NATIONAL ENGINEERING COLLEGE

(An Autonomous Institution – Affiliated to Anna University Chennai)

K.R.NAGAR, KOVILPATTI – 628 503

www.nec.edu.in

REGULATIONS - 2019

DEPARTMENT OF

COMPUTER SCIENCE AND ENGINEERING

CURRICULUM AND SYLLABI OF

M.E. – COMPUTER SCIENCE AND ENGINEERING

M. E. – COMPUTER SCIENCE AND ENGINEERING

SEMESTER – I

S. No.	Course Category	Course Code	Course Title	L	T	P	C	QP
THEORY								
1	SFC	19CT11C	Mathematical Foundations for Computer Professionals	3	1	0	4	A
2	PCC	19CT12C	Advanced Data Structures	3	0	0	3	A
3	PCC	19CT13C	Research Methodology and IPR	2	0	0	2	B
4	PEC	E1	Elective - I	3	0	0	3	A
5	PEC	E2	Elective - II	3	0	0	3	A
6	AC		Audit Course - I	2	0	0	0	D
PRACTICAL								
7	PCC	19CT14C	Advanced Data Structures Laboratory	0	0	3	1.5	-
8	PEC	E3	Elective I Laboratory	0	0	3	1.5	-
Total				**16**	**1**	**6**	**18**	

SEMESTER – II

S. No.	Course Category	Course Code	Course Title	L	T	P	C	QP
THEORY								
1	PCC	19CT21C	Advanced Algorithms	3	0	0	3	A
2	PCC	19CT22C	Machine Learning Techniques	3	1	0	4	A
3	PEC	E4	Elective - III	3	0	0	3	A
4	PEC	E5	Elective - IV	3	0	0	3	A
5	AC		Audit Course - II	2	0	0	0	D
PRACTICAL								
6	PCC	19CT23C	Machine Learning Laboratory	0	0	3	1.5	-
7	PEC	E6	Elective - III Laboratory	0	0	3	1.5	-
8	PCC	19CT24C	Mini Project with Seminar	0	0	4	2	
Total				**14**	**1**	**10**	**18**	**-**

SEMESTER – III

S. No.	Course Category	Course Code	Course Title	L	T	P	C	QP
THEORY COURSES								
1	OEC	E7	Elective - V	3	0	0	3	A
2	OEC	E8	Elective - VI (Open Elective)	3	0	0	3	A
3	PEC	E9*	Elective - VII	3	0	0	3	A
PRACTICAL								
4	PSC	19CT31C	Project Work - I	0	0	20	10	-
Total				**9**	**0**	**20**	**19**	**-**

SEMESTER – IV

S. No.	Course Category	Course Code	Course Title	L	T	P	C	QP
PRACTICAL								
1	PSC	19CT41C	Project Work - II	0	0	32	16	-
Total				**3**	**0**	**32**	**16**	**-**

- **Credits may be earned through NPTEL courses**

TOTAL CREDITS : 71

ELECTIVE COURSES

S. No	Course Code	COURSE TITLE	L	T	P	C	QP
Elective Courses for E2, E5, E7 and E9							
1.	19CT01E	Advanced Digital Image Processing	3	0	0	3	A
2.	19CT02E	Introduction to Intelligent Systems	3	0	0	3	A
3.	19CT03E	Data Analytics	3	0	0	3	A
4.	19CT04E	Information Retrieval Techniques	3	0	0	3	A
5.	19CT05E	Advanced Network Security	3	0	0	3	A
6.	19CT06E	Block Chain Technology	3	0	0	3	A
7.	19CT07E	Computer Vision	3	0	0	3	A
8.	19CT08E	Web Analytics and Development	3	0	0	3	A
9.	19CT09E	GPU Computing	3	0	0	3	A
10.	19CT10E	Quantum Computing	3	0	0	3	A

11.	19CT11E	Software Defined Networks	3	0	0	3	A
12.	19CT12E	Game Theory	3	0	0	3	A
13.	19CT13E	Malicious Node Detection Methodologies	3	0	0	3	A
14.	19CT14E	Wireless Body Area Networks	3	0	0	3	A
15.	19CT15E	Cellular Automata Paradigm	3	0	0	3	A
16.	19CT28E	Vehicular Adhoc Networks	3	0	0	3	A
17.	19CT29E	Cloud Management and Security	3	0	0	3	A
Elective Courses for E1, E3, E4 and E6							
18.	19CT16E	Optimization Techniques	3	0	0	3	A
19.	19CT17E	Deep Learning	3	0	0	3	A
20.	19CT18E	Advanced Data Base Technology	3	0	0	3	A
21.	19CT19E	Big Data Analytics and management	3	0	0	3	A
22.	19CT20E	Data Science	3	0	0	3	A
23.	19CT21E	Advanced Wireless Sensor and Mobile Networks	3	0	0	3	A
24.	19CT22E	Computational Optimization Laboratory	0	0	3	1.5	-
25.	19CT23E	Deep Learning Laboratory	0	0	3	1.5	-
26.	19CT24E	Advanced Data Base Laboratory	0	0	3	1.5	-
27.	19CT25E	Big Data Analytics Laboratory	0	0	3	1.5	-
28.	19CT26E	Data Science Laboratory	0	0	3	1.5	-
29.	19CT27E	Advanced Wireless Sensor and Mobile Networks Laboratory	0	0	3	1.5	-
30.	19CT30E	Advanced virtual reality systems	3	0	0	3	A
Elective Courses for E8							
31.	19GD01E	Business Analytics	3	0	0	3	A
32.	19GD02E	Industrial Safety	3	0	0	3	A
33.	19GD03E	Operations Research	3	0	0	3	A
34.	19GD04E	Cost Management of Engineering Projects	3	0	0	3	A
35.	19GD05E	Composite Materials	3	0	0	3	A
36.	19GD06E	Waste to Energy	3	0	0	3	A

Audit Courses 1 & 2

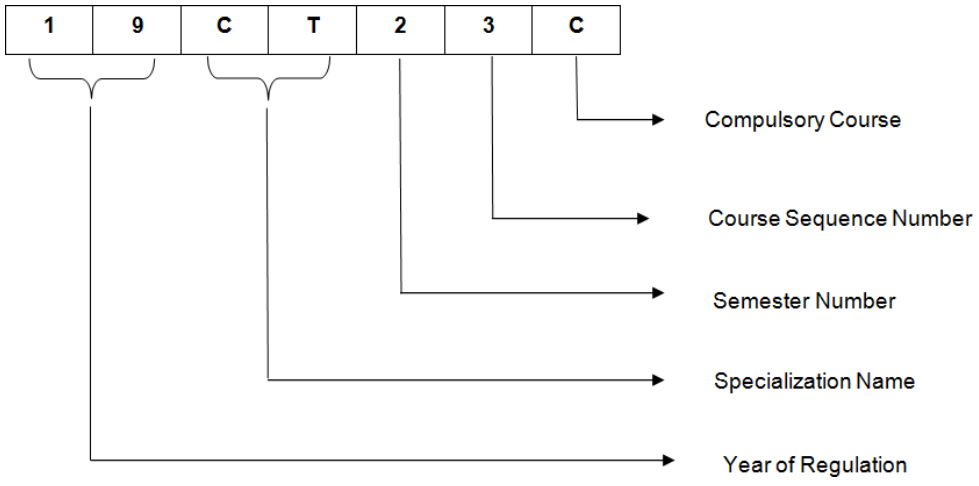
S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
1.	AC	19AC01E	English for Research Paper Writing	2	0	0	0	D
2.	AC	19AC02E	Disaster Management	2	0	0	0	D
3.	AC	19AC03E	Sanskrit for Technical Knowledge	2	0	0	0	D
4.	AC	19AC04E	Value Education	2	0	0	0	D
5.	AC	19AC05E	Constitution of India	2	0	0	0	D

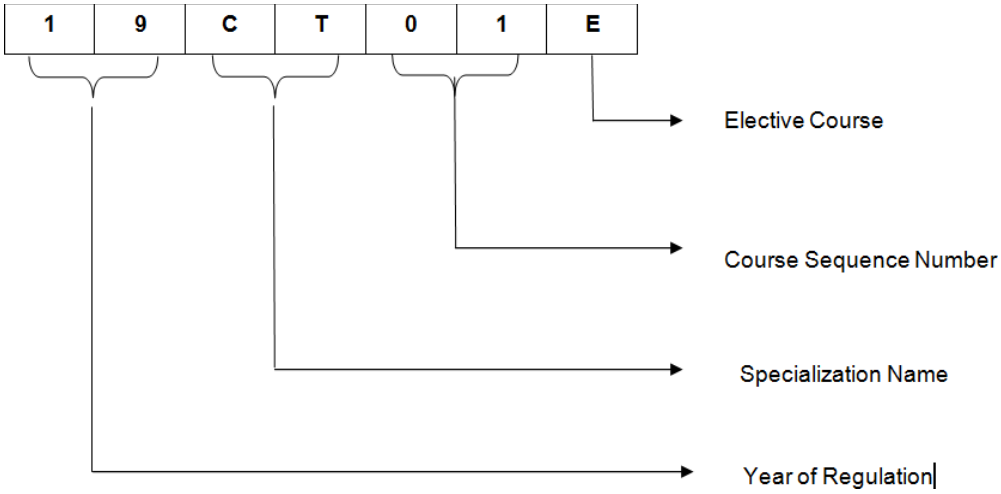
6.	AC	19AC06E	Pedagogy Studies	2	0	0	0	D
7.	AC	19AC07E	Stress Management by Yoga	2	0	0	0	D
8.	AC	19AC08E	Personality Development through Life Enlightenment Skills	2	0	0	0	D

QP - QUESTION PATTERN

Subject Type	Question pattern	2 marks	4 marks	10 marks	11 marks	12 marks	20 marks	Total
Theory (3/4 Credit)	A	10	5	--	--	1 Qn Compulsory & 4 Qns (either or type)	--	100
Theory (2 Credit)	B	10	-	-	1 Qn Compulsory & 4Qn (either or type)			75
Theory (1 Credit)	C	5	--	1 Qn Compulsory & 1 Qn (either or type)	--	--	--	30
Theory Trans Disciplinary	D	--	--	--	--	--	5 out of 8	100
Design oriented	E	--	--	--	--	--	1 Qn Compulsory & 4 Qns (either or type)	100
10,11 and 12 marks questions will be a single question and no subdivisions								

FORMAT FOR COURSE CODE




1
9
C
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E
Elective Course
Course Sequence Number
Specialization Name
Year of Regulation

19CT11C MATHEMATICAL FOUNDATIONS FOR COMPUTER PROFESSIONALS **LT P C QP 3 1 0 4 A**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

- **CO1:** enrich and apply the knowledge of matrix theory concepts in image processing. (K3)
- **CO2:** use set theory principles in complex relational database management systems. (K3)
- **CO3:** apply mathematical foundations, algorithmic principles and graph theory in network security.(K3)
- **CO4:** apply modeling computing techniques to design finite state machines.(K3)
- **CO5:** apply appropriate mathematical transform techniques in signal processing and wavelet. (K3)

UNIT I MATRIX THEORY **12**

Vectors and Matrices - Vector and Matrix Algebra Linear Combinations, Independence, Basis, and Dimension - Using Matrix Algebra to Solve Linear Equations Eigen values – Generalized Eigen Vectors – Canonical Forms – Singular Value Decomposition – The Moore-Penrose Pseudoinverse Principal Component Analysis

UNIT II SET THEORY AND GRAPH THEORY **12**

Elementary theory of sets Sets rules and Combinations – Relations – Functions – Mathematical inductions and Piano‘s Axioms - Graph Theory: Isomorphism - Planar graphs - Graph colouring Hamilton circuits Euler cycles

UNIT III NUMBER THEORY **12**

Divisibility – GCD – Prime Numbers – Fundamental Theorem of Arithmetic – Congruences – Fermat‘s Theorem – Euler‘s Function – Primality Testing – Solution of Congruences – Chinese Remainder Theorem – Wilson‘s Theorem.

UNIT IV MODELING COMPUTATION **12**

Languages and Grammars - Finite-State Machines with Output--Finite-State Machines with No Output - Language Recognition Turing Machines.

UNIT V MATHEMATICAL TRANSFORMS **12**

Laplace Transform: Definition – Results – Properties. Fourier Transform: Fourier Sine and Fourier Cosine Transforms – Properties. Z Transform: Results and Properties.

L: 45; T: 15; TOTAL: 60 PERIODS

REFERENCES

1. Richard Bronson, Schaum's Outline of ¯Matrix Operations‖, 2nd Edition, (Schaum's Outlines) Paperback McGraw-Hill Education, 2011
2. Kenneth H. Rosen,‖ Discrete Mathematics and Its Applications‖, 7th Edition, McGraw-Hill Publishers, 2012.
3. David M. Burton, ¯Elementary Number Theory‖, 7th Edition, Tata McGraw-Hill, 2017.
4. T.Veerarajan, ¯Transforms and Partial Differential Equations‖, McGraw-Hill Publishers, 2012. Jonathan L. Gross, Jay Yellen , Mark Anderson ¯Graph Theory and Its Applications‖, Chapman and Hall/CRC; 3rd Edition,2018
5. https://www.deeplearningbook.org/contents/linear_algebra.html

19CT12C ADVANCED DATA STRUCTURES L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the implementation of dictionaries using hashing techniques. (K2)
CO2: Develop applications using heap data structures and skip list. (K3)
CO3: Develop and analyze algorithms for red-black trees, B-trees and Splay trees. (K3)
CO4: Develop algorithms for text processing applications. (K3)
CO5: Identify suitable data structures and develop algorithms for computational geometry problems. (K4)

UNIT I DICTIONARIES AND HASHING 8

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, Recent Trends in Hashing**.**

UNIT II HEAPS and SKIP LISTS 9

Heaps: Binary Heaps - d-heaps - Leftist Heaps - Binomial Heaps - Fibonacci Heaps-- Pairing Heaps.**Skip Lists:** Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

UNIT III TREES 7

Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

UNIT IV TEXT PROCESSING 11

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

UNIT V COMPUTATIONAL GEOMETRY 10

One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad trees, k-D Trees, various computational geometry methods for efficiently solving the new evolving problem.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C++‖, 4th Edition, Pearson, 2014. (Unit 1,2,3)
2. M T Goodrich Roberto Tamassia, ―Algorithm Design‖, John Willey, 2012, Reprint, 2015, (Unit 4,5)
3. Ellis Horowitz, Sahni, ―Fundamentals Of Data Structures In C++‖, Galgotia publications, 2006.
4. Peter Brass, ―Advanced Data Structures‖, Cambridge University Press, 2014

19CT13C RESEARCH METHODOLOGY AND IPR L T P C QP
2 0 0 2 B

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand research problem formulation. (K2)
CO2: Analyze research related information. (K4)
CO3: Understand the research ethics. (K2)
CO4: Understanding that when IPR would take such important place in growth of individuals & Nation. (K2)
CO5: Recognize the importance of Report writing. (K2)

UNIT I RESEARCH FORMULATION AND DESIGN 6

Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis.

UNIT II DATA COLLECTION AND ANALYSIS 6

Method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools, data analysis with statistical package (Sigma STAT,SPSS for student t-test, ANOVA, etc.), hypothesis testing.

UNIT III RESEARCH ETHICS, IPR AND SCHOLARY PUBLISHING 6

Ethics ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual Property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.

UNIT IV CONTEMPORARY ISSUES IN IPR 6

Interface between IPR and Human Rights -Interface between IPR and Competition Law IPR and sustainable development – Impact of Internet on IPR IPR of Biological systems & E-Commerce.

UNIT V INTERPRETATION AND REPORT WRITING 6

Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

L: 30; TOTAL: 30 PERIODS

REFERENCES

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., ―An introduction to Research Methodology‖, RBSA Publishers, 2015.
2. Kothari, C.R., ―Research Methodology: Methods and Techniques‖**,** New Age International, 2018 (Unit 1 ,Unit 2,Unit 5).
3. Wadehra, B.L. ―Law relating to patents, trade marks, copyright designs and geographical indications‖. Universal Law Publishing,Reprint,2011. (Unit 3,Unit 4)
4. Anthony, M., Graziano, A.M. and Raulin, M.L.. Research Methods: A Process of Inquiry, Allyn and Bacon 2012.
5. Carlos, C.M., Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York, 2000.

19CT14C ADVANCED DATA STRUCTURES LABORATORY L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Implement applications based on the concept of heap, skip list and hashing Techniques. (K3)
CO2: Develop programs for red-black trees, B-trees, AVL and Binary Search trees. (K3)
CO3: Develop algorithms for text processing applications. (K3)
CO4: Identify suitable data structures and develop algorithms for computational geometry problems. (K4)

List of Experiments

1. Write a program to implement the operations of dictionary ADT using different hashing techniques.
2. For given set of elements create skip list. Find the element in the set that is closest to some given value.
3. Read the marks obtained by students of second year in an online examination of particular subject. Find out maximum and minimum marks obtained in that subject. Use heap data structure.
4. Write a program to insert the following elements in a binary search tree in the order of arrival and display the tree 51, 12, 17, 68, 5, 73, 90,36,89,24. Now display all the nodes of the tree wherein all the even numbers are shown first in ascending order followed by all the odd numbers in descending order.
5. Write a program to implement the following operations in the AVL tree
   Insertion into an AVL tree b. Deletion from an AVL tree
6. Write a program to implement the following operations in the Red-Black Tree.
   Insert b. count the number of nodesc. Search d. Clear Tree e. Traversal
7. Write a program to implement the following operations in the B tree
   Insertion into a B tree b. Deletion from a B tree
8. Write a program to implement the Knuth-Morris-Pratt pattern matching Algorithm.
9. Write a program to implement the Huffman coding algorithm.
10. With Trie data structures, develop a program that can be used in the web browser to auto complete the text or show many possibilities of the text that the user is trying to write.
11. You are supposed to build a Social Cop in your smart phone. Social Cop helps people report crimes to the nearest police station in real-time. Use k-d tree to search for the police station nearest to the crime location before attempting to report anything by constructing a 2 dimensional k-d tree from the locations of all the police stations in your city, and then querying the k-d tree to find the nearest police station to any given location in the city.

P:45 TOTAL:45 PERIODS

SOFTWARE REQUIREMENTS

1. C++/ C /JAVA
2. OS -LINUX/ Windows 7/8

19CT21C ADVANCED ALGORITHMS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

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

CO1: Analyze the algorithm‗s efficiency of any given problem (K3)
CO2: Apply different algorithmic design techniques to solve the problem (K3)
CO3: Use efficient data processing techniques to reduce time and space complexity (K3)
CO4: Apply probabilistic and parallel algorithms to solve the basic problems (K3)
CO5: Develop different approximation algorithm (K3)

UNIT I ANALYSIS OF ALGORITHMIC PERFORMANCE 9

Introduction of Analysis of Algorithm – Average and worst case Analysis – Probabilistic and Randomized Algorithm – Computation Analysis – Algorithm Redesign and Adaptation – Asymptotic Notation – Amortized Efficiency

UNIT II ALGORITHMIC DESIGN TECHNIQUES 9

Divide and Conquer: Binary Search – Analysis – Greedy Method: Prim‗s Algorithm – Analysis Dynamic Programming Strategies: Computing Binomial Coefficient – Analysis – Back tracking: Eight Queens problem – Analysis – Branch and Bound – 0/1 Knapsack Problem.

UNIT III EFFICIENT DATA PROCESSING 9

Searching Algorithms – Priority Queues – Binary heaps – Binomial heaps – Dictionaries – Hash tables – String Matching – Introduction to string-matching problem – Naïve Algorithm – Rabin Karp – Knuth Morris Pratt – Boyer-Moore Algorithms and complexity analysis – Data compression algorithms – Huffman Compression – Lempel-Ziv Compression.

UNIT IV PROBABILISTIC AND PARALLEL ALGORITHMS 9

Probabilistic Algorithm – Numerical Probabilistical Algorithms – Monte Carlo Algorithms – Las Vegas Algorithms – Parallel Algorithms: Introduction – Complexity measure for a parallel algorithm – parallel searching algorithm – parallel sorting algorithm – parallel algorithm for matrix manipulation.

UNIT V APPROXIMATION ALGORITHMS 9

The class P and NP: NP-Completeness Problem – NP-Hard problems – Approximation Algorithms: Introduction – Approximation Factor – Polynomial Time Approximation Scheme(PTAS) – Fully Polynomial Time Approximation Scheme(FPTAS) – Approximation Algorithms: Travelling Salesman Problem – Knapsack Problem – Bin Packing – Subset Sum Problem.

L : 45; TOTAL : 45 PERIODS

REFERENCES

1. Selim G.Aki, ―Parallel computation: models and methods‖ Prentice Hall, Digital edition,2007
2. Himanshu B. Dave , ―Design and analysis of Algorithms‖ , 2nd Edition Pearson India, 2013
3. Thomas H.Cormen, Charles, ―Introduction to Algorithms‖, Eastern Economy Edition Paperback -MIT Press, 3rd edition, 2010.
4. Sahni Horowitz, ―Fundamentals of Computer Algorithms‖2nd Edition Paperback Universities Press, 2008.
5. Banachowski. L, Kreczmar. A, Wojciech.R, ―Analysis of Algorithms and Data and Structures‖, 2nd Edition, Addition Wesley, 1991.
6. Anany Levitin, ―Introduction to the Design and Analysis of Algorihms‖ 2nd Edition Pearson India, 2017

19CT22C MACHINE LEARNING TECHNIQUES L T P C QP
3 1 0 4 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the concepts of machine learning (K2)
CO2: Apply the Predictive and Probabilistic modeling techniques (K3)
CO3: Explore the supervised and unsupervised learning techniques (K3)
CO4: Build reinforcement learning models (K3)
CO5: Extract the feature and Optimize the features (K3)

UNIT I BASICS OF LEARNING 12

Components of learning – Learning models – Types of learning – supervised – unsupervised – reinforcement – Curse of Dimensionality – Bias and Variance – Learning Curve –Classification – Training versus testing – Error and Noise

UNIT II PREDICTIVE AND PROBABLISTIC LEARNING 12

Predictive Models: Univariate linear regression – Multivariate linear regression – Logistic regression – Stochastic Gradient Descent – Linear Multiclass Prediction – Probablistic Models: Density Estimation – Naïve Bayes Models – Statistical Estimation – Conditional Models

UNIT III SUPERVISED AND UNSUPERVISED LEARNING 12

Supervised Models: Neural Networks – Multilayer Networks with Backpropagation Algorithm – Case Study: Face Recognition – Kernel Tricks – Soft-SVM with Kernels. Unsupervised Models: Measuring dissimilarity – Spectral clustering –Hierarchical clustering – K-Means clustering – Fuzzy C-Means Clustering – Dimensionality Reduction using PCA

UNIT IV REINFORCEMENT LEARNING 12

Passive reinforcement learning : Direct utility estimation – Adaptive Dynamic Programming – Temporal-Difference Learning – Active reinforcement learning: exploration – learning an action-utility function – Generalization in reinforcement learning – policy search – Applications in game playing – applications in healthcare using AutoML (Google).

UNIT V ANALYTICAL AND FEATURE LEARNING 12

Analytical Learning: Discovering new features – Deductive Learning – Knowledge level learning – Feature Learning : Feature Selection – Greedy Selection Approaches – Feature Manipulation and Normalization – Dictionary Learning with Auto-encoders – Case Study : Image Classification.

L : 45; T: 15; TOTAL : 60 PERIODS

REFERENCES

1. Kevin P. Murphy, ¯Machine Learning: A Probabilistic Perspective‖, MIT Press, 2012
2. Shai Shalev-Shwartz and Shai Ben-David, ¯Understanding Machine Learning: From Theory to Algorithms‖, Cambridge University Press, 2014
3. Andreas C.Muller and Sarah Guido, ¯Introduction to Machine Learning with Python‖, O'Reilly Media, 2017
4. Christopher M. Bishop, ¯Pattern Recognition and Machine Learning‖, Springer, 2011.
5. Tom Mitchell, "Machine Learning", McGraw-Hill, 2017.
6. https://www.coursera.org/learn/machine-learning
7. http://machinelearningmastery.com/best-machine-learning-resources-forgetting-started/
8. https://www.udemy.com/machinelearning/

19CT23C MACHINE LEARNING LABORATORY L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Implement Regression and Probabilistic models(K3)
CO2: Develop supervised and unsupervised models(K4)
CO3: Design a classifier with dictionary learning(K5)

LIST OF EXPERIMENTS

1. Implement the non-parametric Linear Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
2. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
3. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Apply *k*-Means algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using Fuzzy C-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.
6. Write a program to implement Reinforcement Learning algorithm to classify the iris data set. Print both correct and wrong predictions.
7. Build a classifier by implementing Dictionary Learning with Auto encoders to classify the viper dataset.

P: 45 TOTAL: 45 PERIODS

SOFTWARE REQUIREMENTS

1. **Python 3.X**
2. **Anaconda Navigator**

19CT24C	MINI PROJECT WITH SEMINAR	L T P C 0 0 4 2

During the seminar session, each student is expected to prepare and present a topic on Computer Science and Engineering / technology, for duration of about 15 to 20 minutes. Each student is expected to present atleast twice during the semester and the student is evaluated based on the presentation skill, concept and Query clarification. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. A Faculty is to be allotted and he / she will guide and monitor the progress of the student and maintain the attendance also. The seminar will be assessed by a committee appointed by the COE.

P: 60 TOTAL: 60 PERIODS

19CT01E ADVANCED DIGITAL IMAGE PROCESSING L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the fundamentals of digital image processing and morphology.(K1)
CO2: Analyze the suitable segmentation techniques and perform image analysis.(K3)
CO3: Identify various feature extraction techniques for image analysis.(K2)
CO4: Understand and use the concepts of image restoration and fusion.(K2)
CO5: Analyze the different types of 3D image visualization techniques. (K3)

UNIT I IMAGE PROCESSING FUNDAMENTALS 9

Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, 2D image transforms-DFT, DCT, KLT, and SVD. Image enhancement in spatial and frequency domain, Review of Morphological image processing- Basic morphological Algorithms. Image Morphology: Binary and Gray level morphology operations Erosion, Dilation, Opening and Closing Operations Distance Transforms- Features

UNIT II IMAGE SEGMENTATION 9

Detection of Discontinuities –Edge Operators- Edge Linking and Boundary Detection – Thresholding –Region Based Segmentation-Motion Segmentation-Fuzzy clustering, Watershed algorithm, Active contour models, Texture feature based segmentation, Graph based segmentation, Wavelet based Segmentation Applications of image segmentation.

UNIT III FEATURE EXTRACTION 9

First and second order edge detection operators, Phase congruency, Localized feature extraction detecting image curvature, shape features, Hough transform, shape skeletonization, Boundary descriptors, Moments, Texture descriptors-Autocorrelation, Co-occurrence features, Run length features, Fractal model based features, Gabor filter, wavelet features.

UNIT IV IMAGE RESTORATION AND FUSION 9

Model of the Image Degradation/Restoration Process –Noise Models –Restoration in the Presence of Noise Only –Spatial Filtering –Periodic Noise Reduction by Frequency Domain Filtering –Linear, Position-Invariant Degradations –Estimating the Degradation Function –Inverse Filtering – Minimum Mean Square Error (Wiener) Filtering –Constrained Least Squares Filtering –Geometric Transformations-Image Fusion-Overview of image fusion, pixel fusion, wavelet based fusion and region based fusion.

UNIT V 3D IMAGE VISUALIZATION 9

Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, The use of color, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiple connected surfaces, Image processing in 3D, Measurements on 3D images.Case Study: Impulse Noise Reduction Using Morphological Image Processing with Structuring Elements, Web platform using digital image processing and geographic information system tools.

L : 45; TOTAL : 45 PERIODS

REFERENCES

1. Ardeshir Goshtasby, ¯2D and 3D Image registration for Medical, Remote Sensing and Industrial Applications‖, John Wiley and Sons, 2005.
2. Anil K. Jain, ¯Fundamentals of Digital Image Processing‖, Pearson Education, Inc., 2004.
3. JC Russ and FB Neal, ¯The Image Processing Handbook‖, 7th edition., CRC Press, 2015
4. Mark Nixon, Alberto Aguado, ¯Feature Extraction and Image Processing‖, Academic Press, 2004.
5. Rafael C. Gonzalez, Richard E. Woods, ¯Digital Image Processing‖, Pearson Education, Inc., 4th Edition, 2018.
6. Rick S.Blum, Zheng Liu, ¯Multi sensor image fusion and its Applications¯, Taylor & Francis, 2005.

19CT02E INTRODUCTION TO INTELLIGENT SYSTEMS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Comprehend different types of problem solving and search algorithms and its applications (K2)
CO2: Realize the concepts and Knowledge representation and reasoning (K3)
CO3: Acquire in-depth knowledge about the reasoning (K2)
CO4: Appreciate the concept of Machine learning (K2)
CO5: Uncover the state-of-the-art of present technology (K2)

UNIT I INTRODUCTION 9

Overview of AI problems, examples of successful recent AI applications. The Turing test, Rational versus non-rational reasoning. Search Strategies: Problem spaces, problem solving by search. Uninformed search. Heuristics and informed search.Minimax Search, Alpha-beta pruning. Space and time efficiency of search.

UNIT II KNOWLEDGE REPRESENTATION AND REASONING 9

The Propositional logics, First Order Predicate Logic, Forward and Backward Chaining, Resolution, Rule - based production systems; case-based reasoning systems and model based reasoning systems

UNIT III UNCERTAIN KNOWLEDGE AND REASONING 9

Uncertainly, Representing Knowledge in an Uncertain Domain, Conditional Probability, Joint Probability, Bays theorem, Belief Networks, Simple Inference in Belief Networks.

UNIT IV LEARNING 9

Inductive and deductive learning, unsupervised and supervised learning, reinforcement learning, explanation based Learning, concept learning from examples, Quinlan's ID3, classification and regression trees, Bayesian methods.

UNIT V APPLICATIONS 9

Intelligent systems in health and medicine, Machine learning and representation learning, Statistical and structural pattern recognition, Semantic technologies, Information Retrieval, Information Extraction, Natural Language Processing, Robot.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Dan W. Patterson,‖ Introduction to Artificial Intelligence and Expert Systems‖ , 1st Edition, Pearson Education, 2015.
2. S.Russel, P.Norvig, ¯Artificial Intelligence - A Modern Approach‖, 3rd Edition, Pearson Education Ltd., 2014.
3. Christopher M.Bishop, ¯Pattern Recognition and Machine Learning‖, 1st Edition,Springer, 2016.
4. Rajendra Akerkar, ¯Foundations of the Semantic Web, Narosa Publishing House,New Delhi and Alpha Science Intern, 2009.
5. Michael Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems. 2nd edition, Addison Wesley, 2005.

19CT03E DATA ANALYTICS **L T P C QP**
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: Understand data preparation and transformations. (K2)
CO 2: Implement various statistic techniques for data analysis. (K3)
CO 3: Understand different data visualization techniques. (K2)
CO 4: Implement Clustering and predictive analysis for various kinds of data (K3)
CO 5: Analyze data for real time applications. (K4)

UNIT I DATA PREPARATION **9**

Introduction Data sources – Data understanding : Data tables- continuous and discrete variables- scales of measurement- Role in analysis – Frequency distribution – Data preparation : Overview- Cleaning the data – Removing variables – Data transformations – Segmentation.

UNIT II STATISTICS **9**

Overview of Statistics – Descriptive statistics: central tendency-variation-shape –Inferential statistics- Confidence intervals – Hypothesis tests- chi-square- One-way analysis of variance – Comparative statistics: Visualizing relationships – Correlation coefficient – Correlation analysis for more than two variables.

UNIT III DATA VISUALIZATION **9**

Visualization Design Principles : General principles-Graphics design-Anatomy of a graph- Tables : Simple Tables- Summary Tables- Two-way Contingency Tables- Supertables- Univariate Data Visualization – Bivariate Data Visualization – Multivariate Data Visualization – Visualizing Groups : Dendrograms-Decision Trees, Cluster Image Maps Dynamic Techniques.

UNIT IV CLUSTERING AND PREDICTIVE ANALYSIS **9**

Overview – Distance Measures – Agglomerative Hierarchical Clustering – Partitioned Based Clustering – Fuzzy Clustering – Overview of Predictive Analysis – Principal Component Analysis – Multiple Linear Regression – Discriminant Analysis – Logistic Regression – Naive Bayes Classifiers k-nearest neighbors – classification and regression trees- Neural networks.

UNIT V APPLICATIONS **9**

Application: Sales and Marketing – Industry Specific Data Mining – microRNA Data Analysis Case Study – Credit Scoring Case Study – Data Mining Nontabular Data.

L : 45; TOTAL: 45 PERIODS

REFERENCES

1. Glenn J.Myatt, ¯Making sense of data : A practical guide to exploratory data analysis and data mining‖, 2nd Edition, 2014.
2. Edward R. Tufte, ¯ The Visual display of Quantitative Information‖, 2nd Edition, 2001.
3. Ben Fry, ¯Visualizing data : Exploring and Explaining Data with the processing Environment‖, 2008.
4. Tamraparni Dasu, ¯Exploratory Data mining and Data cleaning‖, 2013.

19CT04E INFORMATION RETRIEVAL TECHNIQUES L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: apply information retrieval principles to retrieve relevant information in large collections of data (K3)

CO2: acquire the knowledge in important retrieval models and retrieval performance evaluation for IR systems

CO3: understand and deploy efficient techniques for the indexing of document objects that are to be retrieved (K2)

CO4: develop the multimedia IR systems for handling multimedia data (K3)

CO5: implement features of retrieval systems for web-based and other search tasks (K3)

UNIT I INTRODUCTION 9

Introduction - Components of IR – Practical Issues – Retrieval Process – Architecture Boolean Retrieval –Retrieval Evaluation - Open source Search engine Frameworks –The impact of the web on IR –The role of artificial intelligence (AI) in IR –IR Versus Web Search

UNIT II MODELING AND RETRIEVAL EVALUATION 9

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

UNIT III INDEXING AND QUERING 9

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

UNIT IV MULTIMEDIA INFORMATION RETRIEVAL 9

Data models – Query languages – Spatial access models – Generic approach – One dimensional time series – Two dimensional color images – Feature extraction.

UNIT V WEB RETRIEVAL AND WEB CRAWLING 9

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations — Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Ricardo Baeza – Yates, BerthierRibeiro – Neto, Modern Information Retrieval, Addison-Wesley professional, 2nd Edition, The MIT Press, Cambridge, Massachusetts London, England, 2011.
2. Christopher D. Manning, P. Raghavan and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008 (available at http://nlp.stanford.edu/IR-book).
3. Chakrabarti, S. (2002). Mining the web: Mining the Web: Discovering knowledge from hypertext data. Morgan-kaufman.
4. B. Croft, D. Metzler, T. Strohman, Search Engines: Information Retrieval in Practice, Addison- Wesley, 2009 (available at http://ciir.cs.umass.edu/irbook/).

5. G.G. Chowdhury, ¯Introduction to Modern Information Retrieval‖, 3rd Edition, Facet Publishing, 2010.
6. David A. Grossman, Ophir Frieder, ¯Information Retrieval: Algorithms, and Heuristics‖, Edition, Springer, 2012.
7. Charles T. Meadow, Bert R. Boyce, Donald H. Kraft and Carol L. Barry, ¯Text Information Retrieval Systems‖, 3rd Edition, Academic Press, 2006.

19CT05E ADVANCED NETWORK SECURITY L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Appreciate the contemporary advancements in the field of cryptography and Network Security (K1)

CO2: Elaborate the computational hardness of re synthesis process of various cryptographic algorithms. (K2)

CO3: Use pseudo random number generators in key distribution and management. (K3)

CO4: Analyze the pros and cons of various security protocols and its applications. (K3)

CO5: Explore the necessity of cryptographic algorithms in hardware peripheral design and Digital Signatures. (K2)

UNIT I INTRODUCTION 9

Classical Vs Modern Cyptography - Information Theoretic Security - Shannon's definition of perfect security - Vernam one time pad - Limitations of information theoretic approach --Discrete logarithm - Elgamal encryption algorithm Remote coin flipping bit commitment

UNIT II COMPUTATIONAL HARDNESS AND ONE-WAYNESS 9

One way function - One way permutations - Trapdoor permutations - Integer multiplication - Modular Exponentiation - Hardcore predicates - Gold rich levin construction Linear crypt analysis - Differential crypt analysis

UNIT III PSEUDO RANDOM AND HASH FUNCTIONS 9

Pseudo random generators - Blum-micali-yao construction - Efficient instantiations --Blum-Blum shub construction - Pseudo random functions - Goldreich-Goldwasser - Micali construction - Pseudo random permutations Luby-Racko construction

UNIT IV SECURITY PROTOCOLS 9

SSL/TLS: Confidentiality, Integrity, Authentication- Kerberos and OAuth PKI certificates and Trust model - Synopsis of an attack:Flame - Challenge Response Protocols - Proof of Knowledge Zero Knowledge Proddfs Quorum Cryptography

UNIT V HARDWARE CRYPTOGRAPHY 9

Smart cards - Hardware Security Models (HSM) --Trusted Platform Module (TPM)- Virtualized Cryptographic Processors - Secure boot attestation sealing - Lamport's one-time signature scheme Schnorr signature scheme

L : 45; TOTAL : 45 PERIODS

REFERENCES

1. Jonathan Katz and Yenuda Lindell, "Introduction to Modern Cryptography", Chapman & Hall / CRC press, 2 nd edition,2014.
2. Douglas Stinson, "Cryptography Theory and Practice, 2nd Edition, Chapman & Hall / CRC,4th edition,2018.
3. B.A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 3 rd edition,2016.
4. W.Stalings, "Cryptography and Network Security:Principles and Practice", 5th edition, Pearson Education, 2011.
5. A.Joux, "Algorithmic Cryptanalysis", CRC Press, 2009
6. Wenbo Mao, "Modern Cryptography Theory and Practice, Pearson Education, 2004.

19CT06E BLOCK CHAIN TECHNOLOGY **L T P C QP**
3 0 0 3 A

COURSE OUTCOMES

Upon Completion of the course, the students will be able to

CO1: Identify block chain , transactions, blocks, proof-of-work.(K1)
CO2: Recognize the basic security and its significance in Bitcoin (K2)
CO3: Implement consensus protocol mechanisms and hyperledger tools.(K3)
CO4: Identify the important issues in block chain technology.(K3)
CO5: Analyze the modern needs of cashless transactions (K3)

UNIT I INTRODUCTION **9**

History: Digital Money to Distributed Ledgers- Design Primitives: Protocols, Security, Consensus, Permissions, Privacy -- Blockchain Architecture and Design- History of centralized services- Transactions-Trusted third party for transactions-Making a case for a trustless system -- Decentralized transactions- Verifying and Confirming transactions

UNIT-II BASICS OF CRYPTOGRAPHY AND BITCOIN **9**

Cryptography Hash Function – Properties of Hash Function – Hash pointer and Merkle tree – Digital Signature – Symmetric and Asymmetric Key Cryptography. Creation of Coins – Payments and Double Spending – Transaction in Bitcoin Network – Block Mining – Block propagation and Block relay- Proof of Work (PoW) – Hashcash PoW – Attacks on PoW – Proof of Stack – Proof of Burn – Proof of Elapsed Time.

UNIT III CONSENSUS AND HYPERLEDGER **9**

Consensus: Basic consensus mechanisms-Requirements for the consensus protocols- Scalability aspects of Blockchain consensus protocols. Permissioned Blockchains: Design goals-- Consensus protocols for Permissioned Blockchains. Hyperledger Fabric I: Decomposing the consensus process-Hyperledger fabric components-Chaincode Design and Implementation ---Hyperledger composer tool

UNIT IV CHALLENGES AND SECURITY ISSUES **9**

Security and Safeguards- Protection from attackers - Hacks on exchanges-- stopping adoption- Scalability problems - Bitcoin creation and economy - Network attacks to destroy bitcoin- Limited Supply and Deflation- Ethereum concept and Ethereum classic – Altcoins. Case Study: Failed currencies & blockchains

UNIT V RESEARCH IN BLOCKCHAIN **9**

PoW and BFT Consensus – Consensus scalability – Key Blocks and Microblocks – Authority and Digital Signature – Collective Signing – BFT over Bitcoin – XPAXOS – Multiparty Computation – Data Analysis over Blockchain – Smart contracts.

L : 45; **TOTAL : 45 PERIODS**

REFERENCES

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, ―Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction Kindle Edition‖ Princeton University Press 2016.
2. Blockchain Technology, Kindle Edition, BBVA innovation center.
3. Roger Wattenhofer, ―Distributed Ledger Technology: The Science of the Blockchain‖, 2nd Edition by
4. Andreas M. Antonopoulos, ―Mastering Bitcoin: Unlocking Digital Cryptocurrencies‖, 2nd Release, 2015.

5. https://bitcoin.org/bitcoin.pdf
6. http://scet.berkeley.edu/wp-content/uploads/BlockchainPaper.pdf
7. https://www.bbvaopenmind.com/en/a-secure-model-of-iot-with-blockchain/?utm_source=views&utm_medium=article06&utm_campaign=MITcompany&utm_content=banafa-jan07
8. https://www.evry.com/globalassets/insight/bank2020/bank-2020---blockchain-powering-the-internet-of-value---whitepaper.pdf

19CT07E **COMPUTER VISION** **L T P C QP**
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: Implement fundamental image processing techniques for computer vision (K2)
CO 2: Implement chain codes and other region descriptors to perform shape analysis (K2)
CO 3: Apply Hough Transform for line, circle, and ellipse detections (K2)
CO 4: Apply 3D vision techniques and motion related techniques (K2)
CO 5: Develop applications using computer vision techniques (K3)

UNIT I IMAGE PROCESSING FOUNDATIONS 8

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture

UNIT II SHAPES AND REGIONS 9

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors moments

UNIT III HOUGH TRANSFORM 9

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

UNIT IV 3D-VISION AND MOTION 9

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

UNIT V APPLICATIONS 10

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras-human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. E. R. Davies, ―Computer & Machine Vision‖, Fourth Edition, Academic Press, 2012.
2. R. Szeliski, ―Computer Vision: Algorithms and Applications‖, Springer 2011.
3. Simon J. D. Prince, ―Computer Vision: Models, Learning, and Inference‖, Cambridge University Press, 2012.
4. Mark Nixon and Alberto S. Aquado, ―Feature Extraction & Image Processing for Computer Vision‖, Third Edition, Academic Press, 2012.

5. D. L. Baggio et al., ―Mastering OpenCV with Practical Computer Vision Projects‖, Packt Publishing, 2012.
6. Jan Erik Solem, ―Programming Computer Vision with Python: Tools and algorithms for analyzing images‖, 1st edition, O'Reilly Media, 2012.

19CT08E WEB ANALYTICS AND DEVELOPMENT **L T P C QP**
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the concepts and terminologies related to web analytics.(K2)
CO2: Realize various parameters used for web analytics and their impact. (K2)
CO3: Explore the use of tools and techniques of web analytics. (K2)
CO4: Get experience on websites, web data insights and conversions. (K2)
CO5: Appreciate the concept of web goals (K2)

UNIT I INTRODUCTION **9**

Web Analytics – Basics – Traditional Ways – Expectations – Data Collection – Click stream Data – Weblogs – Beacons – JavaScript Tags – Packet Sniffing –Outcomes data – Competitive data – Search Engine Data.

UNIT II QUALITATIVE ANALYSIS **9**

Customer Centricity – Site Visits – Surveys – Questionnaires –Website Surveys – Post visits – Creating and Running- Benefits of surveys – Critical components of successful strategy.

UNIT III WEB ANALYTIC CONCEPTS **9**

URLS – Cookies – Time on site – Page views – Understand standard reports – Website content quality – Navigation reports – Search Analytics – Internal search, SEO and PPC –Measuring Email and Multichannel Marketing - Competitive intelligence and Web 2.0Analytics – Segmentation – Connectable reports.

UNIT IV GOOGLE ANALYTICS **9**

Analytics - Cookies - Accounts vs Property - Tracking Code -Tracking Unique Visitors --- Demographics - Page Views & Bounce Rate Acquisitions Custom Reporting.

UNIT V GOALS & FUNNELS **9**

Filters - Ecommerce Tracking - Real Time Reports - Customer Data Alert - Adwords Linking - Adsense Linking -Attribution Modeling - Segmentation -Campaign Tracking - Multi-Channel Attribution.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Avinash Kaushik, ―Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity ―, 1st edition, Sybex, 2009.
2. Michael Beasley, ―Practical Web Analytics for User Experience: How Analytics can help you Understand your Users‖, Morgan Kaufmann, 2013.
3. Magy Seif El-Nasr, Anders Drachen, Alessandro Canossa, eds., ―Game Analytics: Maximizing the Value of Player Data‖, Springer, 2013.
4. Bing Liu, ―Web Data Mining: Exploring Hyperlinks, Content, and Usage Data‖, 2nd Edition, Springer, 2011.
5. Justin Cutroni, ―Google Analytics‖, O'Reilly, 2010.
6. Eric Fettman, Shiraz Asif, Feras Alhlou , ―Google Analytics Breakthrough‖, John Wiley & sons, 1st edition, 2016.

19CT09E GPU COMPUTING L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the general principles for parallel computing and pipeline visualization Graphics processing units (GPUs). (K2)

CO2: Analyze GPU architecture, and identify potential software optimizations based on Knowledge of the GPU architecture (K3)

CO3: Exploit experimental highly productive methods for GPU programming, such as GPU libraries and algorithmic (K2)

CO4: Design and implement a programme for a GPU for applications in scientific Computing, machine learning, image and various research fields. (K3)

UNIT I INTRODUCTION TO OPENCL 9

Introduction-The OpenCL programming model-Host program and device kernel-OpenCL objects - Basic program: vector addition.

UNIT II ALGORITHMS IN OPENCL 9

Square matrix transpose-Square matrix multiplication-Work-groups-OpenCL synchronization model-OpenCL memory model-Matrix multiplication with local memory-Parallel reduction algorithms-Sorting algorithms.

UNIT III ARCHITECTURE OF GPU 9

The AMD Southern Islands instruction set architecture-SIMD (Single-Instruction Multiple-Data) execution model-Scalar and vector instructions-Thread divergence-Nested control flow-The Multi2Sim simulation framework- Disassembler, emulator, timing simulator, and pipeline visualization.

UNIT IV RESEARCH TOPICS AND OPPORTUNITIES 9

Memory hierarchies and coherence protocols on APUs-Interconnection networks on GPUs-Rendering graphics using OpenGL-The GPU graphics pipelines-Simulation of new GPU architectures-OpenCL/CUDA to LLVM compiler front-ends-LLVM to NVIDIA/Intel/AMD compiler back-ends and optimizers

UNIT V CASE STUDIES 9

Graphic processing unit computing for large-scale data mining- GPU architecture for data mining data mining tasks and techniques – applications- GPU computing and map reduce- Apriori algorithm on HDFS using GPU

L : 45; TOTAL : 45 PERIODS

REFERENCES

1. Raphael Couturier, ¯Designing Scientific Applications on GPUs‖,1st Edition, Chapman and Hall /CRC press,2013.
2. https://docs.nvidia.com/cuda/cuda-c-programming-guide/index.html
3. Wen-Mei-Hwu , ¯GPU Computing Gems‖, Emerald Edition , Morgan Kaufmann, 1st edition January , 2011.
4. https://www.class-central.com/tag/gpu-programming
5. B. Gaster, L. Howes, D. Kaeli, P. Mistry, D. Schaa, ¯Heterogeneous Computing with OpenCL‖, Morgan Kaufmann, 1st Edition, August 31, 2011.
6. https://docs.nvidia.com/cuda/cuda-quick-start-guide/index.html

7. Aaftab Munshi, Benedict Gaster, Timothy G. Mattson, OpenCL Programming Guide (OpenGL) 1st Edition, Kindle Edition, Addison-Wesley Professional, 2011.
8. Alberto Cano, ¯A survey on graphic processing unit computing for large scale data mining‖, Wiley online library, 2017.

19CT10E QUANTUM COMPUTING L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: recognize the importance of Quantum Computation in Computer Science. (K2)
CO2: be familiar with linear algebra and basic quantum mechanics. (K2)
CO3: appreciate the the potency of the Quantum algorithms and protocols in a research perspective. (K3)
CO4: design simple quantum algorithms by analyzing the computational complexity and considering fault tolerance. (K3)

UNIT I FOUNDATION 9

Overview of traditional computing – Church-Turing thesis – circuit model of computation – reversible computation – quantum physics – quantum physics and computation – Dirac notation and Hilbert Spaces – dual vectors – operators – the spectral theorem – functions of operators – tensor products – Qubits versus classical bits Schmidt decomposition theorem

UNIT II QUANTUM MODEL OF COMPUTATION 9

Quantum Measurements Density Matrices - Positive-Operator Valued Measure -- Fragility of quantum information: Decoherence - Quantum Superposition and Entanglement --Quantum Gates and Circuits No cloning theorem

UNIT III QUANTUM ALGORITHMS –I 9

Superdense coding -Quantum teleportation – Applications of teleportation – Probabilistic versus quantum algorithms -Phase kick-back – Bell's inequality and its implications-- Deutsch and Deutsch-Jozsa algorithm -Simon's algorithm -Quantum phase estimation - Quantum Fourier Transform -Eigenvalue estimation

UNIT IV QUANTUM ALGORITHMS –I 9

Order-finding problem – Shore's factorization algorithm – Finding discrete logarithms – Hidden subgroups – Grover's quantum search algorithm – Amplitude amplification – Quantum amplitude estimation – Quantum counting

UNIT V QUANTUM COMPUTATIONAL COMPLEXITY ANALYSIS AND ERROR CORRECTION 9

Scalability in quantum computing - NMR Quantum Computing - Spintronics and QED approaches Linear Optical Approaches - Nonlinear Optical Approaches Polynomial method – Block sensitivity – Adversary methods Fault tolerance – Quantum error correction

L : 45; TOTAL : 45 PERIODS

REFERENCES

1. Micheal A.Nielsen and Issac L.Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 2013.
2. David McMahon, Quantum Computing Explained, Wiley, 2016.
3. Richard J. Lipton Kenneth W. Regan, ―Quantum algorithms via linear ALGEBRAA Primer‖, The MIT Press Cambridge, Massachusetts London, England, 2014.
4. Michael A. Nielsen and Issac L. Chuang, ―Quantum Computation and Quantum Information‖, Cambridge, 2011.
5. Riley Tipton Perry, ―Quantum Computing from the Ground Up‖, World Scientific Publishing Ltd., 2012.
6. Scott Aaronson, ―Quantum Computing since Democritus‖, Cambridge, 2013.
7. P. Kok, B. Lovett, ―Introduction to Optical Quantum Information Processing‖, Cambridge, 2010.

19CT11E SOFTWARE DEFINED NETWORKS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Analyze the evolution of software defined networks (K2)
CO2: Understand the advanced and emerging networking technologies (K2)
CO3: Apply and analyze the network functions and virtualization. (K3)
CO4: Obtain skills to do advanced networking research and programming (K2)
CO5: Design and develop various applications of SDN (K3)

UNIT I INTRODUCTION 9

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Evolution of Switches and Control Planes-Data Center Innovation-Data Center Needs- SDN Fundamental Characteristics-Operation-Devices-Controller-Centralized and Distributed Control and Data Planes**.**

UNIT II OPEN FLOW & SDN CONTROLLERS 9

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays – SDN via Opening up the Device – General Concepts SDN Controllers

UNIT III DATA CENTERS 9

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN- VxLAN-Network Virtualization using Generic Routing Encapsulation (NVGRE).

UNIT IV SDN PROGRAMMING 9

Programming SDNs- Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.

UNIT V SDN APPLICATION 9

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration.

L:45; TOTAL:45 PERIODS

REFERENCES

1. Paul Goransson and Chuck Black, ―Software Defined Networks: A Comprehensive Approach‖, Second Edition, Morgan Kaufmann publishers, 2016.
2. Patricia A. Morreale, James M. Anderson, ―Software Defined Networking design and deployment‖, First Edition, CRC Press publishers, 2015.
3. Thomas D. Nadeau, Ken Gray, ―SDN: Software Defined Networks‖, First Edition, O‘Reilly Media publishers, 2013.
4. Oswald Coker and Siamak Azodolmolky, ―Software Defined Networking with Open Flow, Packt Publishing Limited‖, Second Edition, 2017.
5. Fei Hu, Editor, ―Network Innovation through Open Flow and SDN: Principles and Design‖, CRC Press, 2014.
6. Siamak Azodolmolky, ―Software Defined Networking with Open Flow‖, First Edition, Packet publishing, 2013.
7. Vivek Tiwari, ―SDN and Open Flow for Beginners‖, Amazon Digital Services, Inc., 2013.
8. Vishal Shukla, ―Introduction to Software Defined Networking - Open Flow & VxLAN‖, Create space Independent Publishing Platform, 2013.

19CT12E **GAME THEORY** **L T P C QP**
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: comprehend a conceptual overview to the tools of game theory and its applications. (K2)

CO2: analyze situations in which two or more individuals (or firms, political parties, countries) interact in a strategic manner (K4)

CO3: analyze the situations involving conflict and/or cooperation (K4)

CO4: introduce the concepts of social choice theory (K2)

UNIT I STATIC GAMES OF COMPLETE INFORMATION 9

Introduction - Decision Theory - Strategic Game - Nash Equilibrium - Multiple Nash Equilibrium Applications Mixed Strategy Equilibrium.

UNIT II DYNAMIC GAMES WITH COMPLETE INFORMATION 9

Extensive Form Games - strategies and equilibrium in extensive form games Backward Induction and sub game perfection.

UNIT III STATIC GAMES OF INCOMPLETE INFORMATION 9

Bayesian Games - Bayesian Nash Equilibrium Applications

UNIT IV DYNAMIC GAMES WITH INCOMPLETE INFORMATION 9

Perfect Bayesian Equilibrium - Signaling Games Applications

UNIT V SOCIAL CHOICE THEORY 9

Social choice and social welfare functions - Condorcet's paradox desirable properties of social choice procedures (Pareto condition, independence of irrelevant alternatives) – popular voting procedures (Borda) Arrow's theorem.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Martin Osborne, ¯An Introduction to Game Theory‖, 2nd Edition, Oxford University Press, 2012.
2. G. Chalkiadakis, E. Elkind, and M. Wooldridge, ¯Computational Aspects of Cooperative Game Theory‖. Morgan & Claypool, 2011.
3. Michael Maschler, Eilon Solan, Shmuel Zamir, ¯Game Theory‖, Cambridge University Press, 1st Edition 2013.
4. Y. Shoham and K. Leyton-Brown, ¯Multiagent Systems‖, Cambridge University Press, 2008.
5. Drew Fundenberg and Jean Tirole, ¯Game Theory‖, 1st Edition, MIT Press, 1991.

19CT13E MALICIOUS NODE DETECTION METHODOLOGIES L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1 : Recognize the importance of network security. (K3)
CO 2 : Compare and analyze the different attacks of networks and its impacts. (K3)
CO 3 : Identify a emerging research issue in trust and reputation systems. (K3)
CO 4 : Acquire knowledge about the various cooperation enforcement and detection mechanisms. (K2)
CO 5 : Design various network topologies incorporate with different mobility models and routing protocols. (K3)

UNIT I INTRODUCTION TO NETWORK SECURITY 9

Security Trends – OSI Security Architecture – Security Services – Security Mechanisms security Requirements – Model for Network Security – Authentication and Integrity Mechanism – Key Distribution.

UNIT II ATTACK TAXONOMY 9

Attack Classification: Passive and Active Attacks – Attackers and their Motivation –Characteristics of Attack Taxonomy – Empirical Lists – Matrices – Process Based Taxonomy – Wormhole – Byzantine – Black hole – DoS – Flooding – Resource Consumption – Location Disclosure

UNIT III TRUST AND REPUTATION SYSTEMS 9

Notion of Trust – security and Trust – Collaborative Filtering and Sanctioning – Trust Classes – Trust and Reputation Network Architectures – Reputation Computation Engines – Commercial and Live Reputation System – Trust management in P2P systems – Trust management in Ad hoc networks – Issues with Reputation Systems

UNIT IV COOPERATION ENFORCEMENT AND DETECTION MECHANISMS 9

Cooperation Enforcement Techniques: Nuglets – Sprite – Detection Mechanisms: Mitigating Routing Misbehavior – OCEAN – CORE – CONFIDENT

UNIT V SIMULATION STUDY 9

Network Simulator 2: Nodes – Configuring a Network – Mobility Models – Routing Protocols – Traffic Generator – Data extraction from Trace file – Visualization.

L:45; TOTAL:45 PERIODS

REFERENCES

1. Kevin Daimi, ¯Computer and Network Security Essentials‖, Springer International Publishing, 2018.
2. Pete Herzog, Marta Barcelo Jordan, Bob Monroe, ¯Network Security Essentials: Study Guide and Workbook‖, ISECOM, Second Edition, 2017
3. William Stallings, ¯Cryptography and Network Security Principles and Practices‖, Seventh Edition, Paperback, Prentice Hall, 2017.
4. Mauro Conti, Matthias Schunter, Trust and Trustworthy Computing, Lecture Notes in Computer Science, springer, 2015.
5. A.Josang, R.Ismail, and C.Boyd, ¯A Survey of Trust and Reputation Systems for Online Service Provision‖, Decision Support System, vol. 43, no. 2. pp. 618-644, March 2007.
6. H.Li, and M.Singhal, ¯Trust management in Distributed Systems‖, IEEE Computers, vol 40, pp. 45-53, February 2007.

19CT14E WIRELESS BODY AREA NETWORKS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the wireless sensor Networks Characteristics. (K2).
CO2: Understand the fundamentals of Body Area Networks. (K2).
CO3: Recognize the salient features of Wireless Body Area Networks. (K2).
CO4: Exemplify the WBAN Technologies. (K3).
CO5: Apply wireless sensor Network concept to implement the Healthcare Applications. (K3).

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS 9

Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Enabling Technologies for Wireless Sensor Networks – Operating Systems – Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

UNIT II DESIGN REQUIREMENT OF BAN AND WBAN 9

BAN Positioning- Architecture of BAN- Requirements of BAN- BAN Standardization The Media Access Control (MAC) - Frame Processing- Physical Layer (PHY) - Application of BAN Design Requirement of WBAN - WBAN Reference architecture - Software frameworks for programming WBAN- Hardware Development and systems for WBAN.

UNIT III NETWORKING OF SENSORS 9

Physical (PHY) layer technologies – Narrow band and UWB – Medium access control (MAC) technologies for WBAN – Unified MAC design independent of underlying PHY technologies; Standardization with IEEE802.15.6, IEEE 11073, and ETSI eHealth Project.

UNIT IV WBAN TECHNOLOGIES 9

WBAN Network topologies and configurations-Basics Medium Access Control protocols – Scheduled protocols-Random Access protocols-Hybrid MAC protocols.

UNIT V WIRELESS SENSOR NETWORKS FOR HEALTHCARE APPLICATIONS 9

General approach to WSN in Healthcare – Key Principles, Methodology – Architecting WSN solutions for Healthcare – Hardware, Firmware and Software Choices.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Kazem sohraby, Daniel Minoli,Taieb znati ,¯Wireless Sensor Networks: Technology, Protocols, and Applications‖, 1st Edition, Willey interscience, 2010.
2. Mehmet R. Yuce, Jamil Khan , ¯Wireless Body Area Networks: Technology, Implementation, and Applications‖,CRC press,2012.
3. Kaveh Pahlavan, Prasanth Krishnamoorthy, ¯Principles of Wireless Networks‖, First Edition, Pearson Education, 2013.
4. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, ¯Principles of Mobile Computing‖, Springer, 2003.
5. Terrance J. Dishongh and Michael Mcgrath, ¯Wireless Sensor Networks for Healthcare Applications‖, Artech House; First edition, October 30, 2009, ISBN -978-1596933057.

6. Huan-Bang Li, Kamya Yekeh Yazdandoost, and Bin Zhen, ―Wireless Body Area Network‖, River Publishers' Series in Information Science and Technology, Oct 29, 2010, ISBN : 978-87-92329-46-2.
7. R. Maheswar, G. R. Kanagachidambaresan, R. Jayaparvathy, Sabu M. Thampi,‖ Body Area Network Challenges and Solutions‖,springer 2019.
8. Bhaskar Krishnamachari, ―Networking Wireless Sensors‖, Cambridge Press, 2009.
9. Diamond A. K. Asare ―Body Area Network Standardization, Analysis and Application‖, University of Eastern Finland and Savonia University of Applied Sciences
10. Mohammed Ilyas And Imad Mahgaob, ―Handbook Of Sensor Networks: Compact Wireless and Wired Sensing Systems‖, CRC Press, 2004.
11. Wayne Tomasi,―Introduction to Data Communication and Networking‖, Pearson Education, 2007.

19CT15E CELLULAR AUTOMATA PARADIGM L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basic concept of Cellular automata. (K2)
CO2: Analyze how simple rules can lead to phenomenally complex and behaviors.(K3)
CO3: Acquire insights into relationship among formal languages, formal grammars and automata.(K3)
CO4: Examine the behavior of stochastic and Monte-carlo dynamics.(K3)
CO5: Expose to concept of quantum cellular automata & reaction diffusion systems. (K2)

UNIT I INTRODUCTION 9

Introduction-Short History-CA &Computation--Powerful Computation Engines-Discrete Dynamical System Simulators-Mathematical Preliminaries -Set Theory-Information Theory - Graph Theory-Groups, Rings and Fields-Abstract Automata-One Dimensional and two Dimensional CA.

UNIT II PHENOMENOLOGICAL STUDIES OF CELLULAR AUTOMATA 9

One-dimensional Systems -Space-Time Patterns-Behavioral Classes - Difference Patterns Blocking Transformations - General Properties of Elementary CA -Local Properties -- Global Properties-A Small Sampling of Rules – Rule 22 and 30-Critical-Like Behavior-Particle-Like Behavior for Space Time Pattern-Reversible Rules-Parameterizing the Space of CA Rules.

UNIT III CELLULAR AUTOMATA AND LANGUAGE THEORY 9

Regular Languages- Finite Automata- Context Free Languages- Push Down Automata-CA Rule - Finite state Transition Graph- Regular Language Complexity --Entropy-Power Spectra of Regular Languages- Numerical Estimates- Li's Algorithm for Generating Power Spectra – Reversible Computation- Universal Logic Gates, The Billiard Ball Model.

UNIT IV PROBABILISTIC CELLULAR AUTOMATA 9

Critical Phenomena- A Heuristic Discussion- Boltzmann Distribution- Free Energy -- Stochastic Dynamics- Monte Carlo Dynamics- Critical Exponents- Ising Model, General-One Dimensional Ising Model-Mean Field Approximation-Spin Glasses.

UNIT V QUANTUM CELLULAR AUTOMATA 9

Quantum Cellular Automata-Introduction- General Properties- A Conservation Law -k=2 systems k=3 systems- Reaction Diffusion Systems- The Belousov- Zhabotinskii Reaction- Greenberg-Hastings Model Hodgepodge Rule- Applications to Immunology- Random Boolean Networks.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Andrew Adamatzky ―Game of Life Cellular Automata‖- Springer; 1st Edition, 2010[Unit-2]
2. Andrew Ilachinski **"**Cellular Automata A Discrete Universe‖ - World scientific publishing company private limited, 2002. [Unit 1-5]
3. Michael Batty, ―Cities and Complexity: Understanding Cities with Cellular Automata, Agent-Based Models, and Fractals**",** The MIT Press, 2007
4. Bastien Chopard, Michel Droz, ―Cellular Automata Modeling of Physical Systems‖, Cambridge University Press, 2009.

19CT16E OPTIMIZATION TECHNIQUES L T P C QP
3 0 0 3 A

COURSE OUTCOMES:

Upon the completion of this course, the student will be able to,

CO1: Formulate optimization problems and apply the concept of optimality criteria for various types of optimization problems. (K2)

CO2: derive the computational complexity of search heuristics using biologically inspired computing. (K3)

CO3: understand the principles, quantum information and limitation of quantum operations. (K2)

UNIT I INTRODUCTION TO OPTIMIZATION PROBLEMS 9

The Optimization Problem: General Structure of Optimization Algorithms – Constraints – Feasible Region – Branches of Mathematical Modeling. Basic Principles :Gradient Information – The Taylor Series – Types of Extrema – Necessary and Sufficient Conditions for Local Minima and Maxima – Classification of Stationary Points – Convex and Concave Functions – Optimization of Convex Functions.

UNIT II ANT COLONY OPTIMIZATION 9

Ant Behavior – Towards Artificial Ants – Ant Colony Optimization – Combinatorial Optimization Meta – heuristic -Local Search – Tabu Search – Global Search. Ant Colony Optimization algorithms for NP --hard problems: Routing problems – Assignment problem – Scheduling problem– Subset problem –Machine Learning Problem –ACO for Traveling Salesman problem – Extensions of Ant Systems – ACO theoretical Considerations.

UNIT III PARTICLE SWARM OPTIMIZATION 9

Swarm Intelligence – PSO Algorithm – Accelerated PSO – Convergence Analysis: Dynamic System – Markov Chain Approach – Binary PSO

UNIT IV GENETIC OPTIMIZATION 9

Introduction – Genetic Algorithms – Role of Genetic Operators – Choice of Parameters – GA Variants – Schema Theorem – Island Based Genetic Algorithms. Convergence Analysis

UNIT V EVOLUTIONARY MODEL 9

Quantum Computing: Bits – Computation – Algorithms – Experimental Quantum information processing – Quantum Information. DNA Computing: Molecular Structure – manipulation of DNA- DNA Annealing Kinetics – Genes – Recombination – Expression – Viruses – Applications.

L:45; TOTAL: 45 PERIODS

REFERENCES

1. Andreas Antoniou,Wu-Sheng Lu, ―Practical Optimization Algorithms and Engineering Applications, Springer Science Business Media, LLC,2007
2. Helio Barbosa, ―Ant Colony Optimization Techniques and Applications‖, IntechOpen, 2013.
3. Xin – She Yang, ―Nature Inspired Optimization Algorithms‖, 1st Edition, Elsevier Insights, 2014.
4. Michael A.Nielsen, Issac L. Chuang, ―Quantum Computation and Quantum Information‖, 10th edition, Cambridge University Press, 2012.
5. Zoya Ignatova, Israel Martínez-Pérez, ― DNA Computing Models‖, Springer Science Business Media, LLC,2008.

6. Mongi A. Abidi, Andrei V. Gribok, Joonki Paik, ―Optimization Techniques in Computer Vision: Ill-Posed Problems and Regularization (Advances in Computer Vision and Pattern Recognition)‖, 1st edition, 2016
7. Edwin K. P.Chong Stanislaw H. Zak, ―An Introduction to Optimization:,2nd Edition, A Wiley-Interscience Publication,2001
8. Dimitris Bertsimas; Robert Weismantel, ―Optimization over integers‖, Dynamic Ideas, 2005
9. Der-San Chen; Robert G. Batson; Yu Dang, ―Applied Integer Programming: Modeling and Solution.‖ , John Wiley and Sons, 2010.

19CT17E DEEP LEARNING L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basis of Machine Learning (K2)
CO2: Explore various Deep Learning Networks (K2)
CO3: Implement Convolutional and Recurrent Neural Algorithms (K3)
CO4: Analyze optimization and generalization in deep learning (K4)
CO5: Explore the deep learning applications (K3)

UNIT I MACHINE LEARNING BASICS 9

Introduction to machine learning Linear models (SVMs and Perceptrons, logistic regression). Learning Algorithms – Capacity, Overfitting and underfitting – Hyperparameters and Validation Sets – Estimators, Bias and Variance – Maximum Likelihood Estimation – Bayesian Statistics – Supervised Learning Algorithms – Unsupervised Learning Algorithms – Stochastic Gradient Descent – Building a Machine Learning Algorithm – Challenges Motivating deep learning.

UNIT II DEEP NETWORKS 9

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and other Differentiation Algorithms – Regularization: Dataset Augumentation – Noise Robustness Early Stopping, Bagging and Dropout--batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks- Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning

UNIT III CONVOLUTION & RECURRENT NETWORKS 9

Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms. Recurrent Neural Networks: Bidirectional RNNs – Deep Recurrent Networks – Recursive Neural Networks.

UNIT IV OPTIMIZATION AND GENERALIZATION 9

Optimization in deep learning- Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning Computational & Artificial Neuroscience

UNIT V CASE STUDY AND APPLICATIONS 9

Imagenet- Object Detection – Object Tracking - Audio WaveNet Natural Language Processing Word2Vec - Joint Detection - Face Recognition - Scene Understanding --Gathering Image Captions.

L:45; TOTAL: 45 PERIODS

REFERENCES

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation,2016.
2. Dr.Adrian Rosebrock, ¯Deep Learning for Computer Vision with Python: Starter Bundle‖, PyImage Search, 1st edition, 2017.
3. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

19CT18E ADVANCED DATABASE TECHNOLOGY **L T P C QP**
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: understand concepts of distributed databases. (K2)
CO2: develop queries for ODMG model using SQL and oracle. (K3)
CO3: analyze the various intelligent databases. (K4)
CO4: acquire knowledge about emerging database models. (K2)
CO5: develop queries for deductive databases. (K3)

UNIT I DISTRIBUTED DATABASES **9**

Introduction – Functionality of Distributed DBMS (DDBMS) – Architecture – Distributed data storage –query processing –Transaction Management – Concurrency control – Replication Servers – Case study on distributed database design.

UNIT II OBJECT ORIENTED DATABASES **9**

Concepts of Object Oriented Databases – Need for complex Datatype – Collection Types and Structured Types – ODMG Model – Object Definition Language - Object Query Language – Conceptual Design Object Relational features in SQL, Oracle.

UNIT III INTELLIGENT DATABASES **9**

Active Databases--Concepts and Triggers –Syntax and Semantics – Temporal Databases – Overview – Spatial Databases – Spatial Representation – Data types – Relationships.

UNIT IV EMERGING DATABASES **9**

Multimedia Databases – Types – Structure – Multimedia database design – Web databases Case studies on web databases – Mobile Databases: Location and Handoff Management – Effect of Mobility on Data Management – Location Dependent Data Distribution – Mobile Transaction Models

UNIT V DEDUCTIVE DATABASES **9**

Deductive Databases: Logic of Query Languages – Datalog Recursive Rules-Syntax and Semantics of Data log Languages- Implementation of Rules and Recursion- Recursive Queries in SQL

L : 45; TOTAL : 45 PERIODS

REFERENCES

1. Dr.Sanjeev Sharma, Dr.Jitendra Agrawal, Dr.Shika Agrawal, ¯Advanced Database Management System‖, Dreamtech press, New Delhi, 2017.
2. R. Elmasri, S.B. Navathe, ¯Fundamentals of Database Systems‖, Global Edition, Pearson Education, 2016.
3. Henry F Korth, Abraham Silberschatz and S. Sudharshan, ¯Database System Concepts‖, 6th Edition, McGraw Hill, 2013.
4. ¯International Workshop on Intelligent Techniques in Distributed Systems (ITDS-2014) Distributed Database Design: A Case Study‖, www.sciencedirect.com
5. http://www.ijcstjournal.org/volume-4/issue-5/IJCST-V4I5P28.pdf,‖ Spatial Data System: Architecture and Applications

19CT19E BIG DATA ANALYTICS AND MANAGEMENT L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: interpret the basic concepts of big data. (K2)
CO 2: demonstrate the NoSQL big data management. (K3)
CO 3: perform map-reduce analytics using Hadoop. (K3)
CO4: understand the importance of visualization and analytics (K3)
CO5: explore the hadoop ecosystem tools for big data analytics. (K3)

UNIT I INTRODUCTION 9

Basics of big data – Issues – Case for Big data – Big data options Team challenge – Big data sources – Acquisition – Nuts and Bolts of Big data. Features of Big Data Evolution of Big data– Best Practices for Big data Analytics Big data characteristics.

UNIT II NEXT GENERATION DATA MODEL 9

Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – Graph databases-- schemaless databases – distribution models– master-slave replication – peer-peer replication – sharing and replication – Case Study: MongoDB.

UNIT III HADOOP AND MAP REDUCE 9

Data format – analyzing data with Hadoop – Hadoop streaming – Hadoop distributed file system (HDFS) – Java interface – data flow– Hadoop I/O – data integrity. Map Reduce: workflows – Anatomy of Map Reduce job – Handling Failures – Job scheduling – Task execution – Input formats – Output formats.

UNIT IV DATA ANALYTICS AND VISUALIZATION 9

Predictive Analytics- Simple linear regression- Multiple linear regression- classification – clustering - association. Visualizations--Visual data analysis techniques- interaction techniques Systems and applications. Case Studies: social media data analysis.

UNIT V ECO SYSTEM TOOLS 9

Pig: Pig Latin – User Defined Functions – Data processing Operators. Hive: Hive Shell – Services and Meta Store, HiveQL: HiveQL data manipulation – HiveQL queries. **Integrating R and Hadoop**: R Streaming, Rhipe and RHadoop.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", 1st Edition, Wiley, 2018.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", 1st Edition, Addison-Wesley Professional, 2015.
3. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'Reilley Media Inc, 2012.
4. Chuck Lam, ¯Hadoop in Action‖, 1st Edition, Manning Publications Co, 2011.
5. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", 1st Edition, O'Reilley Media Inc, 2012.
6. Krishtina Chodorow and Michael Dirolf, ¯MongoDB: The Definitive Guide‖, 1st Edition, O'Reilley Media, 2013.

7. Simon Walkowiak, ―Big Data Analytics with R: Leverage R Programming to uncover hidden patterns in your Big Data‖, 1st Edition, 2016.
8. EMC Education services, ―Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data‖, Wiley; 1 st edition, 2015.

19CT20E DATA SCIENCE L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand fundamentals, and statistical concepts for data science (K2)
CO2: Analyze the key concepts in predictive data analysis (K3)
CO3: Apply data visualization concepts for data science (K3)
CO4: Understand exploratory data analysis concepts (K2)
CO5: Analyze the classification & clustering concepts (K3

UNIT I DATA SCIENCE FUNDAMENTALS 12

Linear Algebra for data science,Probability, Descriptive statistics: histogram charts – scatter plots measures of central tendency, measuring asymmetry: skewness – Measuring variability: Variance. Standard deviation, Covariance. Correlation coefficient Chi-Square test - t-Test --Distributions: Normal distribution, standard normal distribution, Central Limit Theorem, Hypothesis Testing

UNIT II PREDICTIVE DATA ANALYSIS 6

Predictive models : Regression: Linear Regression, Multiple linear regression, logistic regression, time series forecasting, association rule mining, text mining : Sentimental Analysis

UNIT III DATA VISUALISATION 9

Introduction – Data visualization methods: Mapping - Time series Connections and correlations – Scatter plot maps Trees, Hierarchies and Recursion – Data visualization using Tableau

UNIT IV EXPLORATORY DATA ANALYSIS 9

Dimensionality reduction: Linear Discriminant Analysis (LDA), Quadratic Discriminant Analysis (QDA), Principal Components Analysis (PCA), Probabilistic Latent Semantic Analysis (PLSA), Expectation-Maximization (EM) algorithm, E-step and M-step, Hidden variables, Hill climbing, Local maximum, Latent Dirichlet Allocation (LDA)

UNIT V CLASSIFIERS AND CLUSTERING 9

Ensemble of classifiers: Classification – Prediction – Voting, Bagging, Boosting, Stacking, Cascading, Random forest, Semi supervised Learning. Clustering: Similarity and Distance Measures, Hierarchical Algorithms, Clustering Large Data sets, clustering with Categorical Attributes-Outlier analysis

L: 45 ; TOTAL: 45 PERIODS

REFERENCES

1. Vijay Kotu, Bala Deshpande, Data Science: Concepts and Practice,Second Edition, Morgan Kaufmann Publishers,2018
2. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly, 2014
3. Lillian Pierson, Data Science For Dummies, John Wiley & Sons, 2017
4. Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, O'Reilly Media Inc, 2017.

19CT21E ADVANCED WIRELESS SENSOR AND MOBILE NETWORKS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: appreciate the concept of wireless sensor networks, their architecture and applications. (K2)

CO 2: analyze various protocol design and evaluate the performance of wireless sensor networks. (K3)
CO 3: appreciate the concept of mobile networks, their architecture and applications (K2)
CO 4: evaluate the performance and issues of mobile networks (K4)
CO5: understand various security issues in wireless sensor and mobile networks. (K2)

UNIT I MAC & ROUTING IN WIRELESS SENSOR NETWORKS 9

Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – Contention-Based protocols – Schedule-Based protocols – IEEE 802.15.4 Zigbee – Topology Control – Routing

UNIT II TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS 9

Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control in network processing – Operating systems for wireless sensor networks – Examples

UNIT III MAC & ROUTING IN MOBILE NETWORKS 9

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

UNIT IV TRANSPORT & QOS IN MOBILE NETWORKS 9

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

UNIT V SECURITY IN MOBILE AND WIRELESS SENSOR NETWORKS 9

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

L:45; TOTAL:45 PERIODS

REFERENCES

1. Holger Karl, Andreas Willing, ―Protocols and Architectures for Wireless Sensor Networks, John Wiley & Sons, Inc., 2011.
2. Feng Zhao & Leonidas J. Guibas, ―Wireless Sensor Networks- An Information Processing Approach‖, Elsevier, 2004.
3. Ibrahiem M.M.El Emary, S.RamaKrishnan, - Wireless Sensor Networks :From Theory to Applications, 1st Edition,Taylor and Francis Group Publications, 2016.
4. C. Siva Ram Murthy and B.S. Manoj, ―Ad hoc Wireless Networks – Architectures and Protocols‘, Pearson Education, 2004
5. Kazem Sohraby, Daniel Minoli, & Taieb Znati, ―Wireless Sensor Networks Technology, Protocols, and Applications‖, John Wiley, 2007.
6. Anna Hac, ―Wireless Sensor Network Designs‖, John Wiley,2003.
7. The Contiki Operating System. http://www.sics.se/contiki.
8. Mohammad Ilyas, ―The handbook of Adhoc Wireless Networks‖, CRC Press, 2002

19CT22E COMPUTATIONAL OPTIMIZATION LABORATORY L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: learn efficient computational procedures to solve optimization problems
CO2: analyse performance measures for various optimization problems
CO3: model engineering minima/maxima problems as optimization problems

LIST OF EXPERIMENTS

1. Develop a optimization code for Single-objective problem
2. Develop a optimization code for Multi-objective problem
3. Develop a solution for the traveling sales man problem using Ant Colony Optimization method.
4. Develop the PSO solution to economic dispatch problem
5. Create Markov Chain from Stochastic Transition Matrix, Observed State Transitions and Random Transition Matrix
6. Develop a genetic algorithm for the following problem.

   Given a set of 5 genes, each gene can hold one of the binary values 0 and 1.The fitness value is calculated as the number of 1s present in the genome. If there are five 1s, then it is having maximum fitness. If there are no 1s, then it has the minimum fitness. This genetic algorithm tries to maximize the fitness function to provide a population consisting of the fittest individual, i.e. individuals with five 1s. In this example, after crossover and mutation, the least fit individual is replaced from the new fittest offspring.
7. Develop the solution for solving n-queen problem using evolutionary model.
8. Develop the solution for scheduling problem using Multi-Objective Optimization.

P: 45; TOTAL:45 PERIODS

Software Required : MATLAB R2017b.

19CT23E **DEEP LEARNING LABORATORY** **L T P C**
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Implement linear and neural network models(K3)
CO2: Develop supervised CNN & RNN models(K4)
CO3: Build a classifier with pre-trained models(K3)

LIST OF EXPERIMENTS

1. Build a classifier using k-Nearest Neighbour (kNN) algorithm for animals dataset to classify whether it is a dog or a cat.
2. Build a linear model using built-in MNIST dataset to recognize the handwritten digits then apply gradient descent optimization for the same and compare the results.
3. Create a Neural Network model to train and test the birds dataset to classify the bird species.
4. Construct a **CNN model by** considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set, then build an LENET **algorithm** and test the same.
5. Implement **RNN model** for smile detection. Print both correct and wrong predictions.
6. Build an IMAGENET classifier to classify the activity of a person from the viper dataset.

SOFTWARE REQUIREMENTS:

- **ANACONDA NAVIGATOR**
- **PYHTON 3.X**

P: 45; TOTAL: 45 PERIODS

19CT24E ADVANCED DATABASE LABORATORY L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: understand and query advanced databases. (K3)

CO2: apply optimization techniques for relational algebraic expressions. (K3)

1. Consider that the following Project schema is horizontally fragmented according to City, the cities being New Delhi, Kolkata and Hyderabad.

PROJECT

PId	City	Department	Status

a. Write a query to retrieve details of all projects whose department is ¯ICE‖.

b. Write a query to retrieve details of all projects orderby city.

c. Write a query to retrieve details of all projects whose status is ¯Ongoing‖.

2. Consider a distributed database for a bookstore with 4 sites called S1, S2, S3 and S4. Consider the following relations:

Books (ISBN, primary Author, topic, total Stock, price)
Book Store (store No, city, state, zip, inventory Value)
Stock (store No, ISBN, Qty)
Total Stock is the total number of books in stock and inventory Value is the total Inventory value for the store in dollars.
Consider that Books are fragmented by price amounts into:
F1: Books: price up to $20
F2: Books: price from $20.01 to $50
F3: Books: price from $50.01 to $100
F4: Books: price $100.01 and above
Similarly, Book Stores are divided by ZIP codes into:
S1: Bookstore: Zip up to 25000
S2: Bookstore: Zip 25001 to 50000
S3: Bookstore: Zip 50001 to 75000
S4: Bookstore: Zip 75001 to 99999
Task: Write SQL query for the following
1. Insert and Display details in each table.
2. Find the total number of books in stock where price is between $15 and $55.
3. Update the book price of book No=1234 from $45 to $55 at site S3.
4. Find total number of book at site S2.

3. A University wants to track persons associated with them. A person can be an Employee or Student. Employees are Faculty, Technicians and Project associates. Students are Full time students, Part time students and Teaching Assistants.

a) Design an Enhanced Entity Relationship (EER) Model for university database. Write OQL for the following

i. Insert details in each object.
ii. Display the Employee details.
iii. Display Student Details.

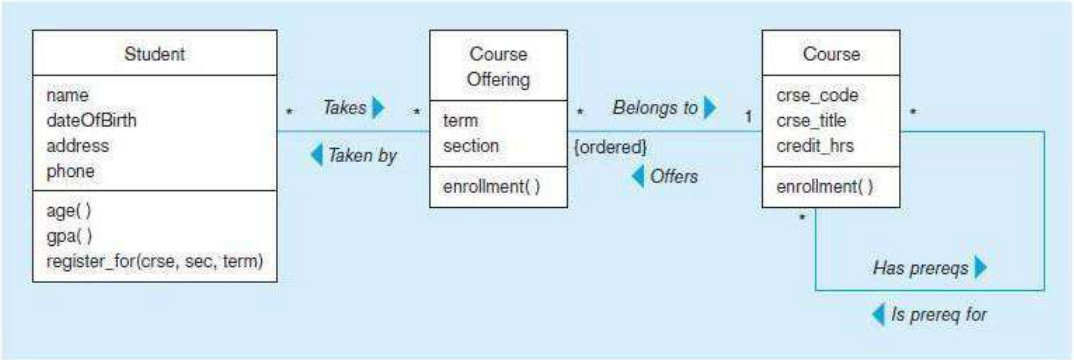
iv. Modify person details.
v. Delete person details.

b) Extend the design by incorporating the following information.

Students are registering for courses which are handled by instructor researchers (graduate students). Faculties are advisors to graduate students. Instructor researchers' class is a category with super class of faculty and graduate students. Faculty are having sponsored research projects with a grant supporting instruction researchers. Grants are sanctioned by different agencies. Faculty belongs to different departments. Department is chaired by a faculty. Implement for the Insertion and Display of details in each class.

4. Consider the following University Schema diagram, Write the ODL Quries to find

a) OQL query for finding the names and phone numbers of those students who took only one course in Fall 1998:
b) OQL query for finding the codes and titles of all courses that were offered in both the winter 1998 and fall 1998 terms:
c) OQL query for finding the total enrollment for all sections of the MBA 664 course being offered in winter 1999:
d) OQL query for finding students residing in Cincinnati who took MBA 665 in fall 1998



5. Consider the Library Book Management database schema with Student database schema. In these databases, if any student borrows a book from library then the count of that specified book should be decremented. Implement such procedure, in which if the system inserts the data into the book_issue database a trigger should automatically invoke and decrements the copies attribute by 1 so that a proper track of book can be maintained.

6. Create triggers and assertions for Bank database handling deposits and loan and admission database handling seat allocation and vacancy position. Design the above relational database schema and implement the following triggers and assertions.

a. When a deposit is made by a customer, create a trigger for updating customers account and bank account

b. When a loan is issued to the customer, create a trigger for updating customer's loan account and bank account.
c. Create assertion for bank database so that the total loan amount does not exceed the total balance in the bank.
d. When an admission is made, create a trigger for updating the seat allocation details and vacancy position.

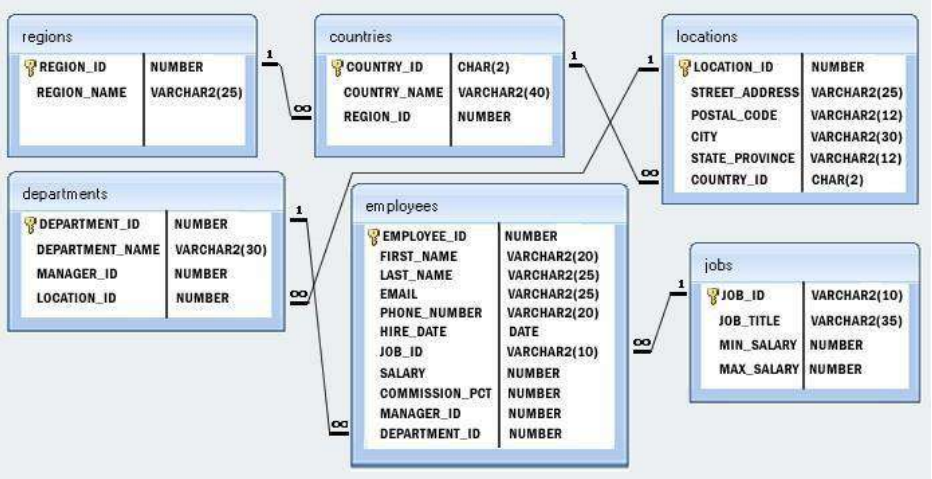
7. Construct a knowledge (deductive) database for kinship domain (family relations) with facts. Extract the following relations using rules.

Parent, Sibling, Brother, Sister, Child, Daughter, Son, Spouse, Wife, husband, Grandparent, Grandchild, Cousin, Aunt and Uncle.

8. Implement Query Optimizer with Relational Algebraic expression construction and execution plan generation for choosing an efficient execution strategy for processing the given query. Also design employee database and test the algorithm with following sample queries.

Select empid, empname from employee where experience > 5
Find all managers working at London Branch

9. Construct tables from the following ER Diagram.



Execute the following queries using Sqlite mobile database.

a. Write a query to find the addresses (location_id, street_address, city, state_province, country_name) of all the departments.

b. Write a query to find the names (first_name, last name), department ID and the name of all the employees.

c. Write a query to find the employee id, name (last_name) along with their manager_id, manager name (last_name)

d. Write a query to find the employee ID, job title number of days between ending date and starting date for all jobs in department 90 from job history.

e. Write a query to display job title, employee name, and the difference between the salary of the employee and minimum salary for the job.

f. Write a query to display the job history that was done by any employee who is currently drawing more than 10000 of salary.

Software Requirements

- MySQL
- Matisse Enterprise Manager
- Prolog 7.1.11
- SQLite3

P: 45; TOTAL: 45 PERIODS

19CT25E **BIG DATA ANALYTICS LABORATORY** **L T P C**
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: work with various data processing tools for big data. (K3)
CO 2: develop a map reduce program for parallel tasks. (K3)
CO 3: implement data analytics techniques (K3)
CO 4: analyze and process social media data. (K3)

LIST OF EXPERIMENTS

1. Installation of Apache Hadoop using Hortonworks Data Platform / Clustered
2. Big Data processing with Hive and HCatolog
3. Query Processing using Hive and Beeswax
4. Develop a map reduce program for word count
5. Writing data processing scripts using Pig
6. Classification analysis using R / python
7. Clustering analysis using R / python
8. Data Visualization using R / python
9. HashTag (social media) analysis using R / python
10. Integration R with Hadoop for data processing

P: 45; TOTAL: 45 PERIODS

Software Required: Hadoop 24.0, Eclipse IDE, Java, R Studio

19CT26E **DATA SCIENCE LABORATORY** **L T P C**
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Work with data science fundamentals using various statistical models.(K3).
CO2: Implement data models and visualization using tools(K3)

List of EXPERIMENTS

1. Develop a data model using statistical method for appropriate data set and draw modeling graph
2. Implement data preprocessing using data preparation techniques with appropriate data set with incomplete data
3. Implement simple linear regression algorithm with appropriate data set.
4. Implement multivariate linear regression model for a real world application.
5. Perform LDA/PCA analysis for dimensionality reduction.
6. Implement association rule mining/sentimental analysis using python
7. Implement outlier analysis concepts using python
8. Implementation of data visualization using Tableau
9. Mini Project: Develop a real world application with all the above data analytics concepts using standard data set.

P: 45; TOTAL: 45 PERIODS

Software Requirements:

Open source Tool: R tool

19CT27E ADVANCED WIRELESS SENSOR AND MOBILE NETWORKS LABORATORY **L T P C 0 0 3 1.5**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: ability to design routing protocols for wireless sensor and mobile networks.(K4)

CO2: acquire the ability to design wireless sensor and mobile network for meeting out real time Requirements.(K5)

CO3: ability to design security protocols for wireless sensor and mobile networks.(K5)

CO4: develop mini projects on applications of sensor networks in health /agriculture / environment / social sectors.(K6)

LIST OF EXPERIMENTS

1. Configuration of Wireless sensor networks and Mobile networks using Switches, Router, Wifi Access Point and PDA (Hardware)
2. Use appropriate simulation tools for the simulation of TCP/ UDP .
3. Implementation of energy efficient protocol in WSN networks.
4. Setup wireless sensor network for existing protocols using simulators Mannasim, Contiki.
5. Develop a Tiny OS program where a PC wirelessly controls a mote by sending it packets that command it to do specific functions. (Hardware**)**
6. Use appropriate simulation tools for the simulation of AODV and TORA protocol.
7. Use appropriate simulation tools for the simulation of DSR/ DSDV.
8. Observe the variation in the network performance of wireless mobile network using simulators – Qualnet,OmNet++, OverSim.
9. Perform basic PDU capture, analysis and display filtering for a wireless sensor network using Wireshark.
10. Examine how networking packets are transferred and exchanged in a mobile network. Student will develop an understanding of the protocols in packets transfer using wireshark software.
11. Perform Simple experiments in mobile networks using the sniffer mode, the packet logger mode, and the Network Intrusion Detection mode of Snort**.**
12. Develop mini projects on applications of sensor networks in health / agriculture /environment / social sectors.

P: 45; TOTAL: 45 PERIODS

SUGGESTED SOFTWARE AND HARDWARE REQUIREMENTS

SOFTWARE

- NS3,Mannasim, Contiki, Qualnet,OmNet++, OverSim
- Tiny OS and MoteView
- Linux (Ubuntu 12.04)
- Wireshark,Snort

HARDWARE

- Router, Switches, Access Point, PDA, Raspberry Pi, Arduino Development Board, MTS420 Sensor Board, MDA300 Data Acquisition Board, MPR2400CA Wireless Module and MIB520 Base station.

19CT28E	VEHICULAR ADHOC NETWORKS	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Recognize the basic principles and challenges of VANET.(K2)
CO2: Realize the concepts of link layer protocols and wireless access technologies. (K2)
CO3: Analysis various routing protocols and connectivity techniques. (K3)
CO4: Understand emerging security issues and various encryption techniques in VANET.(K2)
CO5: Explore the various mobility models and simulation tools of VANET in wireless Environment.(K3)

UNIT I INTRODUCTION TO VANET 9

Introduction - System architecture- communication domains: Vehicle to Vehicle Communication, Vehicle to Infrastructure- Infrastructure to Infrastructure. Characteristics-Challenges and issues in VANET- Enabling Technologies- Applications in VANET: Safety-Related Vehicular Applications-Content Delivery in Zero-Infrastructure VANETs and Emerging Vehicular Applications.

UNIT II VANET LINK LAYER PROTOCOLS 9

MAC Approaches for VANETs-Single Channel MAC Protocol: Centralised and distributed MAC protocols - Distributed and location-based TDMA MAC (DTMAC)- Cluster-Based TDMA (CBT)- Multi Channel MAC Protocol: Centralised and distributed MAC protocols-Predictive TDMA MAC (PTMAC) - Improved Coordinated multi-channel MAC (IC-MAC Wireless Access Technologies WLAN/Wi-Fi- WiMAX- DSRC/WAVE- Cellular systems.

UNIT III ROUTING PROTOCOLS IN VANET 9

Information Dissemination: Introduction, Information Transport & Geographical Data Aggregation Local and summarizing the measurements -VANET Routing protocols-Topology based routing-proactive: CGSR and reactive protocols: DYMO-Hybrid: ZRP-Broadcast routing protocol-UMB-Connectivity in VANET-performance modeling-Node connectivity-Road side connectivity -connectivity in urban area and highways.

UNIT IV DATA SECURITY IN VANET 9

Introduction-security threats-Classification of attacks: Sybil Attack Impersonation Attack and Masquerade - Timing Attack - Global Positioning System (GPS) Spoofing, Hidden vehicle and Tunnel Attack - Illusion Attack- Denial of Service (DoS) Distributed Denial of Service (DDos) security requirements-VANET Security Threats and Challenges-VANET Security Schemes & Concepts: Symmetric Key Approaches-Public Key Approaches-Identity Based Cryptosystem for VANETs.

UNIT V MOBILITY MODELS AND SIMULATION TOOLS IN VANET 9

Mobility Models: Random Models, Flow Models, Traffic Models, Trace or survey-based Models and Behavioral Model - Overview of Simulators - General Features -- Simulator Architecture- Types of Simulators: Mobility Simulator, Network Simulator.

L:45; TOTAL:45 PERIODS

REFERENCES

1. Stephan Olariu, Michele C. Weigle, ¯Vehicular Networks From Theory to Practice‖, Chapman and Hall/CRC ,1st Edition, 2017.
2. Sonali P. Botkar , Sachin P. Gods, ¯VANET Challenges and Opportunities‖ , CRC Press, 1st Edition, 2021 .
3. Zahraa Yaseen Hasen, Saad Talib Hasson, ¯Simulation of Performance Evaluation for VANETs‖, Lap Lambert Academic Publishing, 1st Edition, 2019.

19CT29E	CLOUD MANAGEMENT AND SECURITY	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: understand the components of cloud computing and business agility (K2)

CO2: understand the management capabilities of different cloud services based on the economic benefits, economic constraints and business requirements (K2)

CO3: acquire insight into the security issues related to multi-tenancy cloud model (K2)

CO4: analyze the security of virtual systems and attacks on the VM (K3)

CO5: learn the legal ownership of data and compliance policy for the cloud provider and customer. (K2)

UNIT I CLOUD COMPUTING FUNDAMENTALS 9

Cloud Computing: definition- benefits and challenges. cloud deployment: private, public and hybrid cloud. Cloud service types: IaaS, PaaS, SaaS of cloud computing - role of virtualization in enabling the cloud. Business Agility: Benefits and challenges to cloud architecture - application availability – performance - security and disaster recovery next generation cloud applications.

UNIT II CLOUD SERVICES MANAGEMENT 9

Service Factors: Reliability, availability and security of services deployed from the cloud. Management: Performance and scalability of services tools and technologies used to manage cloud services deployment. Cloud Economics: Cloud computing infrastructures available for implementing cloud based services.

UNIT III MULTITENANCY ISSUES 9

Multi tenancy: Isolation of users/VMs from each other - file system security -- storage considerations--backup and recovery. Virtualization System Vulnerabilities: Management console vulnerabilities - management server vulnerabilities - administrative VM vulnerabilities - guest VM vulnerabilities - hypervisor vulnerabilities --hypervisor escape vulnerabilities configuration issues.

UNIT IV VIRTUALIZATION ATTACKS 9

Possible attacks on VM: deletion of VM - attack on the control of the VM---code or file injection into the virtualized file structure - VM migration attack - Hyper jacking---Guest hopping.

UNIT V LEGAL AND COMPLIANCE ISSUES 9

Responsibility - data ownership - right to penetration test - local law on data storage -- modern Security Standards - Standards for cloud services and virtualization compliance for the cloud provider compliance for the customer.

L:45; TOTAL:45 PERIODS

REFERENCES

1. Jared Carstensen, Bernard Golden and JP Morgenthal, ¯Cloud Computing: Assessing the Risks‖, IT Governance Publishing, 2012.
2. Jerry Archer, Dave Cullinane , Nils Puhlmann, Alan Boehme, Paul Kurtz, Jim Reavis, ¯Security Guidance for Critical Areas of Focus in Cloud Computing v4.0‖, 2017.
3. J.R. (Vic) Winkler, ¯Securing the Cloud‖, Syngress, 1st Edition, 2011.
4. David G. Rosado, Daniel Mellado, Eduardo Fernandez-Medina and Mario Piattini, ¯Security Engineering for Cloud Computing: Approaches and Tools‖, IGI Global, 1st Edition ,2013.

5. Kunjal Trivedi and Keith Pasley, ¯Cloud Computing Security‖, Cisco Press, 2012.
6. Tim Mather, Subra Kumaraswamy, Shahed Latif, ¯Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance‖, O'Reilly Media, 1st Edition, 2009.

19GD01E BUSINESS ANALYTICS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

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

CO1: Understand the importance of business analytics in an organization and understand relationships between business analytics process and organization decision making process. (K1)
CO2: Study the data analytics process and issues (K2)
CO3: Study the descriptive analytics and predictive analytics for business data (K2)
CO4: Use decision-making models for formulation of decision theory. (K2)

UNIT I BUSINESS ANALYTICS 9

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

UNIT II DATA ANALYTICS PROCESS AND ISSUES 9

Organization/sources of data, Importance of data quality, Dealing with missing or incomplete data Data Mining Process Introduction to Data Mining, Data Classification: Decision trees, Association Analysis: Market Basket Analysis – Data mining tools.

UNIT III DESCRIPTIVE ANALYTICS 9

Introduction, Visualizing and Exploring business data, Descriptive Statistics, Sampling and Estimation: Sampling Methods, Sampling Estimation, Introduction to Probability Distributions, Marketing/Planning Case Study on Descriptive Analytics model.

UNIT IV PREDICTIVE ANALYTICS 9

Introduction, Predictive Modeling: Logic-Driven Models, Data-Driven Models, Data mining for Types of Variation in Time Series Data, Regression Model, Smoothing, Fitting models to Data, Marketing/Planning Case Study on Predictive Analytics model.

UNIT V DECISION THEORY 9

Introduction, Decision Theory Model Elements for business process, Types of Decision Environments, Decision Theory Formulation, Decision-Making Under Certainty, Decision-Making Under Risk, Decision-Making under Uncertainty, Expected Value of Perfect Information, Sequential Decisions and Decision Trees, The Value of Imperfect Information: Bayes's Theorem, Decision Theory Practice Problems.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Marc J. Schniederjans, Dara G.Schniederjans, Christopher M. Starkey, Business analytics Principles, Concepts, and Applications, Pearson FT Press, 1st Edition, 2014.
2. James R Evans, ¯Business Analytics‖, Pearson Education, 2nd Edition, 2017

19GD02E INDUSTRIAL SAFETY L T P C QP
3 0 0 3 A

COURSE OUTCOMES

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

CO 1: list out important legislations related to health, Safety and Environment. (K1)
CO 2: list out requirements mentioned in factories act for the prevention of accidents. (K1)
CO 3: understand the health and welfare provisions given in factories act. (K2)
CO 4: understand the statutory requirements for an Industry on registration, license and its renewal. (K2)
CO 5: prepare onsite and offsite emergency plan. (K2)

UNIT I INTRODUCTION 9

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

UNIT II FIRE HAZARDS AND PREVENTION 9

Sources of ignition – fire triangle – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D, E – types of fire extinguishers – fire stoppers –hydrant pipes – hoses – monitors – fire watchers – lay out of stand pipes – fire station-fire alarms and sirens – maintenance of fire trucks – foam generators – escape from fire rescue operations – fire drills- notice-first aid for burns. Sprinkler-hydrants-stand pipes – special fire suppression systems like deluge and emulsifier, selection criteria of the above installations, reliability, maintenance, evaluation and standards – alarm and detection systems. Other suppression systems – CO2 system, foam system, dry chemical powder(DCP) system, halon system – need for halon replacement – smoke venting. Portable extinguishers –flammable liquids – tank farms – indices of inflammability-fire fighting systems.

UNIT III BIOLOGICAL AND ERGONOMICAL HAZARDS 9

Classification of Biohazardous agents – examples, bacterial agents, rickettsial and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases Biohazard control program, employee health program-laboratory safety program-animal care and handling-biological safety cabinets - building design. Work Related Musculoskeletal Disorders –carpal tunnel syndrome CTS- Tendon pain-disorders of the neck- back injuries..

UNIT IV CHEMICAL HAZARDS AND PREVENTION 9

Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. dose, TLV Methods of Evaluation, process or operation description, Field Survey, Sampling methodology, Industrial Hygiene calculations, Comparison with OSHAS Standard. Air Sampling instruments, Types, Measurement Procedures, Instruments Procedures, Gas and Vapour monitors, dust sample collection devices, personal sampling Methods of Control Engineering Control, Design maintenance considerations, design specifications General Control Methods training and education

UNIT V INDUSTRIAL ACTS 9

Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes,welfare, working hours, employment of young persons – special provisions – penalties and procedures-Tamilnadu Factories Rules 1950 under Safety and health chapters of Factories Act 1948, Occupational Safety and Health act of USA (The Williames Steiger Act of 1970) –

Health and safety work act (HASAWA 1974, UK) – OSHAS 18000 – ISO 14000 – American National Standards Institute (ANSI).

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Practical Industrial Safety, Risk Assessment and Shutdown Systems, 1st Edition, Dave Macdonald, Elsevier publications, 2003
2. Occupational Ergonomics: Practical Approach, Theresa Stack, Lee T.Ostrom, Cheryl A. Wilhelmsen, Wiley Publications, 2016
3. The Handbook of Safety Engineering: Principles and Applications, Frank R. Spellman and Nancy E. Whiting, Government Institutes, 2009
4. Benjamin O.Alli, ―Fundamental Principles of Occupational Health and Safety‖, ILO Geneva, 2nd Edition, 2008.
5. Danuta Koradecka, Handbook of Occupational Health and Safety, CRC, 2010.
6. National seminar on hazardous waste management organized by National Safety council, Ministry of environment and forests, Government of India, United States – Asia environmental partnership, Tamilnadu pollution control board and Indian chemical manufacturers association, April 2001.

19GD03E OPERATIONS RESEARCH L T P C QP
3 0 0 3 A

COURSE OUTCOMES

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

CO1: apply the dynamic programming to solve problems of discrete and continuous variables. (K2)
CO2: apply the concept of non-linear programming. (K2)
CO3: carry out sensitivity analysis.(K2)
CO4: model the real world problem and simulate it. (K2)

UNIT I INTRODUCTION 9

Optimization Techniques- Model Formulation- models, General L.R Formulation- Simplex Technique-Sensitivity Analysis

UNIT II LINEAR PROGRAMMING 9

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

UNIT III NONLINEAR PROGRAMMING PROBLEM 9

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

UNIT IV SCHEDULING AND INVENTORY CONTROL MODELS 9

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

UNIT V FINITE AND INFINITE QUEUING MODELS 9

Finite Queuing Models: Introduction, Finite Queuing Models, nfinite Queuing Models: Introduction, Queuing Theory, Operating Characteristics of a Queuing System, Constituents of a Queuing System, Service Facility, Queue Discipline

L: 45; TOTAL: 45 PERIODS

REFERENCES

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

19GD04E COST MANAGEMENT OF ENGINEERING PROJECTS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

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

CO 1: Students should able to apply the dynamic programming to solve problems of discreet and continuous variables. (K1)

CO2: Students should able to apply the concept of non-linear programming Students should able to carry out sensitivity analysis. (K2)

CO 3: Student should able to model the real world problem and simulate(K2)

UNIT 1 **9**

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

UNIT II **9**

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project

UNIT III **9**

Execution: conception to commissioning. Project execution as conglomeration of technical and non-technical activities.Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts.Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

UNIT IV **9**

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

UNIT V **9**

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

L: 45;TOTAL: 45 PERIODS

REFERENCES

1. Charles T. Horngren, Srikant M. Datar, ―Cost Accounting A Managerial Emphasis‖, Prentice Hall of India, 14thEdition,New Delhi. 2011
2. Charles T. Horngren and George Foster, ―Advanced Management Accounting‖. Pearson Education India; 16thEdition,2013.
3. Ashish K. Bhattacharya, ―Principles & Practices of Cost Accounting‖ A. H. Wheeler publisher,Delhi
4. N.D. Vohra,‖ Quantitative Techniques in Management‖, Tata McGraw Hill Book Co. Ltd.

19GD05E COMPOSITE MATERIALS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

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

CO 1: Identify, describe and evaluate the properties of fibre reinforcements polymermatrix materials and commercial composites. (K1)

CO 2: Develop competency in one or more common composite manufacturingtechniques, and be able to select the appropriate technique for manufactureof fibre-reinforced composite products.(K1)

CO 3: Analyse the elastic properties and simulate the mechanical performance of composite laminates; and understand and predict the failure behaviour of fibre-reinforced composite products. (K2)

CO 4: Apply knowledge of composite mechanical performance and manufacturing methods to a composites design project.(K2)

UNIT I INTRODUCTION 9

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

UNIT II REINFORCEMENTS 9

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

UNIT III MANUFACTURING OF METAL MATRIX COMPOSITES 9

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

UNIT IV MANUFACTURING OF POLYMER MATRIX COMPOSITES 9

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

UNIT V DESIGN AND ANALYSIS OF COMPOSITE MATERIALS 9

Strength: Laminar Failure Criteria-strength ratio- maximum stress criteria-maximum strain criteria-interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength;Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots;stress concentrations.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Mechanics of Composite Materials, Autor K Kaw,Taylor & Francis, 2nd Edition, 2006
2. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany,1993
3. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

19GD06E **WASTE TO ENERGY** **L T P C QP**
3 0 0 3 A

COURSE OUTCOMES

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

CO1: analyze the various aspects of Waste to Energy Management Systems (K2)

CO2: understand biochemical conversion of biomass for energy application, bioenergy systems and process integration.(K2)

CO3: understand the management of e-waste (K2)

UNIT I INTRODUCTION TO WASTE AND WASTE PROCESSING 9

Solid waste sources solid waste sources, types, composition, properties, global warming; Municipal solid waste: Physical, chemical and biological properties, waste collection and, transfer stations, waste minimization and recycling of municipal waste, segregation of waste, size reduction, managing waste, status of technologies for generation of energy from waste treatment and disposal aerobic composting, incineration, furnace type and design, medical waste / pharmaceutical waste treatment technologies, incineration, environmental impacts, measures to mitigate environmental effects due to incineration

UNIT II WASTE TRATMENT AND DISPOSAL 9

Land fill method of solid waste disposal land fill classification, types, methods and sitting consideration, Layout and preliminary design of landfills: Composition, characteristics, generation, movement and control of landfill leach ate and gases, environmental monitoring system for land fill gases.

UNIT III BIO-CHEMICAL CONVERSION 9

Energy generation from waste bio-chemical conversion: Sources of energy generation, anaerobic digestion of sewage and municipal waste, direct combustion of MSW-refuse derived solid fuel. Industrial waste, agro residues and anaerobic digestion.

UNIT IV THERMO-CHEMICAL CONVERSION 9

Biogas production, land fill gas generation and utilization, thermo-chemical conversion: Sources of energy generation, gasification of waste using gasifies briquetting, utilization and advantages of briquetting, environmental benefits of bio-chemical and thermo- chemical conversion.

UNIT V E- WASTE MANAGEMENT 9

E-waste: E-waste in the global context: Growth of electrical and electronics industry in India, environmental concerns and health hazards; Recycling e-waste: A thriving economy of the unorganized sector, global trade in hazardous waste, impact of hazardous e-waste in India; Management of e-waste: E-waste legislation, government regulations on e-waste management, international experience, need for stringent health safeguards and environmental protection laws of India.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Nicholas P Cheremisinoff, ¯Handbook of Solid Waste Management and Waste Minimization Technologies‖, An Imprint of Elsevier, New Delhi, 2003.
2. Paul Breeze, ¯Energy from Waste‖, An Imprint of Elsevier, New Delhi, 2018.
3. P Aarne Vesilind, William A Worrell and Debra R Reinhart, ¯Solid Waste Engineering‖, 2nd Edition 2002.
4. C Parker and T Roberts (Ed), ¯Energy from Waste‖, An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985.
5. KL Shah, ¯Basics of Solid and Hazardous Waste Management Technology‖, Prentice Hall, Reprint Edition, 2000.
6. M Datta, ¯Waste Disposal in Engineered Landfills‖, Narosa Publishing House, 1997.

M.E. – COMPUTER SCIENCE AND ENGINEERING

AUDIT COURSES

19AC01E ENGLISH FOR RESEARCH PAPER WRITING L T P C QP
2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: Enhance the knowledge of the research objectives and research process (K1)
CO 2: Develop the level of readability for formulating Rationale and improve writing skills (K3)
CO 3: Formulate suitable sentences and key words for the research paper (K2)
CO 4:Learn about how to write in each section (K3)
CO 5:Understand the skills needed to draft a perfect research paper (K2)
CO 6: Know the format of References and Research format (K1)

UNIT I **5**

Research – Writing Definitions – Framing Objectives – Research process Formulating Research problem – Technical terms and extended definition - Breaking up long sentences--structuring paragraphs and sentences - being concise and removing redundancy avoiding ambiguity and vagueness.

UNIT II **5**

Preparing manuscript – Skimming and Scanning – Review of literature- Identifying the problem - writing problem statements – writing hypothesis- Formulating Rationale – Research Design - linking phrases – Observation and Interview method – Framing Questionnaire – Case study

UNIT III **5**

Processing and data analysis – Identifying threats and challenges to Good Research - key skills needed to write a title - writing abstracts writing key words and introduction- Introductory phrases - Clarity in imperative sentences instruction writing – useful phrases to draft a perfect paper

UNIT IV **5**

Main divisions and Subdivisions -Paragraph writing - coherence - Highlighting the findings - Analyzing Data collection - hedging and criticizing sections - Topic sentence --Paraphrasing and framing key points – Suitable section wise headings

UNIT V **5**

Non-verbal interpretation – Interpretation of Data - Abbreviations – Symbols Tables – graphs – charts - deriving result – Phrases used to Compare and Contrast -result and discussion-- skills needed to write the conclusions – avoiding common mistakes.

UNIT VI **5**

Citation methods – Writing Foot note – End note - bibliography – citation rules Basic reference format - plagiarism – acknowledgement – IEEE Research format – Research review Research paper Publication

L: 30; TOTAL: 30 PERIODS

REFERENCES

1. Using English for Academic Purposes. A guide for students in higher education, comprises a large collection of links, including writing materials: http://www.uefap.com/.
2. British Association of Lecturers in English for Academic Purposes: http://www.baleap.org.uk/.
3. Goldbort R, Writing for Science, Yale University Press, 2006

4. Robert A. Day and Barbara Gastel, ¯How to Write and Publish a Scientific Paper‖, Cambridge University Press, 7th Edition, 2012
5. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman‘s book, 1998.
6. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht, 2016

19AC02E DISASTER MANAGEMENT L T P C QP
2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and manitarian response.(K2)

CO2: Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives. (K2)

CO3: Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations. (K2)

CO4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in (K2)

UNIT I INTRODUCTION 4

Disaster: Definition- Factors and Significance- Difference Between Hazard and Disaster- Natural And Manmade Disasters: Difference-Nature- Types And Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS 6

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

UNIT III DISASTER PRONE AREAS IN INDIA 6

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.

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT 6

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard-Evaluation Of Risk-Application Of Remote Sensing- Data from Meteorological and other Aaencies-Media Reports-Governmental and Community Preparedness**.**

UNIT V RISK ASSESSMENT AND DISASTER MITIGATION 8

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

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

L: 30; TOTAL: 30 PERIODS

REFERENCES

1. Singhal J.P. ―Disaster Management‖, Laxmi Publications, ISBN-10: 9380386427 ISBN-13: 978-9380386423, 2010.
2. Tushar Bhattacharya, ―Disaster Science and Management‖, McGraw Hill India Education Pvt. Ltd., ISBN-10: 1259007367, ISBN-13: 978-125900736, 2012.
3. Gupta Anil K, Sreeja S. Nair, "Environmental Knowledge for Disaster Risk Management", NIDM, New Delhi, 2011.

4. Kapur Anu, "Vulnerable India: A Geographical Study of Disasters", IIAS and Sage Publishers, New Delhi, 2010.
5. National Disaster Management Plan, 2018, https://ndma.gov.in/images/pdf/NDMP-2018-Revised-Draft-1-2018OCT16-A.pdf
6. National Disaster Management Authority, Government of India, 2018, https://ndma.gov.in/images/pdf/Draft-Guidelines-thunderstorm-final.pdf

19AC03E SANSKRIT FOR TECHNICAL KNOWLEDGE L T P C QP
2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Learn the Sanskrit sources of technical knowledge (K1)

CO2: Drawing their attention to a different dimension of Sanskrit literary tradition (K3)

CO3: Create awareness of the contemporary relevance of the Sanskrit sources of traditional wisdom (K3)

UNIT I INTRODUCTION 7

Scope and meaning of study of technical literature in Sanskrit. Different disciplines-interdisciplinary approach-dimensions-contemporary relevance- important works in this direction-scientific methodology in ancient India.

UNIT II AYURVEDA 7

Beginnings of Ayurveda in Atharvaveda-Ayurvedic literature-basic principles of Ayurveda-Pancabhutasiddhanta-Tridosasiddhanta-eight anga-s of Ayurveda- Rasacikitsa-contribution of Kerala to Ayurveda

UNIT III ASTRONOMY AND MATHEMATICS 8

Major texts in Vedic and classical period-Vedangajyotisa-Sulbasutra-s-Aryabhatiya- Aryabhata's contribution-Varahamihira-Brahmagupta-Lalla-etc. Suryasiddhanta- Kerala school Parahita and drk systems-Later astronomical works commentaries.

UNIT IV VASTUSASTRA AND ARTHASASTRA 8

Principles of Vastusastra-Basic texts-Vastuvidya and Ecology-Iconography and sculpture-Kerala tradition of Vastusastra. Arthasastra, a historical and sociaological perspective-structure and contents of the text-emphasis to aspects of agriculture and architecture.

L: 30; TOTAL: 30 PERIODS

REFERENCES

1. Ramakrishna Mission Institute ,"Cultural Heritage of India", (Vol. i and iii), Calcutta,2010
2. Dr. P. C. Muraleemadhavan and Dr. N. K.Sundareswaran," Sanskrit in Technological Age, (Ed.) ", New Bharatiya Book Corporation, Delhi, 2006
3. https://sanskritdocuments.org/articles/ScienceTechSanskritAncientIndiaMGPrasad.pdf
4. http://www.vedanta.gr/wp-content/uploads/2012/03/3_GlossaryOfCommonSanskrit Terms.pdf

19AC04E VALUE EDUCATION L T P C QP
2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the need of values and its classification in contemporary society (K2)
CO2: Become aware of role of education in building value as dynamic social reality. (K1)
CO3: Know the importance of value education towards personal, national and global development. (K1)

UNIT I **10**

Values and self-development –Social values and individual attitudes- Work ethics- Indian vision of humanism-Moral and non- moral valuation- Standards and principles-Value judgements. Importance of cultivation of values-Sense of duty- Devotion- Self-reliance- Confidence- Concentration --Truthfulness-Cleanliness- Honesty- Humanity- Power of faith- National Unity-Patriotism-Love for nature- Discipline.

UNIT II **10**

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

UNIT III **10**

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.

L: 30; TOTAL: 30 PERIODS

REFERENCES

1. Sharma, S.P., "Moral and Value Education: Principles and Practices", Kanishka publishers, 2013.
2. Kiruba Charles & V.Arul Selvi.," Value Education", Neelkamal Publications, New Delhi, 2012.
3. Passi, B.K. and Singh, P.,"Value Education", National Psychological Corporation, Agra. 2004.
4. http://cbseportal.com/exam/e-books/download-free-ncert-e-book-education-for-values-in-school-a-framework/
5. http://cbseacademic.in/web_material/ValueEdu/Value%20Education%20Kits.pdf

19AC05E CONSTITUTION OF INDIA L T P C QP
2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: understand the premises informing the twin themes of liberty and freedom from a civil rights perspective. (K2)

CO2: 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. (K2)

CO3: 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. (K1)

UNIT I HISTORY AND PHILOSOPHY OF INDIAN CONSTITUTION 6

History-Drafting Committee, (Composition & Working) --Preamble- Salient Features.

UNITII CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES 6

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

UNIT III ORGANS OF GOVERNANCE 6

Parliament- Composition-Qualifications and Disqualifications- Powers and Functions- Executive-President-Governor-Council of Ministers- Judiciary- Appointment and Transfer of Judges-Qualifications-Powers and Functions**.**

UNIT IV LOCAL ADMINISTRATION 6

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

UNIT V ELECTION COMMISSION 6

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.

L: 30; TOTAL: 30 PERIODS

REFERENCES

1. Subhash .C, kashyap ¯Our Constitution‖, 5th Edition, 2017
2. www.ieagreements.org/IEA-Grad-Attr-Prof-Competencies.pdf
3. The Constitution of India, 1950 (Bare Act), Government Publication.
4. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
5. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
6. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

19AC06E PEDAGOGY STUDIES L T P C QP
2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Describe the pedagogical practices used by teachers in formal and informal classrooms (K3)

CO2: Understand the effectiveness of these pedagogical practices, in what conditions, and with what population of learners (K2)

CO3: Analyze how teacher education (curriculum and practicum) and the school curriculum with guidance materials support effective pedagogy (K3)

UNIT I INTRODUCTION AND METHODOLOGY 8

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.

UNIT II EFFECTIVENESS OF PEDAGOGICAL PRACTICES 8

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

UNIT III PROFESSIONAL DEVELOPMENT 7

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

UNIT IV RESEARCH GAPS AND FUTURE DIRECTIONS 7

Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

L:30; TOTAL:30 PERIODS

REFERENCES

1. Dr.S.K.Bhatia and Dr.Sonia Jindal, ¯A Text Book Of Curriculum, Pedagogy And Evaluation‖,Paragon International Publications, 2016.
2. Ackers J, Hardman F Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261, 2001.
3. Agrawal M ,"Curricular reform in schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3): 361-379,2004.
4. Akyeampong K ," Teacher training in Ghana - does it count?", Multi-site teacher education research project (MUSTER) country report 1. London: DFID,2003.
5. 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.
6. Alexander RJ,"Culture and pedagogy: International comparisons in primary education",Oxford and Boston: Blackwell,2001.
7. Chavan M, "Read India: A mass scale, rapid, ‗learning to read'", campaign, 2003.
8. www.pratham.org/images/resource%20working%20paper%202.pdf.

19AC07E STRESS MANAGEMENT BY YOGA **L T P C QP**
2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: achieve overall health of body and mind (K1)

CO2: overcome stress (K2)

UNIT I INTRODUCTION **10**

Introduction to Stress-Concept of Stress-Solutions through Mandukya karika -- Relaxation and stimulation combined as the core for stress management-Practice of Stimulation and relaxation.

UNIT II ASAN AND PRANAYAM **10**

Definitions of Eight parts of yoga. (Ashtanga)-Various yoga poses and their benefits for mind & body-Regularization of breathing techniques and its effects-Types of pranayam.

UNIT III YOGA AND STRESS MANAGEMENT **10**

Concepts and Techniques of Stress Management in Ashtanga Yoga of Patanjali--specific practices for stress management-breathe awareness.

L:30; TOTAL:30 PERIODS

REFERENCES

1. Swami Vivekananda, Advaita Ashrama , ¯Rajayoga or conquering the Internal Nature‖, 2016.
2. K.N.Udupa**, "**Stress and Its Management by Yoga‖, Edited by R.C.Prasad, Motilal Banarashidass Publishers, Delhi, 2010.
3. Lisa Shea,‖Yoga for Stress Relief and Forgiveness‖, Kindle Edition, 2015.
4. BKS Iyengar, ¯Yoga: The path to Holstic Health‖, DK Publication, 2019
5. https://www.longdom.org/open-access/stress-and-yoga-2157-7595.1000109.pdf

19AC08E	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L T P C QP 2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: learn to achieve the highest goal happily (K1)

CO2: become a person with stable mind, pleasing personality and determination (K1)

CO3: awaken wisdom in students (K1)

UNIT I INTRODUCTION TO PERSONALITY DEVELOPMENT 10

The concept of personality- Dimensions of personality – Theories of Freud & Erickson- Significance of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles Factors responsible for success – What is failure Causes of failure-SWOT analysis.

UNIT II LIFE ENLIGHTENMENT SKILLS 10

Neetisatakam-Holistic development of personality, Verses 19,20,21,22 (wisdom), Verses 29,31,32 (pride & heroism), Verses 26,28,63,65 (virtue), Verses 52,53,59 (dont's), Verses 71,73,75,78 (do's).Approach to day to day work and duties, Shrimad Bhagwad Geeta, Chapter 2-Verses 41, 47,48, Chapter 3 Verses 13, 21, 27, 35, Chapter 6 Verses 5,13,17, 23, 35, Chapter 18 Verses 45, 46, 48.

UNIT III SHRIMAD BHAGWAD GEETA STATEMENTS 10

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, Chapter3 Verses 36,37,42, Chapter4 Verses 18, 38,39, Chapter18 Verses 37,38,63

L:30; TOTAL:30 PERIODS

REFERENCES

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

		L	T	P	C	QP
19CT30E	**ADVANCED VIRTUAL REALITY SYSTEMS**	**3**	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand Fundamentals of Virtual Reality systems (K2)
CO2: Learn about Geometry of Virtual Worlds (K2)
CO3: Articulate the basic terminologies involved in Visual Rendering and Tracking (K2)
CO4: Learn about Interaction and Evaluating VR Systems (K3)
CO5: Understand Layers of Metaverse and its applications. (K3)

UNIT I INTRODUCTION TO VIRTUAL REALITY 9

Introduction- History of VR - Goals and VR Definitions – AR, VR, MR, XR:-Similarities and Differences - Historical Perspective - Bird's-Eye View – Human Physiology and Perception

UNIT II GEOMETRY OF VIRTUAL WORLDS 9

Geometric Models – Changing Position and Orientation- Translations – 3D rotations and yaw, pitch, and roll – Axis-Angle representations of Rotation – Viewing Transformations - Chaining the transformations.

UNIT III VISUAL RENDERING & TRACKING 9

Visual Rendering – Overview - Ray Tracing and Shading models – Rasterization – Correcting Optical Distortions – Improving Latency and Frame Rates – Immersive Photos and Videos - Tracking 2D Orientation – Tracking 3D Orientation – Tracking Position and Orientation – Tracking Attached Bodies – 3D Scanning of Environments.

UNIT IV INTERACTION & EVALUATING VR SYSTEMS 9

Interfaces Overview – Locomotion – Manipulation – Social Interaction - Perceptual Training – Recommendations for Developers – Comfort and VR Sickness – Experiments on Human Subjects.

UNIT V METAVERSE 9

Introduction - Metaverse - Layers of Metaverse - Milestones of Metaverse –Virtual Reality in the Metaverse – Digital Twins - Augmented Reality in the Metaverse – AR in Military – NFT in the Metaverse - Challenges and requirements of Metaverse – Future of the Metaverse – Application of Metaverse.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Steven M. LaValle, "Virtual Reality", Cambridge University Press, 2020.
2. Andrew Clemens, "Metaverse for Beginners: A Guide to Help You Learn about Metaverse, Virtual Reality and Investing in NFTs", Feb 2022.
3. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2009.

REFERENCES

1. Peter Shirley, Michael Ashikhmin, and Steve Marschner, "Fundamentals of Computer Graphics", A K Peters/CRC Press; 3 Edition, 2009.
2. http://lavalle.pl/vr/
3. http://lavalle.pl/vr/notebookc.pdf
4. http://nptel.ac.in/courses/106106138/
5. https://www.coursera.org/learn/introduction-virtual-reality