrum of Video- Motion-Adaptive Filtering -Motion-Compensated Filtering. Video-Format Conversion: Down-Conversion- De-Interlacing - Frame-Rate Conversion. Multi-Frame Noise Filtering: Motion-Adaptive Noise Filtering- Motion-Compensated Noise Filtering. Multi-Frame Restoration: Multi-Frame Modeling- Multi-Frame Wiener Restoration.

Video-Compression Approaches: Intra-Frame Compression, Motion JPEG 2000 and DigitalCinema- 3D Transform Coding - Motion-Compensated Transform Coding. Early Video Compression Standards: ISO and ITU Standards- MPEG-1 Standard- MPEG-2 Standard-8.3 MPEG-4 AVC/ITU-T H.264 Standard: Input-Video Formats and Data Structure-Intra Prediction -Motion Compensation. High-Efficiency Video-Coding (HEVC) Standard: Video-Input Format and Data Structure – Coding Tree Units.

REFERENCES:

1. Murat Tekalp A, “Digital Video Processing”, Second Edition, Prentice Hall, 1995.
2. Bovik AL, “The Essential Guide to Video Processing”, Academic Press, 2009.
3. Iain E. G. Richardson, “Video Codec Design”, John Wiley and Sons, 2002.
4. Iain E. G. Richardson, “H.264 and MPEG-4 Video Compression: Video Coding for Next
5. Generation Multimedia”, Wiley, 2003.
6. Bovik AL, “Handbook of Image and Video Processing”, second edition, Academic Press, 2005.

COURSE OUTCOMES:

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

1. Exhibit sufficient understanding of video processing including video representation, video filtering and video compression.
2. Demonstrate the program basic video processing operations using the MATLAB.
3. Develop a complete video processing system to achieve a specific task and analyze and interpret the system.
4. Get sufficient understanding of digital video compression and its relevant processing tasks.
5. Evaluate more advanced or future video compression technologies and multimedia application systems that exploit compressed video.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓						✓		
CO2			✓		✓		✓	✓	
CO3		✓							✓
CO4	✓		✓			✓			
CO5	✓			✓			✓		✓

CSCSPEXX	**MEDICAL IMAGE PROCESSING**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To study about medical image fundamentals.
- To acquire knowledge in medical image storage and enhancement techniques.
- To provide an up-to-date background in current state-of-the-art in medical imaging and applications of computational tools for medicine.
- To understand ultrasound image methods.

Introduction to medical imaging technology, systems, and modalities. Brief history, importance, applications, trends, challenges. Medical Image Formation Principles: X-Ray physics, X-Ray generation, attenuation, scattering, dose Basic principles of CT, reconstruction methods, artifacts, CT hardware.

Medical Image Storage, Archiving and Communication Systems and Formats Picture archiving and communication system (PACS), Formats: DICOM Radiology Information Systems (RIS) and Hospital Information Systems (HIS). Medical Image Processing, Enhancement, Filtering Basic image processing algorithms Thresholding, contrast enhancement, SNR characteristics, filtering, histogram modeling.

Medical Image Visualization Fundamentals of visualization, surface and volume rendering/visualization, animation, interaction. Magnetic Resonance Imaging (MRI) Mathematics of MR, spin physics, NMR spectroscopy, imaging principles and hardware, image artifacts.

Medical Image Segmentation - Histogram-based methods, Region growing and watersheds, Markov Random Field models, active contours, model-based segmentation. Multi-scale segmentation, semi-automated methods, clustering-based methods, classification-based methods, atlas-guided approaches, multi-

model segmentation. Medical Image Registration Intensity-based methods, cost functions, optimization techniques.

PET and SPECT Ultrasound Imaging methods, mathematical principles, resolution, noise effect, 3D imaging, positron emission tomography, single photon emission tomography, ultrasound imaging, applications. Medical Image Search and Retrieval Current technology in medical image search, content-based image retrieval, new trends: ontologies. Applications. Other Applications of Medical Imaging Validation, Image Guided Surgery, Image Guided Therapy; Computer Aided Diagnosis/Diagnostic Support Systems.

REFERENCES:

1. Paul Suetens, "Fundamentals of Medical Imaging", Second Edition, CambridgeUniversity Press, 2009.
2. J. Michael Fitzpatrick and Milan Sonka, "Handbook of Medical Imaging: Medical Image Processing and Analysis", volume 2, SPIE Publications, 2009.
3. Kayvan Najarian and Robert Splinter, "Biomedical Signal and Image Processing", Second Edition, CRC Press, 2005.
4. Geoff Dougherty, "Digital Image Processing for Medical Applications", First Edition, CambridgeUniversity Press, 2009.
5. Jerry L. Prince and Jonathan Links, "Medical Imaging Signals and Systems", First Edition, Prentice Hall, 2005.
6. John L. Semmlow, "Biosignal and Medical Image Processing", Second Edition, CRC Press, 2008.

COURSE OUTCOMES:

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

1. Acquire depth knowledge about the various medical image processing techniques
2. Attain practical knowledge in medical Imaging.
3. Perform research works in the area of medical imaging
4. Gain knowledge about how to extract, model, and analyze information from medical data and applications in order to help diagnosis, treatment and monitoring of diseases through computer science.
5. Analyse and implement medical imaging validation, Computer Aided Diagnosis / Diagnostic Support Systems.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓	✓					✓	
CO2			✓	✓	✓		✓		✓
CO3		✓		✓				✓	✓
CO4			✓		✓	✓	✓		
CO5	✓	✓			✓			✓	

CSCSPEXX	**MOBILE ADHOC NETWORKS**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of adhoc Network architecture, Protocols, Issues.
- To introduce the various types of adhoc routing protocols.

- To provide in-depth knowledge about Sensor Network Architecture, its Applications and MAC Protocols for sensor networks.
- To elucidate issues in WSN routing, Indoor and outdoor Localization and Quality of Service in WSN.
- To emphasize on Necessity for Mesh Networks, IEEE 802.11s Architecture and different types of Mesh Networks.

ADHOC- Introduction –Issues in adhoc Wireless Networks. MAC Protocols – Issues, Classifications of MAC protocols, Multi-channel MAC & Power control MAC protocol.

AD-HOC Network routing & TCP– Issues – Classifications of routing protocols – Hierarchical and Power aware. Multicast routing – Classifications, Tree based, Mesh based. adhoc Transport Layer Issues. TCP Over Ad Hoc – Feedback based, TCP with explicit link, TCP-Bus, adhoc TCP, and Split TCP.

WSN and MAC– Introduction – Sensor Network Architecture, Data dissemination, Gathering. MAC Protocols – self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.

WSN Routing, Localization & QOS – Issues in WSN routing – OLSR, AODV. Localization – Indoor and Sensor Network, Localization. QOS in WSN.

Mesh Networks– Necessity for Mesh Networks – MAC enhancements – IEEE 802.11s Architecture – Opportunistic routing – Self configuration and Auto configuration – Capacity Models – Fairness – Heterogeneous Mesh Networks – Vehicular Mesh Networks.

REFERENCES:

1. Marco Conti, Silvia Giordano , Ivan Ivan Stojmenovic Stefano Basagni , "Mobile Ad hoc Networking", Wiley, Second Edition,2015.
2. C.SivaRamMurthyand B.Smanoj,"AdHocWirelessNetworks–Architecturesand Protocols",PearsonEducation, 2006.
3. Perkins, "Ad hoc Networking", Pearson Education, 2008.
4. FengZhaoandLeonidas Guibas,"WirelessSensor Networks",MorganKaufman Publishers, 2004.
5. C.K.Toh,"AdHocMobileWirelessNetworks",PearsonEducation,2002.
6. ThomasKragandSebastinBuettrich,"WirelessMeshNetworking",O'Reilly Publishers, 2007.

COURSE OUTCOMES:

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

1. Understand the knowledge of Ad Hoc networking basics and Architecture.
2. Implement Ad hoc routing protocols and analyzing the performances of Protocols.
3. Recognize wireless sensor networks basics and routing methods.
4. Design and implement the Mesh networks with MAC enhancements.
5. Understand implement the principles of mobile ad hoc networks and to understand the implications on data transmission delay and bandwidth consumption.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓					✓	✓	

CO2			✓	✓					✓
CO3					✓			✓	
CO4			✓			✓			✓
CO5	✓	✓			✓		✓	✓	

CSCSPEXX	**COMPUTER NETWORK ENGINEERING AND MANAGEMENT**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To know the fundamentals of network architectures
- To explicate various protocols and its functionalities
- To study about different network management standards

Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait, Sliding Window, Concurrent Logical Channels.

Switching and Bridging, Datagrams, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork? Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels.

Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems (BGP), IP Version 6(IPv6), Mobility and Mobile IP.

Simple Demultiplexer (UDP), Reliable Byte Stream (TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.

Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System (DNS), ElectronicMail(SMTP,POP,IMAP,MIME),World Wide Web(HTTP),Network Management(SNMP) .

REFERENCES:

1. Larry Peterson and Bruce S Davis “Computer Networks: A System Approach” 5th Edition, Elsevier, 2014.
2. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI, 2014.
3. Uyless Black, “Computer Networks, Protocols, Standards and Interfaces”, 2nd Edition, PHI, 2009.

4. Behrouz A Forouzan "TCP/IP Protocol Suite", 4th Edition, Tata McGraw-Hill, 2009.

COURSE OUTCOMES:

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

1. Classify network services, protocols and architectures.
2. Knowledge on key Internet applications and their protocols.
3. Ability to develop their own applications using the sockets API.
4. Practical knowledge gained by hands-on sessions.
5. Gain the knowledge of application layer protocol.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓							✓	✓
CO2					✓		✓		
CO3		✓	✓					✓	
CO4	✓		✓	✓		✓			✓
CO5		✓			✓		✓	✓	

OPEN ELECTIVES

CSCSOEXX	**DATA SCIENCE**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To provide the knowledge and expertise to become a proficient data scientist.
- To demonstrate an understanding of statistics and machine learning concepts that are vital for data science
- To produce Python code to statistically analyse a dataset.
- To critically evaluate data visualisations based on their design and use for communicating stories from data.

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

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

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.

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

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

REFERENCES:

1. Rachel Schutt, Cathy O'Neil, "Doing Data Science, Straight Talk From The Frontline", O'Reilly Media Inc, 2013.
2. Jure Leskovec, Anand Rajaraman and Jeffrey D. Ullman. "Mining of Massive Datasets", CambridgeUniversity Press, 2014.
3. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015.
4. Cathy O'Neil, Rachel Schutt, "Doing Data Science", O'Reilly Media, 2013.

COURSE OUTCOMES:

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

1. Explain how data is collected, managed and stored for data science.
2. Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists.
3. Implement data collection and management scripts using MongoDB.
4. Apply data visualization techniques and data encodings.
5. Implement recent trends in various data collection and analysis techniques.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		✓			✓		✓		
CO2	✓	✓		✓		✓			✓
CO3				✓	✓			✓	✓
CO4	✓		✓			✓			
CO5		✓	✓		✓		✓		✓

CSCSOEXX	**INTERNET OF THINGS (IoT)**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of Internet of Things.
- To build a small low-cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To apply the concept of Internet of Things in the real-world scenario

Introduction-Characteristics-Physical design - Protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoT vs M2M.

IoT systems management – IoT Design Methodology – Specifications Integration and Application Development.

Physical device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web services.

Intel Galileo Gen2 with Arduino- Interfaces - Arduino IDE – Programming - APIs and Hacks.Various Real time applications of IoT- Connecting IoT to cloud – Cloud Storage for Iot – Data Analytics for IoT – Software & Management Tools for IoT. IoE – Overview – Architecture-Smart objects and LLNs-Secure mobility.

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.

2. Manoel Carlos Ramon, "Intel Galileo and Intel Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.
3. Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014.
4. Cuno Pfister, "Getting Started with the Internet of Things", Maker Media Inc, 2011.

COURSE OUTCOMES:

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

1. Design a portable IoT using Arduino/ equivalent boards and relevant protocols.
2. Develop web services to access/control IoT devices.
3. Deploy an IoT application and connect to the cloud.
4. Analyze applications of IoT in real time scenario.
5. Design IoT based prototypes.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓	✓			✓	✓		
CO2				✓				✓	✓
CO3		✓		✓	✓	✓	✓		
CO4	✓		✓			✓		✓	
CO5		✓		✓		✓		✓	

CSCSOEXX	**BIG DATA ANALYTICS**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To understand several key big data technologies used for storage, analysis and manipulation of data.
- To recognize the key concepts of Hadoop framework, MapReduce, Pig, Hive, Hadoop Ecosystem, R, and NoSQL.
- To prepare a sample big data project.

Introduction to Big Data: Big Data and its importance – Characteristics – Big data analytics – Basic requirements – Big data applications – Map Reduce framework – Algorithms using map reduce. NoSQL Databases: Key-value databases – Column-family databases – Document databases – Graph databases.

Apache Hadoop : Introduction – System principle – Architecture – Hadoop distributed file system – Hadoop Map Reduce – YARN – Operation modes – Hadoop Installation – Cluster creation – Hadoop commands – HDFS commands – YARN commands – Map Reduce commands – Moving Data in and out of Hadoop – Hadoop programming.

Hadoop Ecosystem: Introduction to Pig – Installation – Execution – Pig Latin: Basics – Data types – Building blocks – Operators – Functions – Example Scripts. Introduction to Hive – Installing and Running Hive – Hive QL – Tables – Querying data – User defined functions – Partitioning – Joins – Simple projects. Overview of Spark, Zookeeper, and other Hadoop Ecosystem tools.

Data Analysis Techniques: Linear and logistic regression modeling – Naïve Baye's classifier – Support vector machine – Neural networks – Principal component analysis – Linear Discriminant Analysis – K Nearest Neighbour – Decision Trees – Fuzzy logic – Clustering Techniques: Hierarchical, agglomerative, and K– Means.

Introduction to R: R Installation – Basic statements of R – Importing and exporting data – Ordered and unordered factors – Arrays and matrices – Lists and data frames – Reading data from files – Data visualization – Probability distributions – Statistical models in R – Manipulating objects – Data Pre-processing – Feature selection – Clustering – Classification and regression. Case Studies: Social network analysis – Text analysis –Marketing analysis.

REFERENCES:

1. Chris Eaton, Dirk deroos et al., "Understanding Big data ", McGraw Hill, 2012.
2. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012.
3. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012.
4. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, 2015.
5. Arvind Sathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", 1st Edition, IBM Corporation, 2012.
6. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R", 2013.

COURSE OUTCOMES:

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

1. Categorize and summarize big data and its importance.
2. Differentiate various big data technologies like Hadoop, MapReduce, Hadoop Ecosystem, R, and No-SQL.
3. Apply tools and techniques to analyze big data.
4. Earn tips and tricks for big data use cases and solutions.
5. Apply and analyse statistical models in R using data visualization techniques.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓	✓	✓	✓	✓	✓	
CO2			✓			✓			✓
CO3	✓	✓		✓	✓	✓	✓		
CO4	✓		✓		✓			✓	
CO5		✓		✓		✓			✓

CSCSOEXX	CLOUD COMPUTING TECHNOLOGIES	L	T	P	C
		3	0	0	2

COURSE OBJECTIVES:

- To understand the concepts of cloud and utility computing.
- To understand the various issues in cloud computing.
- To familiarize themselves with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

Evolution of Cloud Computing -System Models for Distributed and Cloud Computing - NIST Cloud Computing Reference Architecture -IaaS - On-demand Provisioning - Elasticity in Cloud - Examples of IaaS Providers - PaaS - Examples of PaaS Providers - SaaS - Examples of SaaS Providers - Public , Private and Hybrid Clouds – Google App Engine, Amazon AWS - Cloud Software Environments - Eucalyptus, Open Nebula, Open Stack, Nimbus.

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines – Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization –Management Virtualization — Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization.

Comprehensive Analysis – Resource Pool – Testing Environment –Server Virtualization – Virtual Workloads – Provision Virtual Machines –Desktop Virtualization – Application Virtualization – Work with AppV – Mobile OS for smart phones – Mobile Platform Virtualization – Collaborative Applications for Mobile platforms.

Map Reduce Hadoop Distributed File Systems – Hadoop I/O – Developing Map Reduce Applications – Working of Map Reduce – Types and Formats – Setting up Hadoop Cluster.

Architectural Design of Compute and Storage Clouds - Inter Cloud Resource Management - Resource Provisioning and Platform Deployment - Global Exchange of Cloud Resources - Security Overview – Cloud Security Challenges – Software as a Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security.

REFERENCES:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
4. Danielle Ruest, Nelson Ruest, “Virtualization: A Beginner‟s Guide”, McGraw-Hill Osborne Media, 2009.
5. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.

COURSE OUTCOMES:

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

1. Articulate the main concepts, key technologies, strengths and limitations of cloud computing.

2. Identify the architecture, infrastructure and delivery models of cloud computing.
3. Explain the core issues of cloud computing such as security, privacy and interoperability.
4. Choose the appropriate technologies, algorithms and approaches for the related issues.
5. Develop map reduce applications.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓	✓	✓	✓	✓	✓		
CO2		✓			✓	✓		✓	✓
CO3	✓	✓	✓	✓	✓		✓		
CO4			✓	✓				✓	✓
CO5		✓			✓		✓		

CSCSOEXX	**ADVANCED WEB DESIGN**	**L**	**T**	**P**	**C**
		3	0	0	2

COURSE OBJECTIVES:

- To understand the issues in the design of web application development
- To learn the concepts of client side and server-side technologies, three tier application using MVC and software components using EJB
- To understand and learn the importance of java-based security solutions
- To learn the concept of frameworks

Web Design Basics: Web Engineering and application development - Introduction - Challenges and role of web engineering - Web design methods - Design issues - OOWS model driven approach - OOHDM - UML based web Engineering - Designing Multichannel Web Application - Designing web application with web ML and Web Ratio - Semantic web Information System - Quality evaluation and experimental web Engineering - Measuring and evaluating web application - Need for empirical Web engineering.

Client and Server-Side Scripting: Web technology basics - HTML5 - Cascading Style Sheet - Client-side scripting - Java script - Java script objects - XML basics - DOM - SAX - XSL - AJAX - RSS - Database connectivity - Server-side scripting - Servlet - Servlet life cycle - Servlet based web application - JSP / PHP / ASP.NET - Case study.

Web Application Development: Three tier architecture - Working with model - View - Controller - JCP -J2EE - XML based APIs - Application servers - Presentation

tier and EIS tier - Java Mail - JMS - Java transactions - JNDI - Java authentication and authorization services - Java cryptography.

Component Based Development: Service Tier and Data tier - EJB architecture - Session beans - Entity beans - Message driven beans - J2EE connector architecture - Web Services - J2EE Web Services - Patterns – Presentation, service tier and Data tier patterns - J2ME - J2ME application development.

Advanced Frameworks: Understanding Struts - MVC framework - Struts control flow - Building mode, view and controller component - Hibernate - Architecture - Understanding O/R mapping - Query language - Spring framework – Architecture - Case studies - Current trends.

REFERENCES:

1. Thomas Erl, "Service Oriented Architecture, Concepts, Technology, and Design", Pearson, 2005.
2. Black book – Java Server Programming (J2EE 1.4), Dreamtech Press, 2007.
3. Gustavo Rossi, Oscar Pastor, Daniel Schwabe, Luis Olsina, "Web Enginering Modelling and Implementing web Applications", Springer, 2008.
4. James McGovern, Sameer Tyagi, Michael E. Stevens, Sunil Mathew "Java web Services Architecture", Elsevier, 2003.

COURSE OUTCOMES:

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

1. Design and develop web applications using various models.
2. Develop Web applications using HTML and scripting technologies with advanced features.
3. Acquire knowledge of security features supported in Java.
4. Develop web services using J2EE and related technologies.
5. Implement advanced frameworks, MVC frameworks and spring frameworks.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓						✓
CO2					✓		✓	✓	
CO3		✓	✓						
CO4	✓	✓		✓		✓			✓
CO5			✓		✓			✓	

CSCSOEXX	**HUMAN AND COMPUTER INTERACTION**	**L**	**T**	**P**	**C**
		3	0	0	2

COURSE OBJECTIVES:

- To learn the design techniques and fundamentals of Human Computer Interaction (HCI)
- To know the various types of existing interfaces and evaluation techniques
- To understand the applications of HCI in emerging trends

The Human – Input-output channels – Human Memory – Thinking – emotions – Psychology & design of interactive systems; Computer – Text entry devices-Positioning, Pointing & drawing – Display devices for Virtual reality, 3D; Interaction – models – Frameworks & HCI, Ergonomics – Interaction styles – WIMP Interfaces – context; paradigms for Interaction.

Interaction design basics – user focus – scenarios – navigation – screen design & layout; HCI in software process – life cycle – Usability engineering – Interactive design & prototyping; Design rules – Principles for usability – standards – guidelines – golden rules – HCI patterns.

Implementation support – Windowing system elements – using tool kits – user interface management; Evaluation techniques – goals – expert analysis – choosing a method; universal design principles – multimodal interaction; user support – requirements – Approaches – adaptive help systems – designing user support systems.

Cognitive models – Goal & task hierarchies – Linguistic models – Physical & device models – architectures; communication & collaboration models – Face-to-face communication – conversation – text based – group working; Task analysis – difference between other techniques – task decomposition – Knowledge based analysis – ER based techniques –uses.

Ubiquitous computing application research – virtual & augmented reality – information & data visualization; understanding hypertext – finding things – Web Technology & issues – Static Web content – Dynamic Web content; Groupware systems – Computer mediated communication – DSS – Frameworks for groupware.

REFERENCES:

1. Alan Dix, Janet Finlay, Gregory D.Abowd, Russell Beale, "Human Computer Interaction", Third Edition, Pearson Education, 2004.
2. John M.Carrol, "Human Computer Interaction in the New Millennium", Pearson Education, 2002.
3. Yvonne Rogers, Helen Sharp, Jenny Preece, "Interaction Design: beyond human-computer interaction", John-Wiley and Sons Inc., 2011.
4. Jonathan Lazar Jinjuan, Heidi Feng, Harry Hochheiser, "Research Methods in Human-Computer Interaction", Wiley, 2010.

COURSE OUTCOMES:

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

1. Understand the requirements and specifications for the interaction design.
2. Analyze the evaluation techniques of human interaction.
3. Able to design an efficient and user-friendly human computer interface.
4. Determine the most appropriate HCI methods to meet the needs of a practical software development project.
5. Analyse and implement cognitive models and Ubiquitous computing applications.

	Mapping of COs with POs								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓	✓		✓	✓	✓		
CO2		✓		✓				✓	✓
CO3	✓		✓	✓	✓	✓		✓	✓
CO4		✓	✓			✓	✓		
CO5		✓			✓			✓	

CSCSOEXX	**SOFT COMPUTING**	**L**	**T**	**P**	**C**
		3	0	0	3

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 the student hand-on experience on MATLAB to implement various strategies.

Introduction to soft computing and neural networks: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.

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.

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.

Genetic Algorithms: Simple GA, crossover and mutation, multi-objective Genetic algorithm (MOGA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.

Matlab/Python Lib: Introduction to Matlab/Python, Arrays and array operations, functions and files, study of neural network toolbox and fuzzy logic toolbox. Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).

REFERENCES:

1. Jyh-Shing roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence", Prentice Hall, 2003.
2. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", Prentice Hall, 1st Edition, 1995.
3. Timothy J.Ross, "Fuzzy Logic with Engineering applications", Tata McGraw Hill, 3rd edition, 2010.
4. David E.Goldberg, "Genetic Algorithms in Search Optimization and Machine Learning", Pearson Education, 2007.
5. MATLAB Toolkit.

COURSE OUTCOMES:

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

1. Identify and describe soft computing techniques and their roles in building intelligent machines.
2. Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems
3. Apply genetic algorithms to combinatorial optimization problems.
4. Evaluate and compare solutions by various soft computing approaches for a given problem.
5. Implement various applications of GA in Machine Learning.

	Mapping of COs with POs

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

AUDIT COURSES

CSCSACXX	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

- To understand how to improve your writing skills and level of readability
- To learn about what to write in each section
- To understand the skills needed when writing a Title
- To ensure the good quality of paper at very first-time submission

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

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

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

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

Skills are needed when 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, " Writing for Science", Yale University Press (available on Google Books), 2006.
2. Day R, "How to Write and Publish a Scientific Paper", CambridgeUniversity Press, 2006.
3. Highman N, "Handbook of Writing for the Mathematical Sciences", SIAM. Highman's book, 1998.

COURSE OUTCOMES:

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

1. Plan and prepare paragraphs without ambiguity and vagueness.
2. Check plagiarism and paraphrasing.
3. Review the literatures and write a good discussion on any topic.

4. Utilize the knowledge obtained to write a good research paper.

CSCSACXX	DISASTER MANAGEMENT	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

- To understand the key concepts in disaster risk reduction and humanitarian response.
- To evaluate disaster risk reduction, humanitarian response policy and practice from multiple perspectives.
- To develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- To understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Introduction: Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude. Repercussions of Disasters and Hazards: Economic Damage, Loss of Human And Animal Life, Destruction Of Ecosystem.

Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, 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.

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

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

Risk Assessment Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co- Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. Disaster Mitigation: Meaning, Concept and Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation InIndia.

REFERENCES:

1. R. Nishith, SinghAK, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company, 2007.
2. Sahni Pardeep, Alka Dhameja, Uma Medury, "Disaster Mitigation: Experiences and Reflections", PHI Learning Pvt. Ltd., 2001.

3. Goel S. L., "Disaster Administration and Management: Text and Case Studies", Deep&Deep Publication Pvt. Ltd., 2008.

COURSE OUTCOMES:

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

1. Demonstrate the significance of natural and man-made disasters.
2. Gain knowledge about disaster prone areas in India.
3. Understand post-disaster diseases/epidemics and their remedies.
4. Assess disaster risk and mitigation.

CSCSACXX	SANSKRIT FOR TECHNICAL KNOWLEDGE	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
- To Learn Sanskrit for improving brain function.
- To learn Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- To explore the huge knowledge from ancient literature.

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

Order Introduction of roots, Technical information about Sanskrit literature.

Technical concepts of engineering-electrical, Mechanical, Architecture, Mathematics.

REFERENCES:

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

COURSE OUTCOMES:

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

1. Understand basic Sanskrit language.
2. Study ancient Sanskrit literature about science & technology.
3. Use as a logical language to develop logic in students.

CSCSACXX	VALUE EDUCATION	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

- To understand value of education and self- development.
- To imbibe good values in students.
- To let the students, know about the importance of character.

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

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

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship.

Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature. Character and Competence –Holy books vs Blind faith. Self-management and Good health.

Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

REFERENCES:

1. Chakraborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, 2000.

COURSE OUTCOMES:

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

1. Demonstrate knowledge of self-development.
2. Learn the importance of Human values.
3. Develop the overall personality.

CSCSACXX	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

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

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

Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality Right to Freedom Right against Exploitation Right to Freedom of Religion.

Cultural and Educational Rights Right to Constitutional Remedies Directive Principles of State Policy Fundamental Duties.

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

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

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning.

Institute and Bodies for the welfare of SC/ST/OBC and women.

REFERENCES:

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

COURSE OUTCOMES:

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

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

CSCSACXX	PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

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

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

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

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

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

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

REFERENCES:

1. Ackers J, Hardman F, "Classroom interaction in Kenyan primary schools", Compare, 31 (2): 245-261, 2001.
2. Agrawal M, "Curricular reform in schools: The importance of evaluation", Journal ofCurriculum Studies, 36 (3): 361-379, 2004.
3. Akyeampong K, "Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER)",country report 1. London: DFID, 2003.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count?", International Journal Educational Development, 33 (3): 272–282, 2013.

COURSE OUTCOMES:

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

1. Understand pedagogical practices that are being used by teachers in formal and informal classrooms in developing countries.
2. Appreciate the evidence on the effectiveness of these pedagogical practices, conditions, and the population of learners.
3. Realise the teacher education (curriculum and practicum), the school curriculum and guidance materials that best support effective pedagogy.

CSCSACXX	**STRESS MANAGEMENT BY YOGA**	**L**	**T**	**P**	**C**
		2	0	0	0

COURSE OBJECTIVES:

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

Definitions of Eight parts of yoga. (Ashtanga)

Yam and Niyam.

Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Asan and Pranayam

i) Various yog poses and their benefits for mind & body

ii)Regularization 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, Advaita Ashrama (Publication Department), Kolkata
3. Develop healthy mind in a healthy body thus improving social health also
4. Improve efficiency.

COURSE OUTCOMES:

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

1. Know the definitions of eight pats of yoga.
2. Understand the Do's and don'ts in life.
3. Practice various yog poses and realize their benefits.

CSCSACXX	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

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

Neetisatakam-Holistic development of personality

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

Approach to day to day work and duties.

Shrimad Bhagwad Geeta : Chapter 2-Verses, Chapter 3-Verses 13, 21, 27, 35, Chapter 6 Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.

Statements of basic knowledge.

Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68, Chapter 12 -Verses 13, 14, 15, 16,17, 18, Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-

Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

REFERENCES:

1. Swami Swarupananda, "Srimad Bhagavad Gita", Advaita Ashram Publication Department, 1909.
2. P.Gopinath, "Bhartrihari's Three Satakam (Niti-sringar-vairagya)", Rashtriya Sanskrit Sansthanam, New Delhi.

COURSE OUTCOMES:

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

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.
2. Understand person who has studied Geeta, who will lead the nation and mankind to peace and prosperity.
3. Study of Neetishatakam will help in developing versatile personality of students.

VALUE ADDED COURSES

CSCSVAXX	INTRODUCTION TO DATA SCIENCE	L	T	P
		3	0	0

COURSE OBJECTIVES:

- To understand the basic concepts of computers and operating sustems.
- To familiarize the fundamentals of Internet, web utilities, computer networks.
- To learn the network security and protocols.
- To gain knowledge in the basics of data science.

Introduction to computers and operating systems: Computer system – hardware: input devices, output devices – Software: system software - application Software - utility Software - Virus: types of virus – virus preventive and corrective measures - operating system: Building blocks of a generic operating system – Types of operating system – Functions of operating systems.

Internet and web utilities: Internet Vs Intranet – Browser – Universal Resource Locator (URL) - World Wide Web (WWW) – Search Engine - e-Mail Servers – e-Mail services: Create, Forward, Reply, Attachment, Carbon Copy (CC), Blind Carbon Copy (BCC).

Introduction to computer network: Types of Network – LAN, MAN, WAN, WLAN - Basic networking devices: Repeater, Hub, Switch, Bridge, Router, Gateway - Wi-Fi

Hotspot - IP Address: Class A, B, C and D – Protocols: TCP/IP, HTTP, FTP – Network Models. Review of Reference Models: OSI, TCP/IP and their comparison.

Fundamentals of network security: Attacks – Services – Mechanisms – Conventional Encryption – Classical and Modern Techniques – Digital Signatures – Authentication Protocols. Authentication– Applications – Electronic Mail Security – IP Security – Web Security- Intruders – Viruses – Worms – Firewalls -Design Principles.

Introduction to data science: statistical Inference - Exploratory Data Analysis and the Data Science Process - Basic Machine Learning Algorithms - Feature Generation and Feature Selection - Data Visualization.

REFERENCES:

1. Sanjay Saxena, "A First Course in Computers", Vikas Publishing house, 2001.
2. Comer, "Computer Networks and Internet with Internet Applications", PHI, Fourth Edition, 2006.
3. Stallings William, Data and Computer Communication, Pearson, tenth edition, 2014.
4. Stallings William, "Cryptography and Network Security" PHI, Sixth Ediiton, 2014.
5. Cathy O'Neil and Rachel Schutt. "Doing Data Science, Straight Talk from the Frontline", O'Reilly. 2014.

COURSE OUTCOMES:

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

1. Identify and describe basic concepts in computers and operating system.
2. Understand and handle Internet facilities.
3. Describe the network protocols and network security systems.
4. Apply various basic data science concepts for a given problem.

CSCSVAXX	ADVANCED DATA SCIENCE	L	T	P
		3	0	0

COURSE OBJECTIVES:

- To equip the students with some of the basic concepts and principles of data science.
- To make the students learn techniques and tools to deal with data collection and integration, exploratory data analysis, modeling, evaluation, and effective communication.
- To develop skill sets needed to be a data scientist.
- To work effectively on data science projects.

Introduction: Big Data and Data Science hype, Datafication, Data Scientist, Current landscape of perspectives, Statistical Inference - Populations and Samples, Statistical modeling, Probability distributions, Modeling - Exploratory Data Analysis - Philosophy- Data Science Process - Case Study: RealDirect.

Algorithms: Linear Regression, k-NN, k-means, Spam Filters, Naive Bayes, Wrangling - Logistic Regression: Classifiers, Case Study: M6D Logistic Regression.

Feature Generation Brainstorming, Role of domain expertise, and Place for imagination – Feature Selection: Filters, Wrappers, Decision Trees, RandomForests.

Recommendation Engines: Nearest Neighbors - Dimensionality Problem-Singular Value Decomposition, Principal Component Analysis - Social Network Analysis.

Data Visualization: Basic principles, ideas and tools for data visualization, Sample projects – Data Engineering algorithms - Data Scientists and Ethics.

REFERENCES:

1. Rachel Schutt and Cathy O'Neil, "Doing Data Science, Straight Talk From The Frontline", O'Reilly Media, 2013.
2. Jure Leskovek, Anand Rajaraman and Jerey D. Ullman, "Mining of Massive Datasets", 2nd Edition, CambridgeUniversity Press. 2014.
3. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective, MIT Press, Cambridge, 2013.
4. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking, O'Reilly Media, 2013.

COURSE OUTCOMES:

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

1. Describe the basic concepts of Data Science.
2. Apply basic machine learning algorithms for predictive modeling.
3. Apply Exploratory Data Analysis and Data Science process in a case study.
4. Identify approaches used for Feature Generation and Feature Selection and use in applications.
5. Create effective visualization of given data.