P.S. R. ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)

(Accredited by NAAC and listed under 12B of UGC Act, 1956)

Sevalpatti (P.O), Sivakasi – 626140.

Department of Computer Science and Engineering

CURRICULUM

AND

SYLLABI

Regulations – 2019

M.E., COMPUTER SCIENCE AND ENGINEERING

(FULL-TIME)

(Candidates admitted from 2019–2020 onwards)

INSTITUTE VISION & MISSION

Vision	• To contribute to the society through excellence in technical education with societal values and thus a valuable resource for industry and the humanity.
Mission	• To create an ambience for quality learning experience by providing sustained care and facilities. • To offer higher level training encompassing both theory and practices with human and social values. • To provide knowledge based services and professional skills to adapt tomorrow's technology and embedded global changes.

DEPARTMENT VISION & MISSION

Vision	• To impart holistic education in Computer Science and Engineering to cater the needs in academia, industry and society.
Mission	• Offering under graduate and post graduate programmes by providing effective and balanced curriculum and equip themselves to gear up to the ethical challenges awaiting them. • To confer continuous activities in technical and research that will enable the students to face the real time challenges in the field of Computer Science and Engineering. • To provide training for the students in a socially responsible manner with inculcating integrity and human values.

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Proficiency in Computer Science and Engineering problem identification, formulation, analysis, design, execution and safety using appropriate tools.
2. Solve problems in the algorithms, system software, multimedia, web design, cloud, big data analytics and networking disciplines of Computer Science and Engineering with competence in modern tool usage.
3. Apply modern construction techniques, equipment and management tools so as to complete the project within specified time and funds.
4. Graduates will have a broad understanding of economical, environmental, societal and health involved in infrastructural development and ability to function within multidisciplinary teams.

PROGRAM OUTCOMES (POs)

1. An ability to independently carry out research/ investigation and development work to solve practical Problems in key areas of Computer Science and Engineering.
2. An ability to write and present a substantial report/document.
3. Able to demonstrate Computer Science and Engineering Problems critically in development project and find suitable solution.
4. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.
5. Able to design a system, component or process as per needs and specifications.
6. Able to use modern engineering tools, software and equipment to analyze problems.

P.S.R. ENGINEERING COLLEGE, SIVAKASI – 626140.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Consolidated Curriculum Structure

(PG REGULATION – 2019)

Programme: M.E. Computer Science and Engineering

SEMESTER	THEORY COURSES					MANDATORY COURSES	PRACTICAL COURSES		SPECIAL COURSES	TOTAL CREDITS
I	192CS11 Mathematical foundations of Computer Science *(3)*	192CS12 Advanced Data Structures *(3)*	192CS13 Data Science *(3)*	***192CSEXX Program Elective – I (3)***	192SE13 Research Methodology and IPR *(3)*	192ACXX Audit Course *(0)*	192CS14 Advanced Data Structures Laboratory *(2)*	192CS15 Data Science Laboratory *(2)*	--	***19***
II	192CS21 Advanced Algorithms *(3)*	192CS22 Soft Computing *(3)*	192CS23 Ethical Hacking *(3)*	***192CSEXX Program Elective – II (3)***		192ACXX Audit Course *(0)*	192CS24 Soft Computing Laboratory *(2)*	192CS25 Network Security Laboratory *(2)*	192CS26 Mini Project with Seminar *(2)*	***18***
III		***192CSEXX Program Elective – III (3)***	*192OEXX Open Elective (3)*						192CS31 Project Phase – I *(10)*	***16***
IV									192CS41 Project Phase – II *(16)*	***16***
									TOTAL CREDITS	***69***

P.S.R. ENGINEERING COLLEGE, SIVAKASI – 626140.

PG REGULATION – 2019
CHOICE BASED CREDIT SYSTEM

M.E. COMPUTER SCIENCE AND ENGINEERING

CURRICULUM [I – IV SEMESTERS – FULL-TIME]
(Candidates admitted from 2019–2020 onwards)

Total Credits: 69

SEMESTER – I

S. No.	Course Code	Course Title	Category	L–T–P	Credit
1	192CS11	Mathematical Foundations of Computer Science	PC	3–0–0	3
2	192CS12	Advanced Data Structures	PC	3–0–0	3
3	192CS13	Data Science	PC	3–0–0	3
4	192CSEXX	*Program Elective – I*	PE	3–0–0	3
5	192SE13	Research Methodology and IPR	MC	3–0–0	3
6	192ACXX	*Audit Course – I*	AC	2–0–0	0
7	192CS14	Advanced Data Structures Laboratory	PC	0–0–4	2
8	192CS15	Data Science Laboratory	PC	0–0–4	2

No. of Credits: 19

SEMESTER – II

S. No.	Course Code	Course Title	Category	L–T–P	Credit
1	192CS21	Advanced Algorithms	PC	3–0–0	3
2	192CS22	Soft Computing	PC	3–0–0	3
3	192CS23	Ethical Hacking	PC	3–0–0	3
4	192CSEXX	*Program Elective – II*	PE	3–0–0	3
5	192ACXX	*Audit Course – II*	AC	2–0–0	0
6	192CS24	Soft Computing Laboratory	PC	0–0–4	2
7	192CS25	Network Security Laboratory	PC	0–0–4	2
8	192CS26	Mini Project with Seminar	PROJ	0–0–4	2

No. of Credits: 18

SEMESTER – III

S. No.	Course Code	Course Title	Category	L–T–P	Credit
1	192CSEXX	*Program Elective – III*	PE	3–0–0	3
2	192OEXX	*Open Elective*	OE	3–0–0	3
3	192CS31	Project Phase – I	PROJ	0–0–20	10

No. of Credits: 16

SEMESTER – IV

S. No.	Course Code	Course Title	Category	L–T–P	Credit
1	192CS41	Project Phase – II	PROJ	0–0–32	16

No. of Credits: 16

Total No. of Credits: 69

PROGRAM ELECTIVES					
S. No.	**Course Code**	**Course Title**	**Category**	**L–T–P**	**Credit**
1	192CSE01	Wireless Sensor Networks	PE	3–0–0	3
2	192CSE02	Introduction to Intelligent Systems	PE	3–0–0	3
3	192CSE03	Block Chain and Cryptography	PE	3–0–0	3
4	192CSE04	Advanced Wireless and Mobile Networks	PE	3–0–0	3
5	192CSE05	Data Preparation and Analysis	PE	3–0–0	3
6	192CSE06	Secure Software Design and Enterprise Computing	PE	3–0–0	3
7	192CSE07	Computer Vision	PE	3–0–0	3
8	192CSE08	Human and Computer Interaction	PE	3–0–0	3
9	192CSE09	GPU Computing	PE	3–0–0	3
10	192CSE10	Digital Forensics	PE	3–0–0	3
11	192CSE11	Mobile Applications and Services	PE	3–0–0	3
12	192CSE12	Compiler for HPC	PE	3–0–0	3
13	192CSE13	Optimization Techniques	PE	3–0–0	3
14	192CSE14	Network Performance and Vulnerability Analysis	PE	3–0–0	3
15	192CSE15	Storage and Server Security	PE	3–0–0	3

OPEN ELEVTIVES					
S. No.	**Course Code**	**Course Title**	**Category**	**L–T–P**	**Credit**
1	192OE01	Business Analytics	OE	3–0–0	3
2	192OE02	Industrial Safety	OE	3–0–0	3
3	192OE03	Operations Research	OE	3–0–0	3
4	192OE04	Design of Experiments	OE	3–0–0	3
5	192OE05	Composite Materials	OE	3–0–0	3
6	192OE06	Cost Management of Engineering Projects	OE	3–0–0	3
7	192OE07	Waste to Energy	OE	3–0–0	3
8	192OE08	Nanomaterials and Nanotechnology	OE	3–0–0	3

AUDIT COURSES					
S. No.	**Course Code**	**Course Title**	**Category**	**L–T–P**	**Credit**
1	192AC01	Constitution of India	MC	2–0–0	0
2	192AC02	Disaster Management	MC	2–0–0	0
3	192AC03	English For Research Paper Writing	MC	2–0–0	0
4	192AC04	Sanskrit for Technical Knowledge	MC	2–0–0	0
5	192AC05	Value Education	MC	2–0–0	0
6	192AC06	Pedagogy Studies	MC	2–0–0	0
7	192AC07	Stress Management by Yoga	MC	2–0–0	0
8	192AC08	Personality Development through Life Enlightenment Skills	MC	2–0–0	0

PC – Program Core, PE – Program Elective, AC – Audit Course, OE – Open Elective

MC – Mandatory Course, PROJ – Project

192CS11	MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE	L	T	P	C
		3	0	0	3

Programme: M.E. Computer Science and Engineering **Sem: 1 Category: PC**

Aim: To provide the knowledge about applications of mathematics in computer science.

Course Outcomes: The Students will be able to

CO1: Understand the basic notions of discrete and continuous probability.

CO2: Understand the methods of statistical inference, and the role that sampling distributions play in those methods.

CO3: Able to perform correct and meaningful statistical analyses of simple to moderate complexity.

CO4: Able to formulate problems using network protocols.

CO5: Able to model and solve real-world problems using graphs theory concepts.

CO6: Develop solution with the help of machine learning tools.

UNIT I **9**

Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains

UNIT II **9**

Random samples, Sampling distributions of estimators**,** Methods of Moments and Maximum Likelihood, Statistical inference**,** Introduction to multivariate statistical models: Regression and Classification problems, Principal components analysis, The problem of over fitting model assessment.

UNIT III **9**

Graph Theory: Isomorphism, Planar graphs, Graph coloring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems.

UNIT IV **9**

Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.

UNIT V **9**

Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bioinformatics, soft computing, and computer vision.

Total Hours 45

References:

1. John Vince, “Foundation Mathematics for Computer Science”, Springer Nature, 1/e, 2015.
2. K.Trivedi. “Probability and Statistics with Reliability, Queuing, and Computer Science Applications”, 2/e, Wiley 2016.
3. M. Mitzen macher and E.Upfal. “Probability and Computing: Randomized Algorithms and Probabilistic Analysis”, Cambridge University Press, 2005.
4. Alan Tucker, “Applied Combinatorics”. John Wiley & Sons, 2002.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	2					2			
CO2	2	2					3			
CO3	3	3			2			2		
CO4	3	3	2				3	2		
CO5	3	3	2				2	1		1
CO6	2	1			3		3	2		2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CS12 **ADVANCED DATA STRUCTURES** **L T P C**
3 0 0 3

Programme: M.E. Computer Science and Engineering **Sem: 1 Category: PC**

Aim: To understand the advanced algorithms of graphs and trees.

Course Outcomes: The Students will be able to

CO1: Understand the implementation of symbol table using hashing techniques.

CO2: Develop and analyze algorithms for red-black trees, B-trees and Splay trees.

CO3: Develop algorithms for text processing applications.

CO4: Identify suitable data structures and develop algorithms for computational geometry problems.

CO5: Handle operations like searching, insertion, ,traversing mechanism etc. on various data structures.

CO6: Solve problem involving graphs, trees and heaps.

UNIT I **9**

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

UNIT II **9**

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists
Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees.

UNIT III **9**

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

UNIT IV **9**

Computational Geometry: 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.

UNIT V **9**

Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem

Total Hours 45

References:

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Pearson, 4/e, 2014.
2. Michael T. Goodrich and Roberto Tamassia, “Data Structure and Algorithms in Java”, Wiley, 4/e, 2005.
3. Alfred Aho, Hopcroft, Ullman, “Data Structures and Algorithms”, Pearson Education, 2002.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2		2		1		2	3		
CO2	1	2	3		2		3	3		
CO3	3	2	3		3		2	2		
CO4		3	2		2		3	3		
CO5		1			2		3	2		
CO6	2	3	1				3	2		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CS13 **DATA SCIENCE** **L T P C**
3 0 0 3

Programme: M.E. Computer Science and Engineering **Sem: 1 Category: PC**

Aim: To provide practical foundation level training that enable immediate and effective participation in big data and other analytics projects.

Course Outcomes: The Students will be able to

CO1: Use current techniques, skills, and tools necessary for managing and doing analytics on big data.
CO2: Design extraction and mining tools for Social networks.
CO3: Apply analytical tools for complex problems
CO4: Gain knowledge on web personalization and web visualization of social networks
CO5: Know about extraction and mining tools for social networks.
CO6: Able to work with database concepts

UNIT I – INTRODUCTION TO BIG DATA ANALYTICS, OVERVIEW OF DATA SCIENCE **9**

Big Data Overview, State of the Practice of Analytics, Big Data Analytics in Industry Verticals. Overview of Data Analytics Lifecycle, Discovery, Data Preparation, Model Planning, Model Building, Communicating Results and Findings, Operationalizing.

UNIT II – ANALYTICS AND STATISTICAL MODELING FOR BIG DATA TOOLS **9**

Learning various tools to Perform Analytics on unstructured data using Map Reduce Programming paradigm. Use Hadoop, HDFS, HIVE, PIG and other products in the Hadoop ecosystem for unstructured data analytics. Effectively use advanced SQL functions and Green plum extensions for in-database analytics. Use MADlib to solve analytics problems in-database. Apache Spark.

UNIT III – STATISTICAL MODELING FOR BIG DATA – THEORY AND METHODS: **9**

Examining analytic needs and select an appropriate technique based on business objectives; initial hypotheses; and the data's structure and volume. Apply some of the more commonly used methods in Analytics solutions Explain the algorithms and the technical foundations for the commonly used methods. Explain the environment (use case) in which each technique can provide the most value. Use appropriate diagnostic methods to validate the models created. Use R and in-database analytical functions to fit, score and evaluate models.

UNIT IV – USING R FOR INITIAL ANALYSIS OF THE DATA **9**

Introduction to Using R Initial Exploration and Analysis of the Data Using R Basic Data Visualization Using R. How to use the R package as a tool to perform basic data analytics, reporting, and apply basic data visualization techniques to sample data. Apply basic analytics methods such as distributions, statistical tests and summary operations, and differentiate between results that are statistically sound vs. statistically significant. Identify a model for sample data and define the null and alternative hypothesis.

UNIT V – END GAME - OPERATIONALIZING AN ANALYTICS PROJECT **9**

The various tasks needed to operationalize an analytics project. Deliverables of an analytics lifecycle project. Framework for creating final presentations for sponsors and analysts. Evaluation of data visualization and ways to improve – Application of these concepts to a big data analytics problem in the final lab. Case Study: Social Network Mining and Analysis using Text Mining.

Total Hours 45

References:

1. "Analytics in Practice, Author: Soumendra Mohanty, Publisher: Tata McGraw Hill Education 2011.
2. Ke W. Collier, "Agile Analytics: A Value-Driven Approach to Business Intelligence and Data Warehousing", Pearson Education, 2012.
3. Donald Miner, "MapReduce Design Patterns", O'Reilly 2012.

4. C. Bishop, “Pattern Recognition and Machine Learning”, Springer 2010.
5. Airoldi, E.M., Blei, D.M., Fienberg, S.E., Xing, E.P. “Mixed Membership Stochastic Block Models”, 2008.
6. Reza Zafarani, Mohammad Ali Abbasi, Huan Liu, ”Social Media Mining”, Cambridge University Press, 2014.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	1			3		2	3		
CO2	2	1	2		3		3	3		
CO3	3	3	3		2		2	3		
CO4	2				3		3	2		
CO5	1				2		3	3		
CO6	3						3	2		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192SE13 **RESEARCH METHODOLOGY AND IPR** **L T P C 3 0 0 3**

Programme: M.E. Computer Science and Engineering **Sem: 1 Category: MC**

Aim: To provide the idea about research methods and its complications.

Course Outcomes: The Students will be able to

CO1: Understand research problem formulation.

CO2: Analyze research related information.

CO3: Follow research ethics

CO4: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

CO5: Understand that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general and engineering in particular.

CO6: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT I **9**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

UNIT II **9**

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations Effective literature studies approaches, analysis. Plagiarism, Research ethics,

UNIT III **9**

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

UNIT IV **9**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: Technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT V **9**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR; Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Total Hours 45

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: An Introduction for Science & Engineering Students", 1996.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction", 2004
3. Ranjit Kumar, "Research Methodology: A Step by Step Guide for beginners", Pearson Education, 2/e, 2005.

4. Robert P.Merges, Peter S.Menell, Mark A.Lemley, "Intellectual Property in New Technological Age", 2016.
5. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.
6. http://www.ipindia.nic.in/resources.htm
7. http://www.ipr.res.in/

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3		2				2			
CO2	2							2		
CO3								3		
CO4	2	2					3	2		
CO5	3	2	2		2		2	2		2
CO6	1	3	1	2			1	2		3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CS14 ADVANCED DATA STRUCTURES LABORATORY

L	T	P	C
0	0	4	2

Programme: M.E. Computer Science and Engineering **Sem: 1 Category: PC**

Aim: To provide knowledge about the advanced techniques of data structures.

Course Outcomes: The Students will be able to

CO1: Implement tree data structure.

CO2: Analyze the working of various Tree operations.

CO3: Implement program for graph representation.

CO4: Understand the concept of hashing

CO5: Understand operations like insert and search record in the database.

CO6: Understand concept & features like extended binary search tree.

LIST OF EXPERIMENTS

1. Implement an Expression Tree. Produce its Pre-order, In-order, and Post-order traversals.
2. Implement Binary Search Tree
3. Implement Hashing techniques
4. Implementing the following Graph traversal algorithms:
   a) Depth first traversal
   b) Breadth first traversal
5. Implement a Backtracking algorithm for Knapsack problem
6. Implement Topological sorting
7. Implement Shortest Path using Dijkstra's algorithm
8. Implement Minimum Spanning Tree

Total Hours 60

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2		2		2	3		
CO2	1	3	2		2		3	3		
CO3	3	2	3		3		3	2		
CO4		3	2		2		3			
CO5		2							1	
CO6		3	3					2	2	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CS15 **DATA SCIENCE LABORATORY** **L T P C**
0 0 4 2

Programme: M.E. Computer Science and Engineering **Sem: 1 Category: PC**

Aim: To understand and utilize the data science concepts.

Course Outcomes: The Students will be able to

CO1: Solve real world problems using R Programming

CO2: Analyze and Summarize different types of data sets.

CO3: Understand Spark paradigm.

CO4: Work with Hive.

CO5: Understand the concepts and able to develop API.

CO6: Apply various Modelling techniques for performing Prediction.

LIST OF EXPERIMENTS

1 Exercises to solve real world problems in Machine Learning using R.
- Installing the R platform.
- Loading the dataset.
- Summarizing the dataset.
- Visualizing the dataset.
- Evaluating some algorithms.
- Making some predictions.

2 Run a basic Word count program to understand Spark paradigm.

3 Install Hive and use Hive to create, alter, drop databases.

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

5 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. You can use Java/Python ML library classes/API.

Total Hours 60

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2		2		1		2	3		
CO2	1	2	3		2		3	3		
CO3	3	2	3		3		2	2		
CO4		3	2		2		3	3		
CO5		1			2		3	2		
CO6	2	3	1				3	2		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CS21 **ADVANCED ALGORITHMS** **L T P C 3 0 0 3**

Programme: M.E. Computer Science and Engineering **Sem:** 2 **Category:** PC

Aim: To understand the concepts of algorithm complexities.

Course Outcomes: The Students will be able to

CO1: Analyze the complexity/performance of different algorithms.

CO2: Determine the appropriate data structure for solving a particular set of problems.

CO3: Categorize the different problems in various classes according to their complexity.

CO4: Have an insight of recent activities in the field of the advanced data structure.

CO5: Determine the most suitable algorithm for any given task and then apply it to the problem.

CO6: Understand a wide range of advanced algorithmic problems, their relations and variants, and application to real-world problems.

UNIT I **9**

Sorting: Review of various sorting algorithms, topological sorting.

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

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.

UNIT II **9**

Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path. **Flow-Networks:** Maxflow- mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.

UNIT III **9**

Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition. **Shortest Path in Graphs:** Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.

UNIT IV **9**

Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem. **Discrete Fourier Transform (DFT):** In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm. **Linear Programming:** Geometry of the feasibility region and Simplex algorithm

UNIT V **9**

NP-completeness: Examples, proof of NP-hardness and NP-completeness. Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm. Recent trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

Total Hours 45

References:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, 3/e, MIT Press, 2009.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D.Ullman, “The Design and Analysis of Computer Algorithms”, Addison-Wesley Pub. Co., 1974.
3. Kleinberg, Tardos, "Algorithm Design", Pearson Education, 1/e, 2009.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3			3	2	3	2		
CO2	3	2			2	3	2	3		
CO3	2	3			3	2	3	2		
CO4	2	2			3	2	2	3		
CO5		3						2		
CO6					2			3		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CS22	SOFT COMPUTING	L	T	P	C
		3	0	0	3

Programme: M.E. Computer Science and Engineering **Sem:** 2 **Category:** PC

Aim: To understand the concepts of soft computing and applications.

Course Outcomes: The Students will be able to

CO1: Basics of soft computing characteristics and concepts.

CO2: Basics of AI and Computational intelligence.

CO3: Fuzzy Logic, Various fuzzy systems and their functions

CO4: Genetic algorithms, its applications and advances

CO5: Learning machine learning techniques and classification techniques.

CO6: Applications of Soft computing to solve problems in varieties of application domains

UNIT IINTRODUCTION TO SOFT COMPUTING **9**

Evolution of Computing: Concept of computing systems. “Soft" computing versus "Hard" computing Characteristics of Soft computing, Soft Computing Constituents, From Conventional AI to Computational Intelligence Some applications of Soft computing techniques.

UNIT IIFUZZY LOGIC **9**

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

UNIT IIINEURAL NETWORKS **9**

Introduction to Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks.

UNIT IVGENETIC ALGORITHMS **9**

Introduction to Genetic Algorithms (GA), Basic GA framework and different GA architectures. GA operators: Encoding, Crossover, Selection, Mutation, etc. Solving single-objective optimization problems using GAs.

UNIT V MACHINE LEARNING **9**

Machine Learning: Machine Learning Techniques – Machine Learning Using Neural Nets. Machine Learning Approach to Knowledge Acquisition. Support Vector Machines for Learning – Linear Learning Machines – Support Vector Classification – Support Vector Regression - Applications

Total Hours 45

References:

1. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Application and Programming Techniques”, Pearson Education, 2003.
2. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1995.
3. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, 1997.
4. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, “Neuro-Fuzzy and Soft Computing”, PHI, 2003.
5. Melanie Mitchell, “An Introduction to Genetic Algorithms”, MIT Press; Fifth printing, 1999.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3				2	2	2		
CO2	2	3				3	3	3		
CO3	3	2		2		2	3	3		
CO4	3	2			3	2	3	2		
CO5	3	2			2		3	2		
CO6	2	2	3				2	1		2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CS23 **ETHICAL HACKING** **L T P C**
3 0 0 3

Programme: M.E. Computer Science and Engineering **Sem:** 2 **Category:** PC

Aim: To provide the knowledge about user data security and protecting data assets.

Course Outcomes: The Students will be able to

CO1: Identify and analyze the stages an ethical hacker requires to take in order to compromise a target system.

CO2: Identify tools and techniques to carry out a penetration testing.

CO3: Critically evaluate security techniques used to protect system and user data.

CO4: Defend hacking attacks and protect data assets.

CO5: Demonstrate systematic understanding of the concepts of security at the level of policy and strategy in a computer system.

CO6: Exploit the vulnerabilities related to computer system and networks using state of the art tools and technologies.

UNIT I **9**

Introduction to Ethical Disclosure: Ethics of Ethical Hacking, Ethical Hacking and the legal system, Proper and Ethical Disclosure

UNIT II **9**

Penetration Testing and Tools: Using Meta split, Using Back Track Live CD Linux Distribution

UNIT III **9**

Vulnerability Analysis: Passive Analysis, Advanced Static Analysis with IDA Pro, Advanced Reverse Engineering

UNIT IV **9**

Client-side browser exploits, Exploiting Windows Access Control Model for Local Elevation Privilege, Intelligent Fuzzing with Sulley, From Vulnerability to Exploit

UNIT V **9**

Malware Analysis: Collecting Malware and Initial Analysis, Hacking Malware. Case study of vulnerability of cloud platforms and mobile platforms & devices.

Total Hours 45

References:

1. Shon Harris, Allen Harper, Chris Eagle and Jonathan Ness, “Gray Hat Hacking: The Ethical Hackers' Handbook”, 3/e, 2011.
2. Ec-Council, “Ethical Hacking and Countermeasures: Attack Phases”, Delmar Cengage Learning, 2009.
3. Michael T. Simpson, Kent Backman, James E. Corley, “Hands-On Ethical Hacking and Network Defense”, Cengage Learning, 2012.
4. Patrick Engebretson, “The Basics of Hacking and Penetration Testing – Ethical Hacking andPenetration Testing Made Easy”, Syngress Media, 2/e, 2013.
5. Jon Erickson, “Hacking: The Art of Exploitation”, No Starch Press, 2/e, 2008.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2				3	2		
CO2	2	3	2		3		2	3		2
CO3	2	3					3			
CO4	2	2					3			
CO5	3	2					3			
CO6	3	3					2			3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CS24 SOFT COMPUTING LABORATORY

L	T	P	C
0	0	4	2

Programme: M.E. Computer Science and Engineering **Sem:** 2 **Category:** PC

Aim: To understand the concepts of analysis of data and soft computing algorithms.

Course Outcomes: The Students will be able to

CO1: Apply various classification algorithms
CO2: Develop applications with the help of neural network concepts
CO3: Apply machine learning concepts
CO4: Do data analysis with the help of deep learning resources
CO5: Apply code optimization techniques
CO6: Do analysis in dataset

LIST OF EXPERIMENTS

1. Implement Various classification Algorithms
2. Implement Neural Network in user application
3. Implement Building FIS
4. Simulating and Developing FIS for user application
5. Analytic Data analysis using deep learning algorithm
6. Coding and Minimizing a Fitness Function Using the Genetic Algorithm
7. Custom Output Function for Genetic Algorithm
8. Implement Support Vector Machine algorithm to analysis user dataset.
9. Implement Machine Learning algorithm
10. Implement Various Clustering Techniques

Total Hours 60

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3			2		3	3		2
CO2	2	2					3	2		
CO3	1	3	2		3		3	3		3
CO4	2	2					2	2		
CO5		3			2		2	3		
CO6		3					2	3		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CS25 **NETWORK SECURITY LABORATORY** **L T P C**
0 0 4 2

Programme: M.E. Computer Science and Engineering **Sem: 2 Category: PC**
Aim: To understand and implement network security techniques.
Course Outcomes: The Students will be able to
CO1: Implement the cipher techniques
CO2: Develop the various security algorithms
CO3: Use different open source tools for network security and analysis
CO4: Apply security techniques in real network operations
CO5: Apply different mathematical approaches to develop new cyber security techniques
CO6: Understand the future scope of security technique developments

LIST OF EXPERIMENTS

1. Implement the following Substitution & Transposition Techniques concepts:
   1.1 Caesar Cipher and Playfair Cipher
   1.2 Hill Cipher and Vigenere Cipher
   1.3 Rail fence – row & Column Transformation
2. Implement the following algorithms
   2.1 DES
   2.2 AES
   2.2 RSA and Diffie-Hellman Algorithm
   2.3 MD5 and SHA-1
3. Implement the Signature Scheme - Digital Signature Standard
4. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).
5. Setup a honey pot and monitor the honeypot on network (KF Sensor)
6. Installation of rootkits and study about the variety of options
7. Perform wireless audit on an access point or a router and decrypt WEP and WPA. (NetStumbler)
8. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)

Total Hours 60

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3			3		3	2		
CO2	3	2	2		2		3	2		
CO3	1	3			3		3	3		
CO4	2	3			3		2	2		
CO5	3	3			2		3	2		
CO6	1				2		2	3		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CS26 **MINI PROJECT WITH SEMINAR** **L T P C**
0 0 4 2

Programme: M.E. Computer Science and Engineering **Sem: 2 Category: PROJ**
Aim: To identify and solve the engineering problem, provide solution to Engineering community and present the technical solution.

Course Outcomes: The Students will be able to

CO1: Synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
CO2: Select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
CO3: Present the findings of their technical solution in a written report.
CO4: Demonstrate the design methodology for the project.
CO5: Improve their communication skills, presentation skills and other soft skills.
CO6: Gain the knowledge about various magazine, newsletters and journals related to their field.

SYLLABUS CONTENTS:

The students are required to search / gather the material / information on a specific a topic Comprehend it and present / discuss in the class. They can take up small problems in the field of design engineering as mini project. It can be related to solution to an engineering problem, verification and analysis of experimental data available, conducting experiments on various engineering subjects, material characterization, studying a software tool for the solution of an engineering problem etc.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	3	3	3	3	2	3	3
CO2	3	2	2	3	2	3	3	2	3	3
CO3	1	3	3	3	3	2	3	3	3	3
CO4	2	3	3	3	3	2	2	2	2	3
CO5	3	3	2	2	2	2	3	2	3	3
CO6	1	2	3	3	2	3	2	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CS31 **PROJECT PHASE – I**

L	T	P	C
0	0	20	10

Programme: M.E. Computer Science and Engineering **Sem: 3 Category: PROJ**

Aim: To identify and solve the engineering problem, provide solution to Engineering community and present the technical solution.

Course Outcomes: The Students will be able to

CO1: Synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.

CO2: Select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.

CO3: Present the findings of their technical solution in a written report.

CO4: Demonstrate the design methodology for the project.

CO5: Improve their communication skills, presentation skills and other soft skills.

CO6: Gain the knowledge about various magazine, newsletters and journals related to their field.

SYLLABUS CONTENTS:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following

- Relevance to social needs of Society
- Relevance to value addition to existing facilities in the Institution
- Relevance to Industry need
- Problems of National importance
- Research and development in various domain

The student should complete the following:

- Literature Survey Problem Definition
- Motivation for study and Objectives
- Preliminary Design / Feasibility / Modular approaches
- Implementation and Verification
- Report and Presentation

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	3	3	3	3	2	3	3
CO2	3	2	2	3	2	3	3	2	3	3
CO3	1	3	3	3	3	2	3	3	3	3
CO4	2	3	3	3	3	2	2	2	2	3
CO5	3	3	2	2	2	2	3	2	3	3
CO6	1	2	3	3	2	3	2	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CS41 **PROJECT PHASE – II**

L	T	P	C
0	0	32	16

Programme: M.E. Computer Science and Engineering **Sem: 4 Category: PROJ**

Aim: To identify and solve the engineering problem, provide solution to Engineering community and present the technical solution.

Course Outcomes: The Students will be able to

CO1: Demonstrate a sound technical knowledge of their selected project topic.

CO2: Undertake problem identification, formulation and solution.

CO3: perform a literature search to review current knowledge and developments in the chosen project

CO4: Undertake detailed technical work in the chosen area using one or more of theoretical studies and modeling.

CO5: Prepare an interim report describing the work undertaken and results.

CO6: Present the work in a forum involving seminar, conference, project Expo and poster presentations

SYLLABUS CONTENTS:

The dissertation stage II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

- Experimental verification / Proof of concept.
- Design, fabrication and testing of proposed research work.
- The viva-voce examination will be based on the above report and work

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	3	3	3	3	2	3	3
CO2	3	2	2	3	2	3	3	2	3	3
CO3	1	3	3	3	3	2	3	3	3	3
CO4	2	3	3	3	3	2	2	2	2	3
CO5	3	3	2	2	2	2	3	2	3	3
CO6	1	2	3	3	2	3	2	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CSE01 **WIRELESS SENSOR NETWORKS** **L T P C**
3 0 0 3

Programme: M.E. Computer Science and Engineering **Sem: - Category: PE**

Aim: To understand the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols and its functions.

Course Outcomes: The Students will be able to

CO1: Understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology

CO2: Understand the medium access control protocols and address physical layer issues

CO3: Learn key routing protocols for sensor networks and main design issues

CO4: Learn transport layer protocols for sensor networks, and design requirements

CO5: Understand the Sensor management, sensor network middleware, operating systems.

CO6: Understand the network standards

UNIT I – INTRODUCTION **9**

Challenges For Wireless Sensor Networks-Comparison of Sensor Network with Ad Hoc Network -Single Node Architecture-Hardware Components-Energy Consumption of Sensor Nodes-Network Architecture -Sensor Network Scenarios -Design Principles-Applications of wireless sensor networks.

UNIT II – PHYSICAL LAYER **9**

Wireless Channel and Communication Fundamentals -Physical Layer and Transceiver Design Consideration in Wireless Sensor Networks - IEEE Standards: Bluetooth, IEEE 802.11b - Representative sensor nodes -WINS, μamps.

UNIT III – DATA LINK LAYER **9**

MAC Protocols -Fundamentals of Wireless MAC Protocols, Low Duty Cycle Protocols and Wakeup Concepts - Contention Based Protocols - Schedule Based Protocols -Link Layer Protocols - Error Control - Framing -Traffic -Adaptive Medium Access Protocol (TRAMA) - The IEEE 802.15.4 MAC Protocol.

UNIT IV – NETWORK LAYER **9**

Gossiping and Agent-Based Unicast Forwarding–Energy Efficient Unicast, Broadcast and Multicast -Geographic Routing -Mobile Nodes -Data Centric and Content Based Networking-LEACH, PEGASIS -Location Based Routing -GF, GAF, GEAR, GPSR -Real Time Routing Protocols -TEEN, APTEEN, SPEED, RAP -Data Aggregation.

UNIT V – SENSOR PROGRAMMING **9**

Programming Challenges in Wireless Sensor Networks- Tiny Operating System – Event Driven Programming-Contiki OS -Techniques for Protocol Programming-Introduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example.

Total Hours 45

References:

1. Holger Karl, Andreas willig, “Protocol and Architecture for Wireless Sensor Networks”, John Wiley publication, 1/e, 2010.
2. Kazem Sohraby, Daniel Minoli, Taieb Znati, “Wireless Sensor Networks, Technology, Protocols and Applications”,Wiley-Interscience, 1/e, 2007.
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks: An Information Processing Approach”, Elsevier Publication, USA, 2004.

4. Sudip Misra, Isaac Woungang, Subhas Chandra Misra, "Guide to Wireless Sensor Networks", Springer Publication, 2006.
5. Sitharama Iyengar S, Nandan Parameshwaran, Balkrishnan N and Chuka D Okye, "Fundaments of Sensor Network Programming, Applications and Technology", John Wiley & Sons, USA, 2011.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	3			2		2	3		3
CO2	2	2			2		3	3		
CO3	3	3	2		3		3	2		2
CO4	3	2			2		3	3		
CO5	3	3					2	2		
CO6		3					2	2		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CSE02 INTRODUCTION TO INTELLIGENT SYSTEM

L	T	P	C
3	0	0	3

Programme: M.E. Computer Science and Engineering **Sem: - Category: PE**

Aim: To gain knowledge about intelligence system and its algorithms.

Course Outcomes: The Students will be able to

CO1: Learn various algorithms in the neural networks for optimizing real world problems.

CO2: Learn fuzzy logic and its implementation methods.

CO3: Knowledge in genetic algorithm

CO4: Learn various networks and applications.

CO5: Learn Linguistic hedges and their inferences.

CO6: Learn Operations on fuzzy set, Fuzzy compliments, Fuzzy intersection, Fuzzy union, Fuzzy relations.

UNIT I **9**

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

UNIT II **9**

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

UNIT III **9**

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

UNIT IV **9**

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

UNIT V **9**

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning.

Total Hours 45

References:

1. Luger G.F. and Stubblefield W.A. “Artificial Intelligence: Structures and strategies for Complex Problem Solving”, Addison Wesley, 6/e, 2008.
2. Russell S. and Norvig P., “Artificial Intelligence: A Modern Approach”. Prentice-Hall, 3/e, 2009.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2		3		2		3	2		2
CO2	2		3		2		2	2		
CO3	2		2				2	3		3
CO4	3		3		3		3	2		
CO5	3		2		3			2		3
CO6	3		2		2		2	3		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CSE03 **BLOCK CHAIN AND CRYPTOGRAPHY** **L T P C**
3 0 0 3

Programme: M.E. Computer Science and Engineering **Sem:** - **Category:** **PE**

Aim: To gain knowledge about block chain and crypto currencies implementation.

Course Outcomes: The Students will be able to

CO1: Develop a secure systems using block chain and cryptographic concepts
CO2: Discuss trends in Distributed Systems.
CO3: Apply network virtualization.
CO4: Understand the idea of peer to peer services and file system.
CO5: Apply remote method invocation and objects.
CO6: Design process and resource management systems.

UNIT I **9**

Block Chain - Introduction to crypto economics - Byzantine agreement - Extensions of BFT (Ripple, Stellar) – Blockchain Dynamics - Public and private blockchains - Hard and soft forks - Sharding Side chain - Verifiers – trust, cost and speed - Proof of work and other models.

UNIT II **9**

Smart Contracts - Distributed Virtual Machines, Smart Contracts, Oracles - Basics of contract law – Smart contracts and their potential Trust in Algorithms, - Integration with existing legal systems - OpenZeplin, OpenLaw- Writing smart contracts.

UNIT III **9**

Cryptography and Other Technologies: Application of Cryptography to Blockchain - Using hash functions to chain blocks - Digital Signatures to sign transactions - Using hash functions for Proof-of-Work. - Putting the technology together – examples of implementations with their tradeoffs.

UNIT IV **9**

Implementation: Supply Chain and Identity on Blockchain – Blockchain interaction with existing infrastructure – Trust in blockchain data - Scaling Blockchain – reading and writing data. Differentiate nodes, sparse data and Merkle trees - Fixing on the fly – Layer 2 solutions - Lightning and Ethereum state channels

UNIT V **9**

Bitcoin - The big picture of the industry – size, growth, structure, players - Bitcoin versus Cryptocurrencies versus Blockchain - Distributed Ledger Technology (DLT) - Strategic analysis of the space –Major players: Block chain platforms, regulators, application providers, etc. - Bitcoin, HyperLedger, Ethereum, Litecoin, Zcash.

Total Hours 45

References:

1. Don Tapscott and Alex Tapscott, “Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies Is Changing the World”, Portfolio, 2018.
2. Paul Vigna and Michael J. Casey, “The Age of Cryptocurrency: How Bitcoin and the Blockchain Are Challenging the Global Economic Order”, Picador. 2016.
3. Alan T. Norman, “Blockchain Technology Explained: The Ultimate Beginner’s Guide About Blockchain Wallet, Mining, Bitcoin, Ethereum, Litecoin, Zcash, Monero, Ripple, Dash, IOTA And Smart Contracts”, CreateSpace Independent Publishing Platform, 2017.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3			2		3	2		2
CO2	3	3			3			3		
CO3		3		2			2	2		
CO4		2								
CO5	3	2		3			2	3		
CO6	3	2	3				3			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CSE04 ADVANCED WIRELESS AND MOBILE NETWORKS

L	T	P	C
3	0	0	3

Programme: M.E. Computer Science and Engineering **Sem: - Category: PE**

Aim: To understand the advancements in mobile and wireless networks.

Course Outcomes: The Students will be able to

CO1: Demonstrate advanced knowledge of networking.

CO2: Understand various types of wireless networks, standards, operations and use cases.

CO3: Be able to design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.

CO4: Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.

CO5: Design wireless networks exploring trade-offs between wire line and wireless links.

CO6: Develop mobile applications to solve some of the real world problems.

UNIT I **9**

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

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

UNIT II **9**

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

UNIT III **9**

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview.

WIRELESS SENSOR NETWORKS: Introduction, Application, Physical, MAC layer and Network Layer, Power Management, TinyOS Overview.

UNIT IV **9**

SECURITY : Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication.

UNIT V **9**

WIRELESS PANs: Bluetooth and Zigbee, Introduction to Wireless Sensors. **ADVANCED TOPICS:** IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Adhoc Networks.

Total Hours 45

References:

1. Schiller J., “Mobile Communications”, Addison Wesley 2000.
2. Stallings W., “Wireless Communications and Networks”, Pearson Education 2005.
3. Stojmenic Ivan, “Handbook of Wireless Networks and Mobile Computing”, John Wiley & Sons Inc 2002.
4. Yi Bing Lin and Imrich Chlamtac, “Wireless and Mobile Network Architectures”, John Wiley & Sons Inc 2000.
5. Pandya Raj, “Mobile and Personal Communications Systems and Services”. PHI, 2004.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3		3				3	2		2
CO2	2		2		2		2	3		
CO3	2	3	2		3		2	2		
CO4	3		2				3	3		3
CO5		2	3				3	2		
CO6		2	3				3	2		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CSE05 **DATA PREPARATION AND ANALYSIS** **L T P C**
3 0 0 3

Programme: M.E. Computer Science and Engineering **Sem: - Category: PE**

Aim: To prepare the data for analysis and develop meaningful data visualization.

Course Outcomes: The Students will be able to

CO1: Able to extract the data for performing the Analysis.

CO2: Discuss the real time issues.

CO3: Understand the idea of transformation and segmentation.

CO4: Analyze the statistics for clustering.

CO5: Designing the visualizations and network hierarchy.

CO6: Able to understand the rules and grouping of data.

UNIT I **9**

DATA GATHERING AND PREPARATION: Data formats, parsing and transformation, Scalability and real -time issues.

UNIT II **9**

DATA CLEANING: Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation.

UNIT III **9**

EXPLORATORY ANALYSIS: Descriptive and comparative statistics, Clustering and association, Hypothesis generation.

UNIT IV **9**

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

UNIT V **9**

GROUPING: Introduction, Clustering, Associative rules and decision trees.

Total Hours 45

References:

1. Glenn J. Myatt, “Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining”, John Wiley & Sons, Inc., 2007.
2. Federico Castanedo, “Data Preparation in the Big Data Era”, O'Reilly Media, Inc, 2015.
3. Dorian Pyle, “Data Preparation for Data Mining”, Morgan Kaufmann Publishers, Inc., 1999.
4. Q. Ethan Mccallum, “Bad Data Handbook: Cleaning up the Data so you can get back to work”, O'Reilly Media, Inc, 2015.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3		3		3	2		
CO2	3	2			2		2	2		3
CO3	2				3		3	3		
CO4	3	3			3		3	3		
CO5	3	3	3		2		3	3		
CO6	3		2		3		3	2		2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CSE06 **SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING** **L T P C 3 0 0 3**

Programme: M.E. Computer Science and Engineering **Sem: - Category: PE**

Aim: To provide the knowledge about secure software designing.

Course Outcomes: The Students will be able to

CO1: Differentiate between various software vulnerabilities.
CO2: Software process vulnerabilities for an organization.
CO3: Monitor resources consumption in a software.
CO4: Interrelate security and software development process.
CO5: Troubleshoot network problems.
CO6: Administer the network system.

UNIT I - SECURE SOFTWARE DESIGN **9**

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

UNIT II - ENTERPRISE APPLICATION DEVELOPMENT **9**

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

UNIT III - ENTERPRISE SYSTEMS ADMINISTRATION **9**

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

UNIT IV – TROUBLESHOOTING **9**

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

UNIT V – EXCEPTIONS AND CASE STUDY **9**

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

Total Hours 45

References:

1. Theodor Richardson, Charles N Thies, “Secure Software Design”, Jones & Bartlett Publishers, 2013.
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, “Enterprise Software Security”, Addison Wesley, 2014.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	2					3	3		2
CO2	3	2			3		2	2		
CO3	3	3			2		3			3
CO4	3	3					3	3		
CO5	2	2			2		3	3		2
CO6	2	2			1		2	2		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CSE07 **COMPUTER VISION**

L	T	P	C
3	0	0	3

Programme: M.E. Computer Science and Engineering **Sem:** - **Category:** PE

Aim: To understand the concepts of computer vision.

Course Outcomes: The Students will be able to

CO1: Implement fundamental image processing techniques required for computer vision

CO2: Perform shape analysis

CO3: Implement boundary tracking techniques

CO4: Apply chain codes and other region descriptors

CO5: Apply Hough Transform for line, circle, and ellipse detections

CO6: Implement the applications of computer vision.

UNIT I – IMAGE PROCESSING FOUNDATIONS **9**

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

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

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

UNIT V – APPLICATIONS **9**

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 –combining views from multiple cameras –human gait analysis Application: In-vehicle vision system: locating roadway –road markings.

Total Hours 45

References:

1. E. R. Davies, “Computer & Machine Vision”, Academic Press, 4/e, 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”, Academic Press, 3/e, 2012.
5. D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt Publishing, 2012.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	1			3		3	2		
CO2	3	3			2		2	2		2
CO3	3	2			3		3	2		
CO4	2	2			2		3	2		
CO5	3	3			3		3	3		3
CO6	3	2					2			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CSE08	HUMAN AND COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

Programme: M.E. Computer Science and Engineering **Sem:** - **Category:** PE

Aim: To provide the knowledge about human and computer information processing.

Course Outcomes: The Students will be able to

CO1: Explain the capabilities of both humans and computers from the viewpoint of human information processing.

CO2: Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms

CO3: Apply an interactive design process and universal design principles to designing HCI systems

CO4: Describe and use HCI design principles, standards and guidelines

CO5: Understand the structure of models and theories of human computer interaction and vision

CO6: Design an interactive web interface an basis of models studied

UNIT I FOUNDATIONS OF HCI **9**

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

UNIT II DESIGN & SOFTWARE PROCESS **9**

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

UNIT III USER SUPPORT & GROUPWARE **9**

User Support-Introduction- requirements of user support - approaches to user support - adaptive help systems - designing user support systems - Groupware-introduction - Groupware systems - computer mediated communication - meeting and decision support systems - shared applications and artifacts.

UNIT IV MOBILE HCI **9**

Mobile Ecosystem: why mobile, Designing for context, developing a mobile strategy, Types of Mobile Applications: Widgets, Applications, Games, Mobile Information Architecture, Mobile Design: Elements of Mobile Design, Tools.

UNIT V UBIQUITOUS COMPUTING, HYPERTEXT AND WORLD WIDE **9**

Web Ubiquitous computing application research –virtual & augmented reality –Understanding hypertext –finding things –Web technology and issues – Static web content –Dynamic web content-Groupware systems –Computer mediated communication –DSS –Frameworks for groupware-Information and data visualization.

Total Hours 45

References:

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

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3		3		3			2
CO2	2	3			3		2	3		
CO3	3	2			2		3			
CO4	3	3	2		3		3	2		3
CO5	3	3			2		2			
CO6		2						3		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CSE09 **GPU COMPUTING**

L	T	P	C
3	0	0	3

Programme: M.E. Computer Science and Engineering **Sem: - Category: PE**

Aim: To understand about the parallel programming and deep learning concepts.

Course Outcomes: The Students will be able to

CO1: Learn concepts in parallel programming.
CO2: Develop programs on GPUs, debugging and profiling parallel programs.
CO3: Able to synchronize memory management
CO4: Apply graph and deep learning concepts
CO5: Implement pitfalls and event based synchronization techniques
CO6: Able to debug GPU programs

UNIT I **9**

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

UNIT II **9**

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

UNIT III **9**

Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU.

Functions: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.

UNIT IV **9**

Support: Debugging GPU Programs. Profiling, Profile tools, Performance aspects

Streams: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based-Synchronization - Overlapping data transfer and kernel execution, pitfalls.

UNIT V **9**

Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning

Advanced topics: Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing

Total Hours 45

References:

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

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3		3		3			3
CO2	2	2			3		2	3		3
CO3	3	3	2		2		2	2		2
CO4	3	3	2		2		2	2		2
CO5	3	2	3		3		3	3		3
CO6	2	2					3	3		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CSE10 **DIGITAL FORENSICS** **L T P C**
3 0 0 3

Programme: M.E. Computer Science and Engineering **Sem: - Category: PE**

Aim: To gain knowledge about the forensic digital environments.

Course Outcomes: The Students will be able to

CO1: Understand relevant legislation and codes of ethics
CO2: Computer forensics and digital detective and various processes, policies and procedures
CO3: E-discovery, guidelines and standards, E-evidence, tools and environment.
CO4: Email and web forensics and network forensics
CO5: Able to identify crime data and analyze it.
CO6: Use different security tools to identify the crimes.

UNIT I **9**

Digital Forensics Science: Forensics science, computer forensics, and digital forensics.
Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics

UNIT II **9**

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

UNIT III **9**

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

UNIT IV **9**

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

UNIT V **9**

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

Total Hours 45

References:

1. John Sammons, "The Basics of Digital Forensics", 2/e, 2014.
2. John Vacca, "Computer Forensics: Computer Crime Scene Investigation", Laxmi Publications, 2015.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3		2		2		3	2		
CO2	3		2				3	3		2
CO3	3	2	3				2	2		
CO4	2	2	3				2	3		
CO5	2	2	3		3		3	3		3
CO6	3	3					2	3		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CSE11 MOBILE APPLICATION AND SERVICES

L	T	P	C
3	0	0	3

Programme: M.E. Computer Science and Engineering **Sem:** - **Category:** PE

Aim: To provide the knowledge about mobile application and its services.

Course Outcomes: The Students will be able to

CO1: Explore the differences between mobile based application and conventional application

CO2: Design UI in the context of mobile application

CO3: Learn about architecture and developing mobile applications for Android

CO4: Write Android application involving connectivity to database and sensors.

CO5: Learn about the various services of android applications.

CO6: Develop android applications.

UNIT I INTRODUCTION **9**

Brief History of Mobile Software Development - Mobile Web Vs. Mobile App - Hardware and Software for different Mobile frameworks - Difference between Mobile and Desktop applications

UNIT II USER INTERFACE **9**

Mobile Application users - Basic Design principles - Mobile Information Design - Mobile Platforms: Android, IOS, Blackberry OS, Windows Phone

UNIT III APPLICATION DEVELOPMENT FOR ANDROID – I **9**

Android Platform - Different SDKs and their growth - Android Architecture - Android Development Environment Setup - Anatomy of Android Application - Views & Layouts - List View - Adapters - HTTP Connection initiation .

UNIT IV APPLICATION DEVELOPMENT FOR ANDROID – II **9**

Database Integration - Android Preferences - Broadcast Receivers - Content providers - Usage of different sensors –- intent filters

UNIT V SERVICES **9**

Overview of services in Android - Implementing a Service - Service lifecycle - Inter Process Communication (AIDL Services) -Web Services: Consuming web services - Receiving HTTP Response - Telephony Services –developing Apps.

Total Hours 45

References:

1. Wei-Meng Lee, “Beginning Android™ 4 Application Development”, John Wiley & Sons, 2012.
2. Jeff Mc Wherter, Scott Gowell, “ Professional Mobile Application Development” Wrox, 2012.
3. Carmen Delessio, Lauren Darcey, Shane Conder “Teach Yourself Android Application Development in 24 Hours”, 3/e, SAMS publication, 2013.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2		2		3	3		3
CO2			2		3		2	2		3
CO3	3	2	3				2	2		
CO4	2	2		3			3			1
CO5	2	2	3		3		3	3		2
CO6	3	3	2				2	3		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CSE12 **COMPILER FOR HPC** **L T P C**
3 0 0 3

Programme: M.E. Computer Science and Engineering **Sem: - Category: PE**
Aim: To understand the concepts of HPC compiler.
Course Outcomes: The Students will be able to
CO1: Know about compilers and HPC basics
CO2: Use the knowledge of patterns, tokens & regular expressions for solving a problem.
CO3: Use formal attributed grammars for specifying the syntax and semantics of programming languages.
CO4: Design and use the powerful compiler generation tools.
CO5: Apply simple intermediate code optimizations techniques to improve the performance of a program in terms of speed & space.
CO6: Design Parallelizing compiler and HPC programs.

UNIT I – COMPILERS AND PARALLER PLATFORMS **9**

Compilers - Phases of a compiler - Cousins of the Compiler - Compiler construction tools – Lexical Analysis - Role of Lexical Analyzer - Specification and recognition of Tokens. Syntax Analysis – The role of the parser - Context-free grammars - Writing a grammar - Top down parsing - Bottom-up Parsing - LR parsers - Constructing an SLR(1) parsing table-Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing, Organization and Contents of the Text, Parallel Programming Platforms-Parallel programming Compilers.

UNIT II – DESIGN ISSUES OF HPC **9**

Programming Using the Message-Passing Paradigm: Principles of Message Passing Programming, The Building Blocks: Send and Receive Operations, MPI: the Message Passing Interface, Topology and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, One-Dimensional Matrix-Vector Multiplication, Single-Source Shortest-Path, Sample Sort, Groups and Communicators, Two-Dimensional Matrix-Vector Multiplication

UNIT III – INTERMEDIATE CODE GENERATION AND CODE OPTIMIZATION **9**

Intermediate languages - Declarations - Assignment Statements - Boolean Expressions – Case Statements - Back patching - Procedure calls - Introduction to code optimization - Principal Sourcesof Optimization - Optimization of basic Blocks - loops in flow graphs - Peephole optimization -Introduction to Global Data Flow Analysis.

UNIT IV – CODE GENERATION AND PROGRAMMING SYNCHRONIZATION **9**

Issues in the design of a code generator - The target machine - Run-time storage management – Basic blocks and flow graphs - Next-use information - A simple code generator - Register allocation and assignment - The DAG representation of basic blocks - Generating code from DAGs.- Synchronization: Parallel Algorithms onto Parallel Architectures, Performance Analysis of Parallel Algorithms Programming Shared Address Space Platforms: Thread Basics-The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads-OpenMP: a Standard for Directive Based Parallel Programming.

UNIT V – PARALLELIZING COMPILER **9**

Basic concepts and examples - Iteration spaces - Affine array indexes - Data reuse - Array data dependence - Finding synchronization free parallelism - Synchronization between parallel loops - Locality optimizations. Case study: Open source parallelizing compilers- Parallel programming models, Processes and threads, Shared variables Message passing, Parallel Object Oriented languages, Tuple space, Automatic parallelization Introduction to advanced topics – JIT, Dynamic compilation, Interpreters (JVM/Dalvik), Cross compilation using XMLVM, Case studies(self-study): GCC, g++, nmake, cmake. NVCC (case study for parallel compilation), LLVM.

Total Hours 45

References:

1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, "Compilers Principles, Techniques and Tools", Pearson Education Asia, 2003
2. K. Muneeswaran, "Compiler Design", Oxford University Press, 2013
3. Allen I. Holub "Compiler Design in C", Prentice Hall of India, 2003.
4. C.N.Fischer and R. J. LeBlanc, "Crafting a compiler with C", Benjamin Cummings, 2003.
5. J.P. Bennet, "Introduction to Compiler Techniques", TMGH, 2/e, 2003.
6. Kai Hwang, "Advanced Computer Architecture: Parallelism, Scalability, Programmability", McGraw Hill 1993.
7. John J. Donovan "System Programming", Tata McGraw-Hill Edition, 2000.
8. David Culler, Jaswinder Pal Singh, "Parallel Computer Architecture: A Hardware/Software Approach", Morgan Kaufmann, 1999.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1		3	2				3	2		
CO2	3	2					3			
CO3	2	3			3		2			2
CO4	2	3	3				3	3		
CO5	3	2					3	2		
CO6	3	3					2	3		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CSE13 OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

Programme: M.E. Computer Science and Engineering **Sem:** - **Category:** PE

Aim: To provide insight to the mathematical formulation of real world problems.

Course Outcomes: The Students will be able to

CO1: Formulate optimization problems.

CO2: Understand and apply the concept of optimality criteria for various types of optimization problems.

CO3: Solve various constrained and unconstrained problems in Single variable and multivariable.

CO4: Apply the methods of optimization in real life situation.

CO5: Do analysis in real time problems

CO6: Work with various optimization techniques tools.

UNIT I **9**

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

UNIT II **9**

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

UNIT III **9**

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

UNIT IV **9**

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

UNIT V **9**

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

Total Hours 45

References:

1. Laurence A. Wolsey (1998), "Integer programming" Wiley, ISBN 978-0-471-28366-9.
2. Andreas Antoniou, Wu-Sheng Lu, "Practical Optimization Algorithms and Engineering Applications", Springer, 2007
3. Edwin K., P. Chong & Stanislaw h. Zak, "An Introduction to Optimization", John Wiley, 4/e, 2017.
4. Dimitris Bertsimas; Robert Weismantel (2005), "Optimization over integers", Dynamic Ideas", ISBN 978-0-9759146-2-5.
5. John K. Karlof (2006), "Integer Programming: theory and practice", CRC Press. ISBN 978-0-8493-1914-3.
6. H. Paul Williams (2009). Logic and Integer Programming. Springer. ISBN 978-0-387-922799.
7. Michael Jünger; Thomas M. Liebling; Denis Naddef; George Nemhauser; William R. Pulleyblank; Gerhard Reinelt; Giovanni Rinaldi; Laurence A. Wolsey, eds. (2009), "50 Years of Integer Programming 1958-2008: From the Early Years to the State-of-the- Art", Springer. ISBN 978-3-540-68274-5.
8. Der-San Chen; Robert G. Batson; Yu Dang (2010), "Applied Integer Programming: Modeling and Solution", John Wiley and Sons. ISBN 978-0-470-37306-4.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	2			2		3			
CO2	3				3			2		
CO3	2	3			3		2			3
CO4	2	2		2			3			
CO5	2	2					3	2		
CO6	3	3			2		2			3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CSE14 **NETWORK PERFORMANCE AND VULNERABILITY ANALYSIS** **L T P C 3 0 0 3**

Programme: M.E. Computer Science and Engineering **Sem: 3 Category: PE**

Aim: To provide the knowledge about importance of networks and its vulnerabilities.

Course Outcomes: The Students will be able to

CO1: Construct the vulnerability life cycle using available standards and models

CO2: Identify the agents and perform active and passive scanning

CO3: Diagnose the vulnerabilities and their impacts using various testing methods

CO4: Examine the various vulnerability Assessment Tools and its effect in a given network

CO5: Survey with different tools to report detected vulnerabilities and examine their reach of execution

CO6: Examine the Use of Discovery Reports

UNIT I INTRODUCTION **9**

Introduction-VA -life cycle -Origins of VM -Introducing the Security Industry and Its Flaws -Sources of Vulnerabilities -Why VM Is Important -The Vulnerability Creation Process -Risk of Major Financial Loss -Loss of Revenue -Lost Productivity -The VM Program and Technology Development and Roles

UNIT II HARDWARE **9**

The Appliance Model-User-Supplied Hardware and Virtualization-Agents-Agent Architecture-Advantages and Disadvantages-Detection Methods-Passive Network Analysis-Advantages and Disadvantages-Detection Methods-Active Scanning Technology-Advantages and Disadvantages

UNIT III DETECTION METHODS **9**

Discovery -Black Box Testing -White Box Testing-Web Application Testing -Hybrid Approach-Inference Scanning

UNIT IV STANDARDS **9**

CVE-Structure -Limitations of CVE -The Standard for Vulnerability Test Data -Definitions Schema -System Characteristics Schema -Results Schema -The Standard for Vulnerability Severity Rating -CVSS Nomenclature -NVD -CPE -XCCDF -SCAP-VA.

UNIT V TOOLS **9**

Open source tools -NMAP -NMAP commands –NMAP Scripting -Nessus -Advantages and Disadvantages of VA Tools -Scan Modes -Using Nessus –OpenVAS –SCAN Modes -Active Scanner Deployment -Virtual Scanners.

Total Hours 45

References:

1. Park Foremann, “Vulnerability Management”, CRC Press, 2010.
2. Abhishek Singh , Baibhav Singh , Hirosh Joseph, “Vulnerability Analysis and Defence for the Internet”, Springer Science+Business Media, 2008.
3. Thomos Bonold, Mathieu Feuillet, “Network Performance Analysis”, Wiley Publication, 2011.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	3			3		3			3
CO2	2	2	3				2	3		
CO3	3	2					2			2
CO4	2	3					3	2		
CO5	2	3	3		2		2			
CO6		3						3		2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192CSE15 STORAGE AND SERVER SECURITY **L T P C 3 0 0 3**

Programme: M.E. Computer Science and Engineering **Sem: - Category: PE**

Aim: To understand about the cloud storage environments and its security.

Course Outcomes: The Students will be able to

CO1: Critically appraise the opportunities and challenges of information management in complex business environments

CO2: Evaluate information storage management design in a cloud environment and how it relates to the business objectives of an organization

CO3: Investigate how a global storage solution can be optimized so that it can be delivered successfully from the cloud

CO4: Assess the security of virtual systems

CO5: Evaluate the security issues related to multi-tenancy

CO6: Compare modern security concepts as they are applied to cloud computing

UNIT I VIRTUALIZED DATA CENTER ARCHITECTURE **9**

Cloud infrastructures; public, private, hybrid. Service provider interfaces; Saas, Paas, Iaas. VDC environments; concept, planning and design, business continuity and disaster recovery principles. Managing VDC and cloud environments and infrastructures.

UNIT II INFORMATION STORAGE SECURITY & DESIGN **9**

Storage strategy and governance; security and regulations. Designing secure solutions; the considerations and implementations involved. Securing storage in virtualized and cloud environments. Monitoring and management; security auditing and SIEM.

UNIT III OPTIMIZATION OF CLOUD STORAGE **9**

Global storage management locations, scalability, operational efficiency. Global storage distribution; terabytes to petabytes and greater. Policy based information management; metadata attitudes; file systems or object storage.

UNIT IV TECHNOLOGIES FOR VIRTUALIZATION-BASED SECURITY ENHANCEMENT **9**

IBM security virtual server protection, virtualization-based sandboxing; Storage Security-HIDPS, log management, Data Loss Prevention. Location of the Perimeter.

UNIT V MULTI-TENANCY ISSUES **9**

Vulnerabilities- Management console vulnerabilities, management server vulnerabilities, administrative VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities, hypervisor escape vulnerabilities, configuration issues, malware (botnets etc).

Total Hours 45

References:

1. Greg Schulz, “Cloud and Virtual Data Storage Networking”, Auerbach Publications [ISBN: 978-1439851739], 2011.
2. Ronald L. Krutz, Russell Dean Vines, “Cloud Security” [ISBN: 0470589876], 2010.
3. Vmware “VMware Security Hardening Guide” White Paper, June 2011.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1		2	3		3		3	3		
CO2	2	3			2		2	2		3
CO3	3						3			
CO4	2	3	3		3		3	2		
CO5	3	2					3	3		2
CO6	3	3					2	3		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192OE01	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

Programme: M.E. Computer Science and Engineering **Sem:** - **Category:** OE

Aim: To provide the knowledge about business analytics.

Course Outcomes: Students will able to

CO1: Demonstrate knowledge of data analytics.

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

CO3: Use technical skills in predicative and prescriptive modeling to support business decision-making.

CO4: Translate data into clear, actionable insights.

CO5: Understand about the forecasting techniques.

CO6: Do decision analysis, embedded and collaborative business analysis.

UNIT I **9**

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

UNIT II **9**

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

UNIT III **9**

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT IV **9**

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

UNIT V **9**

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

Total Hours 45

References:

1. Marc J. Schniederjans, Dara G.Schniederjans, Christopher M. Starkey, “Business analytics Principles, Concepts, and Applications” Pearson FT Press, 2014.
2. James R. Evans, “Business Analytics”, Pearson Education, 3/e, 2019.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	3					3		3	
CO2	2							3		
CO3	3	2	2				2			3
CO4	3	3			3		3	2		
CO5	3		2				2		2	
CO6	2	3						3		2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192OE02 **INDUSTRIAL SAFETY**

L	T	P	C
3	0	0	3

Programme: M.E. Computer Science and Engineering **Sem:** - **Category:** OE

Aim: To provide the knowledge about safety and preventive measures in industries.

Course Outcomes: The Students will be able to

CO1: Analyze the effect of release of toxic substances
CO2: Understand the industrial laws, regulations and source models.
CO3: Apply the methods of prevention of fire and explosions.
CO4: Understand the relief and its sizing methods.
CO5: Understand the methods of hazard identification and preventive measures.
CO6: Understand about fault tracing and decision trees.

UNIT I **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 **9**

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

UNIT III **9**

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

UNIT IV **9**

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors. Types of faults in machine tools and their general causes.

UNIT V **9**

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

Total Hours: 45

References:

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

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3		3				3		3	
CO2	2	3					2	3		
CO3	3				2		3			
CO4		2	3					2	3	
CO5	3	3					3	3		
CO6	2		3				2		3	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192OE03 **OPERATIONS RESEARCH** **L T P C**
3 0 0 3

Programme: M.E. Computer Science and Engineering **Sem: - Category: OE**
Aim: To understand the concepts of dynamic and nonlinear programming.
Course Outcomes: The Students will be able to
CO1: Apply the dynamic programming to solve problems of discreet and continuous variables.
CO2: Apply the concept of non-linear programming.
CO3: Carry out sensitivity analysis.
CO4: Model the real world problem and simulate it.
CO5: Understand the scheduling and sequencing models.
CO6: Know about graph theory and game theory simulation.

UNIT I **9**
Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT II **9**
Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming.

UNIT III **9**
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

UNIT IV **9**
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT V **9**
Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation.

Total Hours 45

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

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3				3		3	3		2
CO2			2				2			
CO3	2				3			3		
CO4		3						3		2
CO5	3	2					3			
CO6		3			3			2		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192OE04	DESIGN OF EXPERIMENTS	L	T	P	C
		3	0	0	3

Programme: M.E. Computer Science and Engineering **Sem:** - **Category:** OE
Aim: To design the experiments and analyze data collected from experiments
Course Outcomes: The Students will be able to

CO1: Familiarize the fundamentals of design of experiments
CO2: Practice the various tools used in DOE
CO3: Conduct experiments based on factorial design
CO4: Impart the concepts of Taguchi technique
CO5: Apply for product/process optimization
CO6: Analyze the experiments using various methods

FUNDAMENTALS OF DESIGN OF EXPERIMENTS **9**

Basic principles of design of experiment – randomization – replication – interactions - simple comparative experiments - applications of experimental design - barriers in DOE - practical methodology

ANALYTICAL TOOLS OF DOE **9**

Main effects plot - Interactions plots - Cube plots - Pareto plot of factor effects - Normal Probability Plot of factor effects - Response surface plots and regression models - Model building – Analysis of variance

FACTORIAL DESIGNS **9**

Single factor experiments - Latin square designs and extensions –Introduction to factorial designs, two levels, 2^k factorial designs - Fractional factorial designs , two-level, three-level and mixed-level factorials

TAGUCHI APPROACH **9**

Overview of Taguchi approach - common experiments and methods of analysis. Orthogonal array- properties - Degrees of freedom-confidence level and interval – case study exercises.

PARAMETER OPTIMIZATION **9**

Regression models - parameter optimization – single and multi-objective optimization - Response surface methodology – grey relational analysis – complex proportional assessment of alternatives (COPRAS) - case study exercises

Total Hours: 45

References:

1. Douglas C. Montgomery, “Design and Analysis of Experiments”, Wiley, 5/e, 2001.
2. Jiju Antony, “Design of Experiments for Engineers and Scientists”, Elsevier, London, 2/e, 2014.
3. Lennart Eriksson, “ Design of Experiments: Principles and Applications”, Umetrics Academy, Sweden, 2008
4. Oehlert, Gary W. “First Course in Design and Analysis of Experiments”, Freeman Publishers, New York, 2000
5. Ranjit K Roy, Design of Experiments using the Taguchi Approach, John Wiley & sons, Inc., 2001

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3						2			
CO2						3		3	3	
CO3	2								3	
CO4					3					2
CO5			3						3	
CO6	2								3	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192OE05 **COMPOSITE MATERIALS** **L T P C**
3 0 0 3

Programme: M.E. Computer Science and Engineering **Sem: - Category: OE**
Aim: To understand about the design of composite materials.
Course Outcomes: The Students will be able to
CO1: Identify the properties of fiber reinforcements, polymer matrix materials.
CO2: Develop competency in one or more common composite manufacturing techniques.
CO3: select the appropriate technique for manufacture of fiber-reinforced composite products
CO4: Analyze the elastic properties and simulate the mechanical performance of composite laminates; and understand and predict the failure behavior of fiber-reinforced composites
CO5: Apply knowledge of composite mechanical performance and manufacturing methods to a composites design project
CO6: Critique and synthesize literature and apply the knowledge gained from the course in the design and application of fiber-reinforced composites.

UNIT I **9**

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

UNIT II **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 **9**

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

UNIT IV **9**

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

UNIT V **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.

Total Hours 45

Text Books:

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

References:

1. Lubin, “Hand Book of Composite Materials”, Van Nostrand Reinhold, New York, 1982
2. Deborah D.L. Chung, “Composite Materials Science and Applications”, Springer, 2/e, 2010
3. Danial Gay, Suong V.Hoa, &Stephen W. Tasi, “Composite Materials: Design and Applications”, CRC Press, 2002.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3						3	3		
CO2	2	2	3		2			3		
CO3	3						2			2
CO4		3						2		
CO5	2			2	2		3			
CO6		3	2					2		3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192OE06 COST MANAGEMENT OF ENGINEERING PROJECTS **L T P C 3 0 0 3**

Programme: M.E. Computer Science and Engineering **Sem: - Category: OE**

Aim: To provide the knowledge about Project management.

Course Outcomes: The Students will be able to

CO1: Understand the strategic cost management process.
CO2: Know the different types of projects and its stages.
CO3: Understand the concepts of pricing strategies and requirement planning.
CO4: Understand about marginal costing and resource planning.
CO5: Know about the activity based cost management.
CO6: Understand the quantitative cost management techniques.

UNIT I **9**

Introduction and Overview of the Strategic Cost Management Process 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 execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical 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 III **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.

UNIT IV **9**

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.

Total Hours 45

References:

1. Charles T. Horngren, Srikant M. Datar, Madhav V.Rajan, “Cost Accounting A Managerial Emphasis”, Pearson Education, 2015
2. Robert S Kaplan Anthony A. Alkinson, “Advanced Management Accounting”, Pearson; 3/e, 1998.
3. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting”, A. H. Wheeler publisher.
4. N.D. Vohra, “Quantitative Techniques in Management”, Tata McGraw Hill Book Co. Ltd.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	2					3	3		2
CO2	2	3			2		2			
CO3	3		3					3		3
CO4	3	3			2			3		
CO5			2				2			
CO6	2	3					3	3		2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192OE07 **WASTE TO ENERGY**

L	T	P	C
3	0	0	3

Programme: M.E. Computer Science and Engineering **Sem: - Category: OE**

Aim: To understand about the management of waste and producing energy.

Course Outcomes: The Students will be able to

CO1: Explain the aims of water and wastewater treatment

CO2: Explain the importance of drinking water and discharge standards.

CO3: Identify and explain the main physical, chemical and biological processes for water and wastewater treatment.

CO4: Explain and use the main design criteria for water and wastewater treatment processes.

CO5: Design basic treatment processes.

CO6: Develop treatment plant layouts.

UNIT I **9**

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT II **9**

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

UNIT III **9**

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

UNIT IV **9**

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

UNIT V **9**

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Total Hours 45

References:

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

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	2			2		2	2		
CO2			2				2			3
CO3	2	3					3			
CO4	2	3	3		3		3	3		2
CO5	3	2					2			
CO6	3	3						3		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192OE08	NANOMATERIALS AND NANOTECHNOLOGY	L	T	P	C
		3	0	0	3

Programme: M.E. Computer Science and Engineering **Sem:** - **Category:** OE

Aim: To design the experiments and analyze data collected from experiments

Course Outcomes: The Students will be able to

CO1: Acquire the knowledge of the representatives of Nano particles and Characteristic techniques of nanomaterials.

CO2: Be familiar with new trends in engineering, namely nanotechnology and nanofabrication.

CO3: Be familiar with the applications of nanotechnology and nanofabrication in modern industries.

CO4: Get the knowledge in the field of nanotechnology and nanomaterials.

CO5: Practice the Nano electronics.

CO6: Familiarize Nano heat transfer.

ZERO – DIMENSIONAL NANOSTRUCTURES **9**

Nanoparticles through homogenous nucleation, nanoparticles through the heterogeneous nucleation, kinetically confined synthesis of nanoparticles, epitaxial core – shell nanoparticles. One Dimensional Nanostructure-Nanowires And Nanorods: Spontaneous growth, template based synthesis, electro spinning, and lithography.

TWO-DIMENSIONAL NANOSTRUCTURES-THIN FILMS **9**

Fundamentals of film growth, vacuum science, physical vapor deposition (PVD), Chemical Vapor Deposition(CVD), Atomic Layer Deposition (ALD), Electrochemical Deposition, Sol-Gel films.

NANOSTRUCTURES FABRICAITON **9**

Lithography, nano manipulation and nanolithography, soft lithography, assembly of nanoparticles and nanowires, other methods of micro fabrication, Scanning Electron Microscope. Nanomechanics: A high speed review of motion: Displacement, velocity, acceleration and force, nanomechanical oscillation, feeling faint forces.

NANO ELECTRONICS: ELECTRON ENERGY BANDS, ELECTRONS IN SOLIDS **9**

Conductors, insulation and semi-conductors, fermi energy, the density of states for solids, quantum confinement, tunneling, single electron phenomenon, molecular electronics. Nanophotonics: Photonics properties of nanomaterials, near-field light, optical tweezers, photonic crystals.

NANO SCALE HEAT TRANSFER **9**

Nanoscale heat, conduction, convection, radiation. Nanoscale Fluid Mechanics: Fluids at the nanoscale: major concepts, flow fluids flow at the nanoscale, applications of nanofludics.

TOTAL : 45 PERIODS

REFERENCE BOOKS

1. Ben Rogers, Pennathur, Adams, “Nanotechnology: Understanding Small System”, CRC Press, 2008.
2. Bhushan, Bharat (Ed.) “Handbook of Nanotechnology”, Springer 2006.
3. Guozhong Cao, “Nanostructures and Nanomaterials”, Imperial College Press, 2006.
4. Lundstrom, Mark, Guo, Jing, “Nanoscale transistors, Device physics, modeling and simulation”, Springer,2006.
5. Yury Gogotsi, “Nanomaterials Handbook”, Drexel University, Philadelphia, Pennsylvania, USA, 2006.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3						3			
CO2	3							3	2	
CO3	3							3	2	
CO4	2			2			2			
CO5					3	3			3	2
CO6		3			3	2				3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192AC01 **CONSTITUTION OF INDIA** **L T P C**
2 0 0 0

Programme: M.E. Computer Science and Engineering **Sem: - Category: MC**

Course Outcomes: The Students will be able to

CO1: Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.

CO2: Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role

CO3: Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

CO4: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

CO5: Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

CO6: Discuss the passage of the Hindu Code Bill of 1956.

UNIT I **6**

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

UNIT II **6**

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

UNIT III **6**

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

UNIT IV **6**

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

UNIT V **6**

Election Commission: Election Commission: Role and Functioning - Chief Election Commissioner and Election Commissioners - State Election Commission: Role and Functioning - Institute and Bodies for the welfare of SC/ST/OBC and women.

Total Hours 30

References:

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

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1				3						3
CO2						2			2	3
CO3				2						3
CO4				2						3
CO5				3						2
CO6				1						2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192AC02 **DISASTER MANAGEMENT** **L T P C**
2 0 0 0

Programme: M.E. Computer Science and Engineering **Sem: - Category: MC**

Course Outcomes: The Students will be able to

CO1: Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

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

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

CO4: Critically understand the strengths and weaknesses of disaster management approaches.

CO5: Plan and programming according to the situation.

CO6: Identify risk and mitigation during the time of disaster.

UNIT I **6**

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

UNIT II **6**

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

UNIT III **6**

Disaster Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards With Special Reference to Tsunami; Post-disaster Diseases and Epidemics.

UNIT IV **4**

Disaster Preparedness and Management: Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community preparedness.

UNIT V **8**

Risk Assessment and Disaster Mitigation: 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. Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation.

Total Hours 30

References:

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

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1										
CO2										
CO3							1			
CO4										
CO5	3		2		2	3	3	3		
CO6				3					2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192AC03 ENGLISH FOR RESEARCH PAPER WRITING

L	T	P	C
2	0	0	0

Programme: M.E. Computer Science and Engineering **Sem:** - **Category:** MC

Course Outcomes: The Students will be able to

CO1: Understand that how to improve their writing skills and level of readability.

CO2: Learn about what to write in each section.

CO3: Understand the skills needed when writing a paper.

CO4: Learn to get key points from different survey papers.

CO5: Analyze the results with the existing papers.

CO6: Ensure the good quality of paper at very first-time submission.

UNIT I **6**

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

UNIT II **6**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction, Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT III **4**

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

UNIT IV **6**

Skills needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion,

UNIT V **8**

Skills needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Total Hours 30

References:

1. Goldbort R, “Writing for Science”, Yale University Press, 2006 (available on Google Books).
2. Day R, “How to Write and Publish a Scientific Paper”, Cambridge University Press, 2006.
3. Highman N, “Handbook of Writing for the Mathematical Sciences”, SIAM. Highman’sbook, 1998.
4. Adrian Wallwork, “English for Writing Research Papers”, Springer New York Dordrecht Heidelberg London, 2011.

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1		3					2	2		
CO2		3								
CO3		3							3	
CO4		3								3
CO5	2						1		3	
CO6		3								

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192AC04 SANSKRIT FOR TECHNICAL KNOWLEDGE

L	T	P	C
2	0	0	0

Programme: M.E. Computer Science and Engineering **Sem: - Category: MC**

Aim: To get knowledge in illustrious Sanskrit, the scientific language in the world.

Course Outcomes: The Students will be able to

CO1: Understanding basic Sanskrit language

CO2: Ancient Sanskrit literature about science & technology can be understood

CO3: develop logic using Sanskrit which is a logical language

CO4: Enhancing the memory power

CO5: Improve brain functioning

CO6: Explore the huge knowledge from ancient literature

UNIT I **10**

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

UNIT II **10**

- Order
- Introduction of roots
- Technical information about Sanskrit Literature

UNIT III **10**

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

Total Hours 30

References:

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

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1				1			1			
CO2	1		2				1			
CO3							2			
CO4				3				1		
CO5										
CO6										2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192AC05 **VALUE EDUCATION** **L T P C**
2 0 0 0

Programme: M.E. Computer Science and Engineering **Sem: - Category: MC**
Aim: To bring the practices of keeping ethics and moral values for society.
Course Outcomes: The Students will be able to
CO1: Obtain the knowledge of self-development.
CO2: Learn the importance of Human values.
CO3: Develop their overall personality.
CO4: Develop a healthy relationship
CO5: Aware of self-destructive habits
CO6: Kind enough with closed ones.

UNIT I **6**
Values and self-development - Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments.

UNIT II **6**
Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity, Patriotism. Love for nature, Discipline.

UNIT III **6**
Personality and Behavior Development - Soul and Scientific attitude -Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger,

UNIT IV **6**
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 V **6**
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.

Total Hours 30

References:

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

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2		1				1			2
CO2				3						3
CO3										
CO4				3						3
CO5				2						2
CO6				2						1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192AC06 **PEDAGOGY STUDIES** **L T P C**
2 0 0 0

Programme: M.E. Computer Science and Engineering **Sem: - Category: MC**

Course Outcomes: The Students will be able to

CO1: Understand what pedagogical practices are being used by teachers in formal and informal classrooms

CO2: Understand what is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners

CO3: Understand how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy

CO4: Review existing evidence on the review topic to inform programme design.

CO5: Review policy making undertaken by the DfID, other agencies and researchers.

CO6: Identify critical evidence gaps to guide the development.

UNIT I **6**

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

UNIT II **6**

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

UNIT III **6**

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

UNIT IV **6**

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

UNIT V **6**

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

Total Hours 30

References:

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

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2					3	1		2	
CO2						2			2	
CO3						2			2	
CO4					2		2			
CO5			2			2			3	
CO6	1									1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192AC07 **STRESS MANAGEMENT BY YOGA** **L T P C 2 0 0 0**

Programme: M.E. Computer Science and Engineering **Sem:** - **Category:** MC

Aim: To overcome stress and to maintain good health.

Course Outcomes: The Students will be able to

CO1: Demonstrate basic skills associated with yoga activities including strength and flexibility, balance and coordination.

CO2: Demonstrate the ability to perform yoga movements in various combination and forms.

CO3: Demonstrate an understanding of health-related fitness components.

CO4: Demonstrate an understanding of health problems associated with inadequate fitness levels.

CO5: Demonstrate an understanding of sound nutritional practices as related to health and physical performance.

CO6: Demonstrate the ability to create and present various yoga sequences.

UNIT I **10**

Definitions of Eight parts of Yoga. (Ashtanga)

UNIT II **10**

Yam and Niyam.

- Do`s and Don'ts in life.
  - i. Ahinsa, satya, astheya, bramhacharya and aparigraha
  - ii. Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT III **10**

Asan and Pranayam

- Various yog poses and their benefits for mind & body
- Regularization of breathing techniques and its effects-Types of pranayam

Total Hours 30

References:

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

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1			2							2
CO2	2									2
CO3				1						2
CO4				1						2
CO5				1						1
CO6					2		2			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

192AC08 **PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS** **L T P C 2 0 0 0**

Programme: M.E. Computer Science and Engineering **Sem: - Category: MC**

Aim: To become a person with stable mind, pleasing personality and determination

Course Outcomes: The Students will be able to

CO1: Learn to achieve the highest goal happily

CO2: Become a person with stable mind, pleasing personality and determination

CO3: Awake wisdom in them

CO4: Develop their personality by studying Shrimad-Bhagwad-Geeta.

CO5: Develop their versatile personality by studying Neetishatakam.

CO6: Achieve the highest goal in life by studying Shrimad-Bhagwad-Geeta.

UNIT I **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)

UNIT II **10**

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

Total Hours 30

References:

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

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	1						1			
CO2				2						2
CO3	2									2
CO4				1						2
CO5				1						2
CO6				2						2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)