Dr. M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
DEEMED TO BE UNIVERSITY
University with Graded Autonomy Status
(An ISO 21001 : 2018 Certified Institution)
Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

FACULTY OF ENGINEERING AND TECHNOLOGY

OUTCOME BASED EDUCATION

CURRICULUM AND SYLLABUS

(2022 Regulation)

MASTER OF TECHNOLOGY

COMPUTER SCIENCE AND ENGINEERING

FULL TIME

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DEPARTMENT VISION

To become a Premier Institution of Excellence in Computer Science and Engineering that would develop self-sustaining and globally competent Computer Science and Information Technology Professionals.

DEPARTMENT MISSION

M1. Enable students and faculty with the best of Technologies and Knowledge emerging in the domain of Computer Science and Engineering.
M2. Equip the department laboratories with the power of in-demand Technologies and Software for the On-Demand Industry.
M3. Share and Collaborate knowledge across the IT Industries for holistic development of skilled and talented students.
M4. Impart the students with Ethical values, Critical thinking and Broad based computational skills, to enable students to become Entrepreneurs.
M5. Motivate the students to comprehend problems across Inter Disciplinary Domains and offer innovative solution using ICT.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO1: To pursue higher studies with profound knowledge enriched with academia and industrial skill sets.

PEO2: To excel in their professional career with expertise in providing solutions to Information Technology problems.

PEO3: Leadership and participation in teams that act as change agents and innovators in product design and manufacturing related organizations.

PEO4 : To exhibit adaptive and agile skills in the core area of Information Science & Engineering to meet the technical and managerial challenges.

PROGRAMME OUTCOMES

PO1. An understanding of the theoretical foundations and the limits of computing.

PO2. An ability to adapt existing models, techniques, algorithms, data structures, etc. for efficiently solving problems.

PO3. An ability to design, develop and evaluate new computer based systems for novel applications which meet the desired needs of industry and society.

PO4. Understanding and ability to use advanced computing techniques and tools.

PO5. An ability to undertake original research at the cutting edge of computer science & its related areas.

PO6. An ability to function effectively individually or as a part of a team to accomplish a stated goal.

PO7. An understanding of professional and ethical responsibility.

PO8. An ability to communicate effectively with a wide range of audience.

PO9. An ability to learn independently and engage in lifelong learning.

PO10. An understanding of the impact of IT related solutions in an economic, social and environment context.

PROGRAM SPECIFIC OUTCOMES

PSO1: Ability to analyze software product, design and develop computer programs in domain of computer science for efficient design of computer based system of varying complexity.

PSO2: Ability to take up higher studies, employability, research and development and entrepreneurship in the field of computer science and engineering.

Mapping of Mission With PEOs

Mission/PEOs	PEO1	PEO2	PEO3	PEO4
M1	1	3	2	3
M2	2	2	1	3
M3	3	2	3	2
M4	2	1	2	3
M5	3	2	1	2

Mapping of PEOs With POs

PEO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
PEO1	2	2	3	3	3	2	1	1	1	2
PEO2	3	3	3	2	2	1	2	2	1	2
PEO3	2	2	3	2	1	2	2	3	1	2
PEO4	2	3	2	1	2	2	2	1	2	2

Mapping of PEOs with PSOs

PEO/PSO	PSO1	PO2
PEO1	2	3
PEO2	2	2
PEO3	2	3
PEO4	3	2

Correlation Strength :- 3: High , 2: Medium , 1 : Low

M.Tech – Computer Science and Engineering (Full Time)

Curriculum and Syllabus 2022 Regulation
To be implemented from 2022-2023 Batch

	I SEMESTER							
S.No	Sub.Code	Title of Subject	Ty/Lb/ETL	Teaching Scheme				Category
				L	T/S.Lr	P/R	C	
1	EMMA22007	Applied Mathematics for Computer Engineers	Ty	3	1/0	0/0	4	BS
2	EMCS22001	Advanced Data Structure and Algorithms	Ty	3	1/0	0/0	4	PC
3	EMCS22EXX	Program Elective-1	Ty	3	0/0	0/0	3	PE
4	EMCS22EXX	Program Elective-2	Ty	3	0/0	0/0	3	PE
5	EMCS22L01	Advanced Data Structures and Algorithms Lab	Lb	0	0/0	4/0	2	PC
6	EMCS22ELX	Elective Lab 1	Lb	0	0/0	4/0	2	PC
7	EMCC22001	Research Methodology and IPR	Ty	3	0/0	0/0	3	BS
8	EMCC22IXX	Audit Course I	IE	2	0/0	0/0	0	IE
		Total		17	2	8	21	

	II SEMESTER							
S.No	Sub.Code	Title of Subject	Ty/Lb/ETL	Teaching Scheme				Category
				L	T/S.Lr	P/R	C	
1	EMCS22002	Advanced Operating System	Ty	3	1/0	0/0	4	PC
2	EMCS22003	Advanced Computer Architecture	Ty	3	0/0	0/0	3	PC
3	EMCS22EXX	Program Elective-3	Ty	3	0/0	0/0	3	PE
4	EMCS22EXX	Program Elective-4	Ty	3	0/0	0/0	3	PE
5	EMCS22L02	Advanced Operating System Lab	Lb	0	0/0	4/0	2	PC
6	EMCS22ELX	Elective Lab 2	Lb	0	0/0	4/0	2	PC
7	EMCC22IXX	Audit Course II	IE	2	0/0	0/0	0	IE
8	EMCS22I01	Term Paper	IE	0	0/0	0/4	2	PC
		Total		14	1	12	19	

L : Lecture T : Tutorial S.Lr : Supervised Learning P: Practical R : Research C : Credits
Ty/Lb/ETL : Theory / Lab / Embedded Theory and Lab

III SEMESTER								
S.No	Sub.Code	Title of Subject	Ty/LB/ETL	Teaching Scheme				Category
				L	T/S.Lr	P/R	C	
1	EMCS22004/ EMCF22003	Steganography and Digital Watermarking	Ty	3	0/0	0/0	3	PC
2	EMCS22EXX	Program Elective-5	Ty	3	0/0	0/0	3	PE
3	EMOL22I01	Open Elective (NPTEL/SWAYAM/ Any MOOC online approved by AICTE & UGC)	IE	3	0/0	0/0	3	ID
4	EMCS22L03	Dissertation Phase I	Lb	0	0/0	0/10	5	P
5	EMCS22I02	Summer Internship	IE	0	0/0	4/0	2	P
		Total		9	**0**	14	**16**	

IV SEMESTER								
S.No	Sub.Code	Title of Subject	Ty/LB/ETL	Teaching Scheme				Category
				L	T/S.Lr	P/R	C	
1	EMCS22L04	Dissertation Phase II	Lb	0	0/0	10/10	10	P
2	EMCS22I03	Research Publication	IE	0	0/0	2/2	2	PC
		Total		**0**	**0**	24	**12**	

Summary of Credits:

Semester	Credits
I	21
II	**19**
III	**16**
IV	**12**
TOTAL	**68**

Program Elective I								
S.No	**Sub.Code**	**Title of Subject**	**Ty/Lb/ETL**	**L**	**T/S.Lr**	**P/R**	**C**	**Category**
1	EMCS22E01	Advanced Data Science	Ty	3	0/0	0/0	3	PE
2	EMCS22E02	Machine Learning	Ty	3	0/0	0/0	3	PE
3	EMCS22E03	Formal Languages and Automata	Ty	3	0/0	0/0	3	PE

Program Elective II								
S.No	**Sub.Code**	**Title of Subject**	**Ty/Lb/ETL**	**L**	**T/S.Lr**	**P/R**	**C**	**Category**
1	EMCS22E04	Human Computer Interaction	Ty	3	0/0	0/0	3	PE
2	EMCS22E05	Data Visualization Techniques	Ty	3	0/0	0/0	3	PE
3	EMCF22E06/ EMCS22E06	IOT and its Applications	Ty	3	0/0	0/0	3	PE
4	EMCF22E07/ EMCS22E07	Ethical Hacking	Ty	3	0/0	0/0	3	PE

Program Elective III								
S.No	**Sub.Code**	**Title of Subject**	**Ty/Lb/ETL**	**L**	**T/S.Lr**	**P/R**	**C**	**Category**
1	EMCS22E08	Optimization Techniques	Ty	3	0/0	0/0	3	PE
2	EMCS22E09	Advanced Computer Networks	Ty	3	0/0	0/0	3	PE
3	EMCS22E10	Natural Language Processing	Ty	3	0/0	0/0	3	PE
4	EMCF22E11/ EMCS22E11	Edge Computing	Ty	3	0/0	0/0	3	PE

Program Elective IV								
S.No	**Sub.Code**	**Title of Subject**	**Ty/ Lb/ ETL**	**L**	**T/S. Lr**	**P/R**	**C**	**Category**
1	EMCS22E12	Data Preparation and Analysis	Ty	3	0/0	0/0	3	PE
2	EMCS22E13	Network Security	Ty	3	0/0	0/0	3	PE
3	EMCS22E14/ EMCF22001	Digital Forensics and Cybercrime Investigation	Ty	3	0/0	0/0	3	PE

Program Elective V								
S.No	**Sub.Code**	**Title of Subject**	**Ty/Lb/ETL**	**L**	**T/S.Lr**	**P/R**	**C**	**category**
1	EMCS22E15/ EMCF22E15	Malware Analysis	Ty	3	0/0	0/0	3	PE
2	EMCS22E16	Advanced Cloud Computing	Ty	3	0/0	0/0	3	PE
3	EMCS22E17	Game Theory	Ty	3	0/0	0/0	3	PE
4	EMCF22E18/ EMCS22E18	Block Chain Technology	Ty	3	0/0	0/0	3	PE

Program Elective Lab I								
S.No	**Sub.Code**	**Title of Subject**	**Ty/Lb/ETL**	**L**	**T/S.Lr**	**P/R**	**C**	**Category**
1	EMCS22EL1	Advanced Data Science Lab	Lb	0	0/0	4/0	2	PE
2	EMCS22EL2	Machine Learning Lab	Lb	0	0/0	4/0	2	PE
3	EMCS22EL3	Formal Languages and Automata Lab	Lb	0	0/0	4/0	2	PE

Program Elective Lab II								
S.No	**Sub.Code**	**Title of Subject**	**Ty/Lb/ETL**	**L**	**T/S.Lr**	**P/R**	**C**	**Category**
1	EMCS22EL4	Data Preparation and Analysis Lab	Lb	0	0/0	4/0	2	PE
2	EMCS22EL5	Network Security Lab	Lb	0	0/0	4/0	2	PE
3	EMCS22EL6/ EMCF22L01	Digital Forensics and Cybercrime Investigation Lab	Lb	0	0/0	4/0	2	PE

Audit course I&II								
S.No	**Sub.Code**	**Title of Subject**	**Ty/Lb/IE**	**L**	**T/S.Lr**	**P/R**	**C**	**Category**
1	EMCC22I01	English for Research Paper Writing	IE	2	0/0	0/0	0	IE
2	EMCC22I02	Disaster Management	IE	2	0/0	0/0	0	IE
3	EMCC22I03	Sanskrit for Technical Knowledge	IE	2	0/0	0/0	0	IE
4	EMCC22I04	Value Education	IE	2	0/0	0/0	0	IE
5	EMCC22I05	Constitution of India	IE	2	0/0	0/0	0	IE
6	EMCC22I06	Pedagogy Studies	IE	2	0/0	0/0	0	IE
7	EMCC22I07	Stress Management by Yoga	IE	2	0/0	0/0	0	IE
8	EMCC22I08	Personality Development through life Enlightenment Skills	IE	2	0/0	0/0	0	IE
9	EMCC22I09	Research Publication Ethics	IE	2	0/0	0/0	0	IE

Table 1: Credit Distribution

S. No	CATEGORY	Description	No.of Courses	Credits	Total	Credit Weightage (%)	Contact Hours
1	CORE COURSES	Core Theory	4	14	18	26	210
		Core Lab	2	4			120
2	ELECTIVE COURSES	Program Elective Theory	5	15	19	28	225
		Program Elective Lab	2	4			120
3	OPEN ELECTIVES	Open Elective theory	1	3	3	5	45
4	INTERDISCIPLINARY/ ALLIED COURSES	Theory	-	-	-	-	-
		Lab	-	-			-
5	HUMANITIES & SOCIAL SCIENCES , LIFE SKILLS &SOFT SKILLS	Language 1 & 2	-	-	-	-	-
		English 1 & 2	-	-			-
		Soft Skills	-	-			-
		Life Skill	-	-			-
		Foreign Language					-
		Environmental Studies	-	-			-
		Management Papers	-	-			-
		Entrepreneurship Development	-	-			-
6	PROJECTS/INTERNSHIP/ CORE SKILL	Project/term paper/Publication	4	19	24	35	60
		Research Methodology	1	3			45
		Internship / NSS / NCC	1	2			30
7	Audit course		2	0	0		60
8	ANY OTHER	Applied Mathematics	1	4	4	6	60
Total			**21**	**68**	**68**	**100**	**975**

Table 2: Revision/modification done in syllabus content:

S.No	Course(Subject) Code	Course (Subject) Name	Concept/topic if any, removed in current curriculum	Concept/topic added in the new curriculum	% of Revision/ Modification done
1	MCS22C001	Advanced Operating System	Real time and Mobile OS and Case study is removed	Protection and Security , database OS is included	40
2	MCS22C002	Advanced Data Structure and Algorithms	Matroids and graph Matching is removed	Text Processing operations and Graph Algorithms are included	50
3	MCS22C003	Advanced Computer Architecture	SIMD and MIMD architecture is removed	Thread and Data level parallelism is included	40
4	MCS22CE09	Advanced Computer Networks	Fundamentals of computer network is removed	5G Network and Routing protocols are included	70
5	MCS22CE01	Advanced Data Science	Theoretical Concepts are removed	Data Handling and Visualization tools are included	60
6	MCS22CE12	Data Preparation and Analysis	Basic concepts are removed	Essentials of Big data platform is included.	40
7	MCS22CE14	Digital Forensics and Investigation	Fundamental concepts are removed	Digital evidence and Investigation is included	60

Table3: List of New courses/ value added courses//life skills/Electives/interdisciplinary /courses focusing on employability/entrepreneurship/skill development.

S.No	New courses (Subjects)	Value added courses	Life skill	Electives	Inter Disciplinary	Focus on employability/Entrepreneurship/skill development.
1	-	-	-	Machine Learning	-	
2	-	-	-	IoT and Its Application	-	
3	-	-	-	Ethical Hacking	-	
4	-	-	-	Data Visualization techniques	-	
5	-	-	-	Edge Computing	-	
6	-	-	-	Malware Analysis	-	
7	-	-	-	Advanced Cloud Computing	-	
8	-	-	-	Block Chain Technology	-	

Semester I

Subject Code	Subject Name : APPLIED MATHEMATICS FOR COMPUTER ENGINEERS	Ty/Lb/ETL	L	T/S.Lr	P/R	C
EMMA22007	Pre Requisite : Engineering Mathematics	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES The Students should be made to

- Apply the Basic concepts in Algebra
- Use the Basic concepts in Regular Expressions
- Identify and solve problems in Automata Theory
- Understand the Basic concepts of Interpolation
- Apply the Basic concepts in Numerical integration

COURSE OUTCOMES (Cos)
after completing this course the student will be able to

CO1	Demonstrate the knowledge of Basic concepts of Mathematics science & Engineering mathematics (L1,L2,L3)
CO2	Calculate the required parameters using basic mathematical principles, and formulae (L2,L3,L4).
CO3	Apply mathematical techniques to solve problems (L2,L3,L4)
CO4	Examine the relevant graphs, and techniques to provide solutions(L1,L2,L3,L4)
CO5	Examine the trees and properties to use real time problems for accurate results(L3,L4)

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	1	1	2	2	1	-	3	3
CO2	3	3	1	2	3	1	1	-		1
CO3	3	3	2	2	3	2	1	-	2	3
CO4	3	3	2	2	1	2	1	1	2	3
CO5	3	3	2	2	2	2	1	1	2	2

COs/PSOs	PSO1	PSO2
CO1	1	3
CO2	1	3
CO3	2	3
CO4	2	3
CO5	2	3

3/2/1 Indicates Strength of Correlation, 3 – High, 2- Medium, 1- Low

	Basic Sciences			Program Core		Open Elective		Internships/Technical Skills	Soft Skills
	√								

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMMA22007	APPLIED MATHEMATICS FOR COMPUTER ENGINEERS	Ty	3	1/0	0/0	4

UNIT I ALGEBRAIC STURCTURES (12 hrs)

Groups (Definition and Examples) – Subgroups – Permutation groups – Homomorphism –Kernel – Cosets – Lagrange‟s theorem – Rings – Fields (Definition and Examples).

UNIT II FORMAL LANGUAGES (12 hrs)

Regular expressions– Grammars – Context sensitive grammar – Context free grammar – Derivation trees – Finite state machine.

UNIT III AUTOMATA THEORY (12 hrs)

Finite State Automata(FSA) – Deterministic FSA – Non-Deterministic FSA – Push Down Automata – Turing machine.

UNIT IV INTERPOLATION (12hrs)

Newton forward and backward differences – Central differences – Stirling's and Bessel's formulae – Interpolation with Newton's divided differences – Lagrange‟s method.

UNIT NUMERICAL DIFFERENTIATION AND INTEGRATION (12 hrs)

Numerical differentiation with interpolation polynomials – Numerical integration by Trapezoidal and Simpson's (both 1/3 rd & 3/8 th) rules – Two and three point Gaussian Quadrature formulae – Double integrals using Trapezoidal and Simpson's rules.

Total : 60Hrs

Reference Books:

1. Tremblay J.P., Manohar R., *Discrete Mathematical structures with applications to Computer science*, Tata McGraw Hill Publishing Co., (2016).
2. Kenneth Rosen, *Discrete Mathematics and its applications (SIE)*, Tata McGraw Hill Publishing Co., (2018).
3. John C. Martin, *Introduction to languages and the theory of computation (3rd ed.)*, Mcgraw Hill, (2018).
4. Hopcroft J.E., Ullman J.D., *Introduction to Automata theory, Languages and Computation*, Narosa Publishing house, (2016).
5. Veerarajan T., *Numerical Methods*, Tata McGraw Hill Publishing Co., (2018).

Subject Code: EMCS22001	Subject Name : ADVANCED DATA STRUCTURES AND ALGORITHMS	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: Data Structure	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn the mathematical basics and various notations to analyze the complexities of Algorithms.
- To understand the various sorting techniques and tree data structure.
- To understand and analyze the various Text Processing operations and their performances.
- To analyze and understand graph data structures and their applications.
- To understand the performance of polynomial time and NP-Completeness.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Demonstrate various algorithm notations and algorithm correctness.
CO2	Construct various applications based on sorting and tree data structure.
CO3	Experiment with the performance of various Text Processing operations.
CO4	Apply graph data structures to the real time applications.
CO5	Illustrate the performance of the polynomial time algorithm

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	2	2	1	2	2	2	2	1	2
CO2	1	2	2	2	2	2	2	2	3	2
CO3	2	3	3	1	3	3	3	2	3	1
CO4	2	3	3	1	3	3	3	2	3	2
CO5	3	3	3	1	3	3	3	3	2	1
	2	2	2	1	2	2	2	2	1	2

COs / PSOs	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	3
CO4	3	3
CO5	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
				✓					

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMCS22001	ADVANCED DATA STRUCTURES AND ALGORITHMS	Ty	3	1/0	0/0	4

UNIT I ALGORITHM NOTATIONS AND REPRESENTATION (12 Hrs)

Mathematical Induction - Asymptotic Notations – Algorithm Analysis - NP-Hard and Completeness – Recurrence Equations – Solving Recurrence Equations – Memory Representation of Multi-dimensional Arrays — Time-Space Tradeoffs.

UNIT II SORTING AND TREES (12 Hrs)

Heapsort – Quicksort – Topological sort - Sorting in Linear Time – Elementary Data Structures – Hash Tables – Hash Functions- Binary Search Trees – AVL Trees – Red Black trees – Multi-way Search Trees

–B-Trees- Fibonacci Heaps – van Emde Boas Trees – Data Structures for Disjoint Sets.

UNIT III TEXT PROCESSING OPERATIONS (12 Hrs)

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

UNIT IV GRAPH ALGORITHMS (12 Hrs)

Elementary graph Algorithms – Minimum Spanning Trees – Single Source Shortest Paths- All PairsShortest Paths – Maximum Flow - Multithreaded Algorithms – Matrix Operations.

UNIT V LINEAR PROGRAMMING (12 Hrs)

Linear programming – Polynomials and Fast Fourier Transform – Number Theoretic Algorithms –Computational Geometry –NP-Completeness – Approximation Algorithms.

Total : 60 Hrs

Text Books

1. Thomas H. Coreman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction toAlgorithms", PHI, Third Edition, 2016.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education, SecondEdition, 2004.
3. Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, Computational Geometry:Algorithms and Applications, Springer, Third edition, 2008.

Reference Books

1. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, "Data Structures and Algorithms", Addison Wesley, Fifth Edition, 2017.
2. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss,Addison-Wesley Publishing Company, Sixth Edition, 2016.
3. Narasimha karumanchi, Data Structures and algorithms made easy, Fifth Edition, 2017.
4. E. Horowitz, S.Sahni and Dinesh Mehta, "Fundamentals of Data structures in C++", University Press,Fourth Edition, 2007.
5. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, Second Edition, 2002.

Subject Code	Subject Name : ADVANCED DATA STRUCTURES AND ALGORITHMS LAB	Ty/Lb/ETL	L	T/S.Lr	P/R	C
EMCS22L01	Pre Requisite: Nil	Lb	0	0/0	4/0	2

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES The Students should be made to

- To strengthen their problem-solving ability by applying the characteristics of an object-oriented approach.
- To introduce object-oriented concepts in Java.

COURSE OUTCOMES (Cos)
after completing this course the student will be able to

CO1	Demonstrate the usage of various data structures using simple applications
CO2	Discuss non-linear data structure and its application
CO3	Describe the basic operations on arrays, lists, stacks and queue data structures
CO4	Analyze algorithms for operations on Binary Search Trees.
CO5	Determine and analyze the complexity of given algorithms

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**3**	**3**	**1**	**2**	**1**	**2**	**1**	**1**	**2**	**2**
CO2	**3**	**3**	**1**	**2**	**1**	**2**	**3**	**1**	**2**	**1**
CO3	**3**	**2**	**1**	**2**	**1**	**2**	**1**	**1**	**2**	**2**
CO4	**3**	**3**	**2**	**2**	**1**	**1**	**3**	**1**	**2**	**1**
CO5	**3**	**3**	**1**	**3**	**2**	**2**	**1**	**1**	**2**	**1**

COs/POs	PSO1	PSO2
CO1	1	2
CO2	1	3
CO3	2	1
CO4	2	2
CO5	2	2

3/2/1 Indicates Strength of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
							√		

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMCS22L01	ADVANCED DATA STRUCTURES AND ALGORITHMS LAB	Lb	0	0/0	4/0	2

List of Experiments

1. Write Java programs that use both recursive and non-recursive functions for implementing the following searching methods: a) Linear search b) Binary search
2. Write Java programs to implement the following using arrays and linked lists
3. Write Java programs to implement the following using an array. a) Stack ADT b) Queue ADT
4. Write a Java program that reads an infix expression and converts the expression to postfix form. (Use stack ADT).
5. Write a Java program that uses both a stack and a queue to test whether the given string is a palindrome or not.
6. Write Java programs to implement the following using a singly linked list. a) Stack ADT b) Queue ADT
7. Write a Java program to perform the following operations: a) Construct a binary search tree of elements. b) Search for a key element in the above binary search tree. c) Delete an element from the above binary search tree.
8. Write a Java program to implement all the functions of a dictionary (ADT) using Hashing.
9. Write Java programs that use recursive and non-recursive functions to traverse the given binary tree in a)Preorder b) Inorder c) Postorder
10. Write Java programs for the implementation of bfs and dfs for a given graph.
11. Write Java programs for implementing the following sorting methods: a) Bubble sort b) Insertion sort c) Quick sort d) Merge sort e) Heap sort f) Radix sort g) Binary tree sort
12. Write a Java program to perform the following operations: a) Insertion into a B-tree b) Searching in a B-tree.

Total : 60Hrs.

Subject Code: EMCC22001	Subject Name : Research Methodology and IPR	Ty/Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite: core subjects	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P : Practical/Project R : Research C: Credits T/L Theory/Lab

OBJECTIVE: The goal is to emphasize the importance of innovation and creativity by understanding the research concepts and ethics which will aid to build the nation IPR status.

COURSE OUTCOMES (COs) : By doing this course students will

CO1	Understand research problem formulation by Analyzing research related information and its execution by following research ethics
CO2	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CO3	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO4	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.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	3	3	2	3	3	2	2
CO2	2	3	3	3	3	2	3	3	2	2
CO3	2	3	3	3	3	2	3	3	2	2
CO4	2	3	3	3	3	2	3	3	2	2

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical	Soft Skills			
				✓								

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMCC22001	Research Methodology and IPR	Ty	3	0/0	0/0	3

UNIT 1:SELECTION, ANALYSIS AND STATEMENT OF THE RESEARCH PROBLEM; 9 hrs

Literature Review and Formulation of Objectives – using the following Critical thinking Skills – Drawing a Concept map, Oral Communication, Debating, Questioning, Collaborating, Evaluation and Reasoning.

UNIT 2 :RESEARCH DESIGN 9 hrs

Types of Study, Types of Data, Measures of Variablility, Setting up the Hypotheses, data collection techniques and tools, sampling, Describing data – Charts and graphs ; Data processing – Categorization, coding, summarization.

UNIT 3: DATA ANALYSIS AND REPORT WRITING: 9 hrs

Statistical measures, Regression and correlation, significance test; Report writing – Purpose, format, content, editing and evaluation. Using Citation tools; Report for specific purposes – Theses, Journals, Grant application. Oral presentation to an audience; use of project management digital tools and plagiarism checking.

UNIT 4 :INTRODUCTION TO INTELLECTUAL PROPERTY 9 hrs

Types of intellectual property rights – Patent, Copyright, Trade Mark, Industrial Design, Geographical Indication, Trade Secrets - Traditional Knowledge. Elements of Patentability - Novelty, Non Obviousness (Inventive Steps), Industrial Application – Non patentable inventions – Process of patenting – National and International – Form and Fees for IP India

UNIT 5:PRIOR ART SEARCH, PATENT DRAFTING 9 hrs

Drafting patent Claims – Types of claims - Registration Procedure, Rights and Duties of Patentee; Patent infringement; Licensing – Franchising - Joint ventures; Non-Disclosure Agreements (NDAs) - Material Transfer Agreements (MTAs).

Total : 45 Hrs

References:

- C. Vijayalakshmi and C. Sivapragasam (2011) Research Methods – Tips and Techniques, , MJP Publishers
- Deboraj Rumsey (2010) Statistics Essentials for Dummies, Wiley Publishing Incorporated
- Bouchoux (2013) Intellectual Property, DELMAR CENGAGE Learning, USA
- V K Ahuja (2017) Law Relating to Intellectual Property Rights, LexisNexis Butterworths India

IMPORTANT WEB LINKS

- https://www.wipo.int/portal/en/index.html
- http://ipindia.nic.in/
- https://www.epo.org
- https://www.uspto.gov

Semester II

Subject Code: EMCS22002	Subject Name: Advanced operating system	Ty/Lb/ ETL	L	T/S.Lr	P/ R	C
	Prerequisite: Operating System	Ty	3	1/0	0/0	4

L: Lecture T: Tutorial. S.Lr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory / Lab / Embedded Theory and Lab.

OBJECTIVES:

- The students will understand the concepts of Operating System and process.
- Illustrate the Scheduling of a processor for a given problem instance, identify the dead lock situation
- To provide appropriate solution, analyze memory management techniques and implement page replacement Algorithm, understand the implementation of file systems and directories.
- To appreciate emerging trends in operating systems.

COURSE OUTCOMES (Cos) -

Students completing the course were able to

CO1	Apply functions, structures of operating systems(L3)
CO2	Analyze the design issues associated with operating systems(L4)
CO3	Apply various process management concepts including scheduling, synchronization, deadlocks and multithreading(L3)
CO4	Evaluate memory management including virtual memory(L5)
CO5	Analyze the issues related to Processor scheduling(L4)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**3**
CO2	**2**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**2**
CO3	**3**	**2**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**
CO4	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**3**	**2**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**3**	**3**

COs/PSOs	PSO1	PSO2
CO1	3	2
CO2	2	2
CO3	2	3
CO4	2	3
CO5	3	2

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical /	Internships / Technical Skills	Soft Skills
				✓					

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMCS22002	Advanced Operating System	Ty	3	1/0	0/0	4

UNIT-I: INTRODUCTION **12Hrs**

Function of an Operating System-Design Approaches-Types of Advanced Operating Systems-Synchronization Mechanisms-Concept of a Process-Concurrent Processes-The Critical Section Problem-Process Deadlocks-Models of Deadlocks-Models of Resources-A Graph-Theoretic Model of a System State-Necessary and Sufficient Conditions for a Deadlock-Systems with Single-Unit Requests-System with only Consumable Resources-Systems with only Reusable Resources.

UNIT-II: DISTRIBUTED OPERATING SYSTEMS **12Hrs**

Architectures of Distributed Systems-Introduction-Motivations-System Architecture Types-Distributed Operating Systems-Issues in Distributed Operating Systems-Communication Networks-Communication Primitives-Distributed Mutual Exclusion-The Classification of Mutual Exclusion Algorithms-A simple Solution to Distributed Mutual Exclusion-Lamport's Algorithm-The Ricart-Agrawala Algorithm-Maekawas's Algorithm-Distributed Deadlock Detection-Preliminaries-Deadlock Handling Strategies in Distributed System-Issues in Deadlock Detection and Resolution.

UNIT-III: DISTRIBUTED RESOURCE MANAGEMENT **12Hrs**

Distributed File Systems-Introduction-Architecture-Mechanisms for Building Distributed File Systems-Design Issues-Distributed Shared Memory-Algorithms for Implementing DSM-Memory Coherence-Distributed Scheduling-Issues in Load Distributing-Failure Recovery and Fault Tolerance-Recovery-Fault Tolerance-Issues-Atomic Actions and Committing-Commit Protocols-Voting Protocols.

UNIT-IV : REAL TIME AND MOBILE OPERATING SYSTEMS **12Hrs**

Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems – Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory Management - File system.

UNIT-V CASE STUDIES **12Hrs**

Linux System: Design Principles - Kernel Modules - Process Management Scheduling - Memory Management - Input-Output Management - File System - Interprocess Communication. iOS and Android: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

Total : 60 Hrs.

TEXTBOOKS :

1. MukeshSinghal, Niranjan G. Shivaratri-"Advanced Concepts in Operating Systems", McGraw Hill Education, 2017

REFERENCE BOOKS :

1. LeLann,G, Distributed Systems-Towards a Formal Approach,"Information Processing77,1977.
2. Agrawal,D and A.E. Abbadi,"The Generalized Tree Quorum Protocol:An Efficient Approach for Managing Replicated Data",ACM Trans on Database Systems,1992.

Subject Code : EMCS22003	Subject Name : Advanced Computer Architecture	Ty/Lb/ETL	L	T/S Lr	P/R	C
	Prerequisite : Computer Architecture	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- To make students know about the Parallelism concepts in Programming.
- To study the hierarchical memory system including cache memories and virtual memory.
- To make the students know about the importance of multiprocessor, thread level and data level parallelism .

COURSE OUTCOMES (Cos) :

Students completing the course were able to

CO1	Demonstrate concepts of parallelism in hardware/software.
CO2	Describe architectural features of advanced processors.
CO3	Interpret performance of different pipelined processors
CO4	Explain data flow in Thread level parallelism
CO5	Development of software to solve data level parallelism

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**3**	**2**	**2**	**2**	**1**	**3**	**2**	**1**	**3**	**3**
CO2	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**3**	**3**	**3**
CO3	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**2**	**1**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**2**	**2**	**1**	**3**	**3**	**3**	**2**

COs/PSOs	PSO1	PSO2
CO1	1	1
CO2	1	2
CO3	2	1
CO4	1	2
CO5	1	2

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
				✓					

Subject Code	Subject Name	Ty/Lb/ ETL	L	T/SLr	P/R	C
EMCS22003	Advanced Computer Architecture	Ty	3	0/0	0/0	3

UNIT 1 **9 hrs**

Introduction to Parallel Processing: Parallelism in uniprocessor system; parallel computer structure, architectural classification schemes.

UNIT 2 **9 hrs**

Memory management and organization: Memory hierarchy, Virtual memory system, memory allocation and management, cache memory management. Mapping and management techniques, memory replacement policies.

UNIT 3 **9 hrs**

Pipelining and Vector Architecture: Instruction and arithmetic pipelines design, linear and non-linear pipeline pipeline processors, superscalar and superpipeline design.

UNIT 4 **9 hrs**

Thread Level Parallelism: Introduction, Shared-Memory Multicore Systems, Performance Metrics for Shared-Memory Multicore Systems, Cache Coherence Protocols, Synchronization, Memory Consistency.

UNIT 5 **9 hrs**

Data Level Parallelism: Introduction, Vector Architecture, SIMD Instruction Set Extensions for Multimedia, Graphics Processing Units, GPU Memory Hierarchy, Detecting and Enhancing Loop- Level Parallelism.

Total Hrs:45 Hrs

REFERENCES:

1. Advanced Computer Architectures - A Design space approach, DezsoSima, Terence Fountain, Peter Kacsuk, Pearson Education 2017.
2. K Hwang, Advanced Computer Architecture, Tata McGraw-Hill Education, 2016
3. David E. Culler, Jaswider Pal, Parallel computer Architecture, Gulf Professional Publishing, 2017
4. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Fifth Edition, Morgan Kaufmann, May 2018.
5. High-performance Computer Architecture, by Harold Stone Addison Wesley (2016) 3rded.
6. Parallel Computer Architecture: A Hardware/Software Approach David Culler and J.P. Singh with Anoop Gupta, Morgan Kaufmann (August 2016).

Advanced Operating System	**Subject Name :** Advanced Operating System lab	**Ty/Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
EMCS22L02	Prerequisite : Operating System	Lb	0	0/0	4/0	2

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- To learn shell programming and the use of filters in the UNIX environment
- To learn to use system calls through C programs
- To learn to use the file system related system calls
- To gain knowledge of process creation and communication between processes.
- To learn how process synchronization can be done using semaphores.

COURSE OUTCOMES (Cos) -

Students completing the course were able to

CO1	Excel functions, structures and history of operating systems
CO2	Learn understanding of design issues associated with operating systems
CO3	Master various process management concepts including scheduling, synchronization, deadlocks and multithreading
CO4	Master concepts of memory management including virtual memory
CO5	Understand issues related to file system interface and implementation, disk management

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**2**	**2**	**2**	**3**	**1**	**2**	**2**	**2**	**1**	**2**
CO2	**2**	**2**	**1**	**2**	**2**	**2**	**1**	**3**	**3**	**3**
CO3	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**	**2**
CO4	**2**	**2**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**3**
CO5	**3**	**1**	**2**	**3**	**3**	**2**	**2**	**2**	**1**	**2**

COs/PSOs	PSO1	PSO2
CO1	3	3
CO2	2	2
CO3	3	3
CO4	3	3
CO5	3	3

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
							✔		

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMCS22L02	Advanced Operating System Lab	Lb	0	0/0	4/0	2

1. Design and develop a shell that support atleast 20 commands
2. Design and develop program to implement lazy buddy algorithm.
3. Write a multi-class multithreaded program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single customer class; each barber is instantiated from a single Barber class.
4. Use ECOS operating system to develop a program for controlling accessing to a pool of resources using mutexes and condition variables
5. Design and develop a program to realize the virus classification, such as boot sector infector, file infector and macro virus.
6. Stimulate CPU Scheduling algorithm in single program by
    - Round Robin
    - SJF
    - FCFS
    - PRIORITY
7. Design and develop a program for deadlock avoidance and prevence
8. Design and develop a program for file allocation strategies
    - Sequential
    - Indexed
    - Linked
9. Implement a multiprogramming operating system
    - Virtual memory
    - Inter process communication
    - IO Handling, Spooling and Buffering.

Total : 60 Hrs.

Subject Code : EMCS22I01	**Subject Name :** TERM PAPER	**Ty/Lb/IE**	**L**	**T**	**P**	**C**
	Prerequisite : Nil	IE	2	0/0	0/0	2

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- To acquire hands-on experience in converting a novel idea / technique into a working model / prototype involving multi-disciplinary skills and / or knowledge and working in at team.

COURSE OUTCOMES (Cos) :

Students completing the course were able to

CO1	To conceptualize a novel idea / technique into a product
CO2	To develop a multi-disciplinary thinking and enable teamwork
CO3	Ideate and develop a prototype

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO 3**	**PO4**	**PO5**	**PO 6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**1**	**1**	**3**	**3**	**3**	**1**	**2**	**3**	**3**
CO2	**2**	**1**	**2**	**2**	**1**	**1**	**3**	**3**	**2**	**1**
CO3	**2**	**2**	**2**	**1**	**1**	**2**	**1**	**3**	**3**	**2**

COs/PSOs	PSO1	PSO2
CO1	2	1
CO2	1	2
CO3	1	2

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
							√		

Subject Code	Subject Name	Ty/Lb/ ETL	L	T/S. Lr	P/R	C
EMCS22I01	TERM PAPER	Lb	2	0/0	0/0	2

A term paper is an elaborate research-based work on a particular topic in the domain of study. The student must choose a topic of his interest from the domain of study for a term paper. The term paper can be an original research article or review article. In case of review article, the student must refer atleast 50 research/review articles and critically review other researcher's work. The term paper may be 10 -20 pages in length. The general guidelines for writing the term paper as follows:

1. Abstract
2. Introduction to explain about the broad and general statement on the topic chosen.
3. Aim /Objective of the term paper.
4. Description of methodology, concepts and arguments.
5. Identify the research gap and suggest possible future works.
6. Conclusion

Three reviews will be conducted to monitor the progress of the work.At the end of the semester, presentation must be made by the student and Viva-Voce examination will be conducted by the internal Examiner duly appointedby the Head of the department and the students will be evaluated.

Semester III

Subject Code	Subject Name :	Ty/Lb/IE	L	T/SLr	P/R	C
EMCS22004/ EMCF22003	Steganography and Digital Watermarking	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- To learn about steganography methods of hiding data
- To learn about steganography Algorithm and Techniques
- To learn about the watermarking models, applications and tools
- To learn about watermark security and authentication

COURSE OUTCOMES (Cos)
Students completing this course were able to

CO1	Understand different type of steganography methods of hiding data(L2)
CO2	Understand public key steganography and apply the steganography algorithm(L2)
CO3	Make use of different steganography techniques(L3)
CO4	Make use of different steganography techniques for embedding(L3)
CO5	Apply different techniques and tools of watermarking (L3)

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**
CO2	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**
CO3	**3**	**2**	**2**	**1**	**1**	**1**	**2**	**1**	**2**	**1**
CO4	**3**	**2**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**1**
CO5	**3**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**1**	**1**

COs/PSOs	PSO1	PSO2
CO1	**3**	**2**
CO2	**3**	**2**
CO3	**3**	**2**
CO4	**3**	**1**
CO5	**3**	**1**

3/2/1 Indicates Strength of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
				√					

Subject Code	Subject Name	Ty/Lb/IE	L	T/SLr	P/R	C
EMCS22004/ EMCF22003	Steganography and Digital Watermarking	Ty	3	0/0	0/0	3

UNIT I Introduction: 9 Hrs

Steganography: Overview, History, Methods for hiding (text, images, audio, video, speech etc.), Issues: Security, Capacity and Imperceptibility. Steganalysis: Active and Malicious Attackers, Active and passive Steganalysis.

UNIT II 9 Hrs

Frameworks for secret communication: pure steganography, secret key, public key steganography), Steganography algorithms: Adaptive and Non-Adaptive.

UNIT III 9 Hrs

Steganography techniques: Substitution systems, Spatial Domain, Transform domain techniques, spread spectrum, Statistical steganography, Cover Generation and cover selection, Tools: EzStego, FFEncode, hide 4 PGP, Hide and Seek, S Toolsetc..

UNIT IV 9 Hrs

Detection and Distortion Techniques: LSB Embedding, LSB Steganalysis using primary sets, Texture based.

UNIT V Steganography: 9 Hrs

Digital Watermarking: Introduction, Difference between Watermarking and Steganography, History, Classification (Characteristics and Applications), Types and techniques (Spatialdomain, Frequency-domain, and Vector quantization-based watermarking), Attacks and Tools (Attacks by Filtering, Remodulation, Distortion, Geometric Compression, Linear Compression etc.), Watermark security & authentication. Recent trends in Steganography and digital watermarking techniques. Case study of LSB Embedding, LSB Steganalysis using primary sets.

Total : 45 Hrs

Text Book(s)

1. Peter Wayner, Disappearing Cryptography Information Hiding:Steganography&Watermarking, Morgan Kaufmann Publishers, New York,2002.
2. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, Ton Kalker, Digital Watermarking and Steganography, Margan Kaufmann Publishers, New York,2008.
3. Neil F. Johnson, Zoran Duric, SushilJajodia, Information Hiding: Steganography and Watermarking - Attacks andCounter measures.
4. Stefan Katzenbeisser, Fabien A. P. Petitcolas, Information Hiding Techniques for Steganography and DigitalWatermarking.

OPEN ELECTIVE

Subject Code	Subject Name	Ty/Lb/IE	L	T/SLr	P/R	C
EMOL22I01	Open Elective (NPTEL/SWAYAM/ Any MOOC online approved by AICTE & UGC)	IE	3	0/0	0/0	3

Students should register for the online course with a minimum course duration of 8 weeks through the online portals such as NPTEL/SWAYAM/Any MOOC in the beginning of the semester. The course can be core/interdisciplinary in such a way that the same course is not repeated during the course of his study.

Students are expected to attend the online classes regularly and submit the weekly assignments before the due dates. Students should appear for the online examination and submit the certificate at the end of the semester. Internal examination will be conducted by the examiners duly appointed by the head of the department.

Subject Code	Subject Name :	Ty/Lb/IE	L	T/S.Lr	P/R	C
EMCS22L03	Dissertation Phase I	Lb	0	0/0	0/10	5

L : Lecture T : Tutorial S.Lr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue, address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Apply the knowledge and skills acquired in the course of study addressing a specific problem or issue.
CO2	To encourage students to think critically and creatively about societal issues and develop user friendly and reachable solutions
CO3	To refine research skills and demonstrate their proficiency in communication skills.
CO4	To take on the challenges of teamwork, prepare a presentation and demonstrate the innate talents.

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**3**	**1**	**2**	**3**	**1**	**1**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**1**	**1**	**3**	**3**	**3**	**1**	**2**	**2**
CO3	**1**	**2**	**3**	**2**	**2**	**2**	**1**	**1**	**3**	**1**
CO4	**3**	**1**	**2**	**3**	**1**	**1**	**2**	**2**	**2**	**2**

COs/PSOs	PSO1	PSO2	
CO1	**2**	**1**	
CO2	**1**	**2**	
CO3	**2**	**1**	
CO4	**2**	**1**	

3/2/1 Indicates Strength of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
							√		

Subject Code	Subject Name	Ty/Lb/IE	L	T/S.Lr	P/R	C
EMCS22L03	Dissertation Phase I	Lb	0	0/0	0/10	5

- Find your domain of interest and perform an in depth study on the articles of the domain.
- Obtain updated knowledge through Literature Survey in reputed Journals
- Review and finalize the title by various approaches. The title should reflect problem identification, domain name, technology applied etc.
- Review and finalize the approach to the problem identified.
- Prepare a detailed action for conducting investigation including team work.
- Perform detailed Analysis / Modeling / Simulations / Design / Problem solving / Experiments as needed.
- Categorize executable project modules after considering risks and choose efficient tools for designing project modules.
- Elaborate the completed task and compile the work in PPT slides

Subject Code	Subject Name	Ty/Lb/IE	L	T/S.Lr	P/R	C
EMCS22I02	Summer Internship	IE	0	0/0	4/0	2

OBJECTIVES :

- The main objective of the In-plant training is to provide a short-term work experience in an Industry/ Company/ Organization

DESCRIPTION:

- MINI PROJECT:

Students will have an opportunity to expose their knowledge and talent to make an innovative project. Students are supposed to do innovative projects useful to industries/society in the area of relevant Engineering, inter and multi-disciplinary areas, under the guidance of a staff member. They have to prepare a project report and submit to the department.

At the end of the semester Viva-Voce examination will be conducted by the internal Examiner duly appointed by the Head of the department and the students will be evaluated.

- INTERNSHIP

Students are supposed to undergo internship in related Industries for a minimum period of 30 days cumulatively during the semester. They have to prepare a report on the Internship with a certificate in proof from competent authority in the industry. At the end of the semester Viva-Voce examination will be conducted by the Examiners duly appointed by the Head of the department and the students will be evaluated.

Semester IV

Subject Code	Subject Name :	Ty/Lb/IE	L	T/S.Lr	P/R	C
EMCS22L04	Dissertation Phase II	Lb	0/0	0/0	10/10	10

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue , address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Apply the knowledge and skills acquired in the course of study addressing a specific problem or issue.
CO2	To encourage students to think critically and creatively about societal issues and develop user friendly and reachable solutions
CO3	To refine research skills and demonstrate their proficiency in communication skills.
CO4	To take on the challenges of teamwork, prepare a presentation and demonstrate the innate talents.

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**3**	**1**	**2**	**3**	**1**	**1**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**1**	**1**	**3**	**3**	**3**	**1**	**2**	**2**
CO3	**1**	**2**	**3**	**2**	**2**	**2**	**1**	**1**	**3**	**1**
CO4	**3**	**1**	**2**	**3**	**1**	**1**	**2**	**2**	**2**	**2**

COs/PSOs	PSO1	PSO2
CO1	**2**	**1**
CO2	**1**	**2**
CO3	**2**	**1**
CO4	**2**	**1**

3/2/1 Indicates Strength of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
							√		

Subject Code	Subject Name	Ty/Lb/IE	L	T/S.Lr	P/R	C
EMCS22L04	Dissertation phase-II	Lb	0/0	0/0	10/10	10

- Review detailed Analysis / Modeling / Simulations / Design / Problem solving / Experiments as needed.
- Finalize executable project modules after considering risks and efficient tools for designing project modules.
- Combine all the modules through effective team work after efficient testing.
- Develop a final product / process, perform efficient Testing, arrive optimized results and conclusions and suggest future directions.
- Prepare a paper for Conference Presentation and Journal Publication and get review comments.
- Elaborate the completed task, compile the work in PPT slides and create a Project Report in the standard format.

IV SEMESTER								
S.No	**Sub.Code**	**Title of Subject**	**Ty/LB/ETL**	**L**	**T/S.Lr**	**P/R**	**C**	**Category**
2	EMCS22I03	Research Publication	IE	0	0/0	2/2	2	PC

Students are supposed to prepare and publish the article based on either his term paper or area of research in peer reviewed referred journal. Code of research publication ethics should be followed. After publishing the article students should present a seminar in presence of department faculties and PG students. At the end of semester viva examination will be conducted by the examiners appointed by the Head of the department.

Program Elective I

Subject Code	Subject Name : ADVANCED DATA SCIENCE	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
EMCS22E01	Prerequisite: Nil	Ty	3	0/0	0/0	3

L: Lecture T: Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL: Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

The student should be made to:

To provide fundamental knowledge on data science and to understand the role of statistics and optimization to perform mathematical operation in the field of data science. 2. To understand the process of handling heterogeneous data and visualize them for better understanding. 3. To gain the fundamental knowledge on various open-source data science tools and understand their process of applications to solve various industrial problems.

COURSE OUTCOMES (COs) :

CO1	Apply fundamental knowledge on data science. (L3)
CO2	Demonstrate proficiency in machine learning techniques(L4).
CO3	Develop mathematical knowledge and study various algorithms to perform data science operations(L3).
CO4	Develop statistical analysis of data and implement using programming languages(L3).
CO5	Handle various types of data and visualize them through various tools and techniques. Demonstrate numerous open source data science tools to solve real-world problems through industrial case studies(L3).

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	2	3	1	2	3	2	2	1	1	2
CO2	1	1	2	3	2	1	1	1	2	2
CO3	2	3	2	2	1	1	2	3	2	2
CO4	1	1	2	1	1	1	3	2	2	1
CO5	2	2	1	1	2	1	1	2	2	1

COs / PSOs	**PSO1**	**PSO2**
CO1	2	1
CO2	1	2
CO3	3	2
CO4	2	2
CO5	1	2

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓						

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
EMCS22E01	ADVANCED DATA SCIENCE	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO DATA SCIENCE 9 Hrs

Introduction - Typology of problems - Importance of linear algebra, statistics and optimization from a data science perspective - Structured thinking for solving data science problems - Structured and Unstructured data.

UNIT II MACHINE LEARNING TECHNIQUES 9 Hrs

Using mathematical models or algorithms to recognize patterns - classification, or predictions about a dataset – Supervised Learning – Unsupervised Learning – Semi Supervised Learning.

UNIT III ALGORITHMIC FOUNDATIONS 9 Hrs

Linear algebra Matrices and their properties – Eigen values and eigen vectors - Matrix factorizations - Inner products - Distance measures – Projections - Notion of hyper planes - half-planes - elementary spectral graph theory - Sampling and VC-dimension - Random walks and graph sampling - MCMC algorithms - learning, linear and non-linear separators - PAC learning.

UNIT IV PROGRAMMING FOUNDATION AND EXPLORATORY DATA ANALYSIS 9 Hrs

Introduction to Python Programming - Types, Expressions and Variables, String Operations, selection, iteration, Data Structures - Strings, Regular Expression, List and Tuples, Dictionaries, Sets - Exploratory Data Analysis (EDA) - Definition, Motivation - Steps in data exploration - Basic data types - Data type Portability, Basic Tools of EDA, Data Analytics Life cycle.

UNIT V DATA HANDLING AND VISUALIZATION TOOLS WITH TECHNIQUES 9 Hrs

Data Acquisition - Data Pre-processing and Preparation - Data Quality and Transformation - Handling Text Data - Introduction to data visualization - Visualization workflow: describing data visualization workflow - Visualization Periodic Table - Data Abstraction –Analysis - Four Levels for Validation- Task Abstraction – Analysis - Four Levels for Validation Data Representation - chart types: categorical, hierarchical, relational, temporal & spatial - Overview and Demonstration of Open source tools such as R, Octave, Scilab - Python libraries: SciPy and sci-kitLearn, PyBrain, Pylearn2, Weka.

Total Hours: 45

TEXT BOOKS:

1. R. V. Hogg, J. W. McKean and A. Craig, Introduction to Mathematical Statistics, 8th Ed., Pearson Education India, 2019.
2. Avrim Blum, John Hopcroft, Ravindran Kannan, “Foundations of Data Science”, Cambridge University Press, 2020.

REFERENCE BOOKS:

1. Ani Adhikari and John DeNero, ‘Computational and Inferential Thinking: The Foundations of Data Science’ , GitBook, 2019.
2. Cathy O’Neil and Rachel Schutt, ‘Doing Data Science: Straight Talk from the Frontline’, O’Reilly Media, 2013.
3. Hossein Pishro-Nik, “Introduction to Probability, Statistics, and Random Processes”, Kappa Research, LLC, 2014.

Subject Code EMCS22E02	Subject Name: Machine Learning	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL: Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

The student should be made to:

- understand the need for machine learning for various problem solving
- study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- understand the latest trends in machine learning
- design appropriate machine learning algorithms for problem solving

COURSE OUTCOMES (COs) :

CO1	Differentiate between supervised, unsupervised, semi-supervised machine learning approaches(L5)
CO2	Apply the decision tree algorithm and identity and overcome the problem of overfitting(L3)
CO3	Discuss and apply the back propagation algorithm and genetic algorithms to various problems(L3)
CO4	Apply the Bayesian concepts to machine learning(L3)
CO5	Analyze and suggest appropriate machine learning approaches for various types of problems(L4)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**3**	**3**	**1**	**3**	**2**	**1**	**1**	**1**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**2**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**2**	**3**	**3**

COs / PSOs	**PSO1**	**PSO2**
CO1	**2**	**3**
CO2	**3**	**2**
CO3	**3**	**3**
CO4	**3**	**3**
CO5	**3**	**3**

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓						

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
EMCS22E02	Machine Learning	Ty	3	0/0	0/0	3

UNIT INTRODUCTION 9 **Hrs**

Well posed Learning Problems – designing a learning System -Perspectives and Issues in Machine Learning– Concept Learning Task an as Search – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT II NEURAL NETWORKS AND Decision Tree learning 9 **Hrs**

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics in ANN-Decision Tree Representation-Hypothesis Space Search-Inductive Bias-Issues in Decision Tree learning

UNIT III BAYESIAN AND COMPUTATIONAL LEARNING 9 **Hrs**

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV INSTANT BASED LEARNING AND GENETIC ALGORITHMS 9 **Hrs**

K-Nearest Neighbor Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning. – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT V ADVANCED LEARNING 9 **Hrs**

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

Total Hours: 45 Hrs

TEXT BOOK:

1. Tom M. Mitchell, ―Machine Learning‖, McGraw-Hill Education (India) Private Limited, 2013.

2.Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.

REFERENCES:

1. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective‖, CRC Press, 2009.
2. Andreas C. Muller, "Introduction to Machine Learning with Python: A Guide for Data Scientists",O'Reilly,2016.
3. Sebastian Raschka, "Python Machine Learning", Packt Publishing, 2015.

Subject Code	Subject Name :FORMAL LANGUAGES AND FINITE AUTOMATA	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
EMCS22E03	Prerequisite: Compiler Design	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

- To provide introduction to some of the central ideas of theoretical computer science from
- The perspective of formal languages.
- To introduce the fundamental concepts of formal languages, grammars and automata theory.
- Classify machines by their power to recognize languages.
- Employ finite state machines to solve problems in computing.
- To understand deterministic and non-deterministic machines.
- To understand the differences between decidability and undecidability.

COURSE OUTCOMES (COs) :

CO1	Able to understand the concept of abstract machines and their power to recognize the language
CO2	Able to employ finite state machines for modeling and solving computing problems
CO3	Able to design context free grammars for formal languages
CO4	Able to distinguish between decidability and undecidability
CO5	Understand the Turing machine concepts

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**		
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**		
CO3	**3**	**2**	**2**	**2**	**3**	**1**	**2**	**3**	**2**	**3**		
CO4	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**		
CO5	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**2**		

COs / PSOs	PSO1	PSO2		
CO1	**3**	**3**		
CO2	**3**	**2**		
CO3	**3**	**2**		
CO4	**3**	**3**		
CO5	**3**	**2**		

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					√				

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMCS22E03	FORMAL LANGUAGES AND FINITE AUTOMATA	Ty	3	0/0	0/0	3

Unit-1 **9 Hrs**

Introduction to Finite Automata: Structural Representations, Automata and Complexity, the Central Concepts of Automata Theory – Alphabets, Strings, Languages, Problems. Nondeterministic Finite Automata: Formal Definition, an application, Text Search, Finite Automata with Epsilon-Transitions. Deterministic Finite Automata: Definition of DFA, How A DFA Process Strings, The language of DFA, Conversion of NFA with €-transitions to NFA without €-transitions. Conversion of NFA to DFA, Moore and Malay machines

Unit-2 **9 Hrs**

Regular Expressions: Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular Expressions.Pumping Lemma for Regular Languages: Statement of the pumping lemma, Applications of the Pumping Lemma.Closure Properties of Regular Languages: Closure properties of Regular languages, Decision Properties of Regular Languages, Equivalence and Minimization of Automata.

Unit-3 **9 Hrs**

Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Sentential Forms, Parse Tress, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages. Push Down Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Acceptance by final state, Acceptance by empty stack, Deterministic Pushdown Automata. From CFG to PDA, From PDA to CFG.

Unit-4 **9 Hrs**

Normal Forms for Context- Free Grammars: Eliminating useless symbols, Eliminating €-Productions. Chomsky Normal form Griebech Normal form.Pumping Lemma for Context-Free Languages: Statement of pumping lemma, Applications.Closure Properties of Context-Free Languages: Closure properties of CFL's, Decision Properties of CFL's. Turing Machines: Introduction to Turing Machine, Formal Description, Instantaneous description, The language of a Turing machine

Unit-5 **9 Hrs**

Types of Turing machine: Turing machines and halting Undecidability: Undecidability, A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE, Undecidable Problems about Turing Machines, Recursive languages, Properties of recursive languages, Post's Correspondence Problem, Modified Post Correspondence problem, Other Undecidable Problems, Counter machines.

Total:45 Hrs

TEXT BOOKS:

1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.

2. Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekaran, 2nd edition, PHI.

PROGRAM ELECTIVE II

Sub Code: EMCS22E04	Subject Name : HUMAN COMPUTER INTERACTION	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

- Gain knowledge on the desirable features of good user interfaces and the design process
- Ability to design effective screens, web interfaces, system menus and navigational schemes and to identify suitable interaction devices.
- Ability to identify the Internationalization aspects of User Interface Design and apply them in practice.

COURSE OUTCOMES (COs) :

CO1	Design and Development processes and life cycle of Human Computer Interaction
CO2	Analyze product usability evaluations and testing methods.
CO3	Apply the interface design standards/guidelines for cross cultural and disabled users.
CO4	Categorize Design and Develop Human Computer Interaction in proper architectural structures.
CO5	Perform the user interface design process, including interface development and testing

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	3	3	3	2	2	2	3
CO2	3	3	2	3	3	3	2	2	2	3
CO3	2	2	3	2	3	2	3	3	3	3
CO4	3	3	2	3	2	2	3	2	2	2
CO5	2	3	3	2	2	2	2	2	3	2

COs / PSOs	PSO1	PSO2		
CO1	3	2		
CO2	3	2		
CO3	2	2		
CO4	3	3		
CO5	3	2		

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					√				

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
EMCS22E04	HUMAN COMPUTER INTERACTION	Ty	3	0/0	0/0	3

UNIT-I **9 Hrs.**

HCI foundations- Input–output channels, Human memory, Thinking: reasoning and problem solving, Emotion, Individual differences, Psychology and the design of interactive systems, Text entry devices, Positioning, pointing and drawing, Display devices, Devices for virtual reality and 3D interaction, Physical controls, sensors and special devices, Paper: printing and scanning

UNIT-II **9 Hrs.**

Designing- Programming Interactive systems- Models of interaction, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface, The context of the interaction, Experience, engagement and fun, Paradigms for interaction, Cantered design and testing- Interaction design basics

UNIT-III **9 Hrs.**

The process of design, User focus, Scenarios, Navigation design, Screen design and layout, Iteration and prototyping, Design for non-Mouse interfaces, HCI in the software process, Iterative design and prototyping, Design rules, Principles to support usability, Standards and Guidelines, Golden rules and heuristics, HCI patterns

UNIT-IV **9 Hrs**

Implementation support - Elements of windowing systems, Programming the application, Using toolkits User interface management systems, Evaluation techniques, Evaluation through expert analysis, Evaluation through user participation, Universal design, User support

UNIT-V **9 Hrs.**

Models and Theories - Cognitive models, Goal and task hierarchies, Linguistic models, The challenge of display-based systems, Physical and device models, Cognitive architectures Collaboration and communication - Face-to-face communication, Conversation, Text-based communication, Group working, Dialog design notations, Diagrammatic notations, Textual dialog notations, Dialog semantics, Dialog analysis and design

Total: 45 Hrs.

Textbooks:

1. A Dix, Janet Finlay, G D Abowd, R Beale., Human-Computer Interaction, 3rd Edition, Pearson Publishers,2008

2. Shneiderman, Plaisant, Cohen and Jacobs, Designing the User Interface: Strategies for Effective Human Computer Interaction, 5th Edition, Pearson Publishers, 2010

Sub Code: EMCS22E05	Subject Name **:** DATA VISUALIZATION TECHNIQUES	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: Web Technology	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

To Acquiring and Visualizing Data

Building a graphic that uses all of the population distribution data

Understand Basics Of Data Visualization

designing dashboard-visual perception

COURSE OUTCOMES (COs) :

CO1	To know the principles of visual perception.
CO2	Learn the core skills for visual analysis.
CO3	Apply visualization techniques for various data analysis tasks.
CO4	To Learn Visualizing Data Programmatically
CO5	To Understand Information Dashboard Design

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**
CO2	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**
CO3	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**3**	**3**
CO4	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**
CO5	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**

COs / PSOs	**PSO1**	**PSO2**		
CO1	**3**	**3**		
CO2	**3**	**2**		
CO3	**3**	**2**		
CO4	**3**	**3**		
CO5	**3**	**2**		

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					√				

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMCS22E05	DATA VISUALIZATION TECHNIQUES	Ty	3	0/0	0/0	3

UNIT-I: INTRODUCTION TO DATA VISUALIZATION **9 Hrs**

Acquiring and Visualizing Data, Simultaneous acquisition and visualization, Applications of Data Visualization, Keys factors of Data Visualization (Control of Presentation, Faster and Better JavaScript processing, Rise of HTML5, Lowering the implementation Bar) Exploring the Visual Data Spectrum: charting Primitives (Data Points, Line Charts, Bar Charts, Pie Charts, Area Charts), Exploring advanced Visualizations (Candlestick Charts, Bubble Charts, Surface Charts, Map Charts, Infographics). Making use of HTML5 CANVAS, Integrating SVG

UNIT-II: BASICS OF DATA VISUALIZATION – TABLES **9 Hrs**

Reading Data from Standard text files (.txt, .csv, XML), Displaying JSON content Outputting Basic Table Data (Building a table, Using Semantic Table, Configuring the columns), Assuring Maximum readability (Styling your table, Increasing readability, Adding dynamic Highlighting), Including computations, Using data tables library, relating data table to a chart.

UNIT-III: VISUALIZING DATA PROGRAMMATICALLY **9 Hrs**

Creating HTML5 CANVAS Charts (HTML5 Canvas basics, Linear interpolations, A Simple Column Chart, Animations), Starting with Google charts (Google Charts API Basics, A Basic bar chart, A basic Pie chart, Working with Chart Animations).

UNIT-IV: INTRODUCTION TO D3.JS **9 Hrs**

Getting setup with D3, Making selections, changing selection's attribute, Loading and filtering External data : Building a graphic that uses all of the population distribution data, Data formats you can use with D3, Creating a server to upload your data, D3's function for loading data, Dealing with Asynchronous requests, Loading and formatting Large Data Sets

UNIT-V: INFORMATION DASHBOARD DESIGN **9 Hrs**

Introduction, Dashboard design issues and assessment of needs, Considerations for designing dashboard-visual perception, Achieving eloquence, Advantages of Graphics _Library of Graphs, Designing Bullet Graphs, Designing Sparklines, Dashboard Display Media, Critical Design Practices, Putting it all together - Unveiling the dashboard**.**

Total: 45 Hrs.

TEXT BOOKS:

1. Jon Raasch, Graham Murray, Vadim Ogievetsky, Joseph Lowery, "JavaScript and jQuery for Data Analysis and Visualization", WROX

2. Ritchie S. King, Visual story telling with D3" Pearson

3. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.

4. A Julie Steele and Noah Iliinsky, Designing Data Visualizations: Representing Informational Relationships, O'Relly

5. Andy Kirk, Data Visualization: A Successful Design Process, PAKT

6. Scott Murray, Interactive Data Visualization for Web, O'Relly

7. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.

8. Tamara Munzner, Visualization Analysis and Design, AK Peters Visualization Series, CRC Press,Nov. 2014

Subject Code EMCS22E06/ EMCF22E06	Subject Name : IoT and Its Applications	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: Networks	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

- To study fundamental concepts of IoT.
- To understand roles of sensors in IoT
- To learn different protocols used for IoT design
- To be familiar with IoT and M2M
- To understand the IoT design methodologies.

COURSE OUTCOMES (COs) :

CO1	Understand the various concepts, terminologies and architecture of IoT systems.
CO2	Use sensors and actuators for design of IoT.
CO3	Understand and apply various protocols for design of IoT systems
CO4	Differentiate between IoT and M2M
CO5	Apply various design methodologies for IoT applications.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	2	1	2	1	1	2	2
CO2	3	2	3	2	1	2	1	3	3	2
CO3	3	2	3	2	3	3	2	2	3	3
CO4	3	2	3	2	2	3	3	2	3	3
CO5	3	2	2	2	2	3	2	2	3	3

COs / PSOs	PSO1	PSO2
CO1	2	2
CO2	3	3
CO3	3	3
CO4	3	3
CO5	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					√				

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
EMCS22E06/ EMCF22E06	IoT and Its Applications	Ty	3	0/0	0/0	3

UNIT I : Introduction of IoT **9 Hrs**

Introduction- Characteristics of IoT- Physical & Logical Design of IoT-Enabling Technologies in IoT-IoT Levels and Deployment Templates.

UNIT II: Sensors Networks **9 Hrs**

Definition-Types of Sensors-Types of Actuators, Examples and Working-IoT Development Boards: Arduino IDE and Board Types-RaspberryPi Development Kit-RFID Principles and components-Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes.

UNIT III: Wireless Technologies for IoT **9 Hrs**

WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus-IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT-Edge connectivity and protocols.

UNIT IV: IoT and M2M **9 Hrs**

Introduction- M2M-Difference between IoT and M2M-SDN and NFV for IoT.

UNIT V: Developing Internet of Things **9 Hrs**

IoT Design Methodology- Logical design using Python-Control flow-Functions-Packages-File Handling.

Total : 45 Hrs

TEXT BOOK :

1. Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on-Approach)", 1 st Edition, VPT, 2014.
2. Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Wiley Publications
3. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications
4. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.

REFERENCE BOOK:

1. Daniel Minoli, — "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications

2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press

Subject Code EMCS22E07/ EMCF22E07	Subject Name **:** ETHICAL HACKING	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: Network Security	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

Introduces the concepts of Ethical Hacking

Gives the students the opportunity to learn about different tools and techniques in Ethical hacking and security

Practically apply Ethical hacking tools to perform various activities.

COURSE OUTCOMES (COs) :

CO1	Understand the core concepts related to vulnerabilities and their causes
CO2	Understand ethics behind hacking and vulnerability disclosure
CO3	Appreciate the impact of hacking
CO4	Exploit the vulnerabilities related to computer system and networks using state of the art tools and Technologies
CO5	Studies of recent vulnerabilities and attacks

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**2**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**
CO2	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**3**
CO3	**2**	**2**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**
CO5	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

COs / PSOs	**PSO1**	**PSO2**		
CO1	**3**	**3**		
CO2	**3**	**2**		
CO3	**2**	**2**		
CO4	**3**	**3**		
CO5	**3**	**2**		

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					√				

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMCS22E07/ EMCF22E07	ETHICAL HACKING	Ty	3	0/0	0/0	3

UNIT –I **9 Hrs.**

Ethical hacking process, Hackers behavior and mindset, Maintaining Anonymity, Hacking Methodology, Information Gathering, Active and Passive Sniffing, Physical security vulnerabilities &countermeasures. Internal and External testing. Preparation of Ethical Hacking and Penetration Test Reports and Documents.

UNIT -II **9 Hrs**

Social Engineering attacks and countermeasures. Password attacks, Privilege Escalation and Executing Applications, Network Infrastructure Vulnerabilities, IP spoofing, DNS spoofing

UNIT-III **9 Hrs**

Wireless Hacking: Wireless footprint, Wireless scanning and enumeration, Gaining access (Hacking 802.11), WEP, WPA, WPA2. DoS attacks. Web server and application vulnerabilities, SQL injection attacks, Vulnerability Analysis and Reverse Engineering, Buffer overflow attacks.

UNIT -IV **9 Hrs.**

Client-side browser exploits, Exploiting Windows Access Control Model for Local Elevation Privilege. Exploiting vulnerabilities in Mobile Application Introduction to Metasploit: Metasploit framework, Metasploit Console, Payloads, Metrpreter

UNIT-V **9 Hrs.**

Introduction to Armitage, Installing and using Kali Linux Distribution, Introduction to penetration testing tools in Kali Linux. Case Studies of recent vulnerabilities and attacks.

Total : 45 Hrs.

TEXT BOOKS:

1.Baloch, R., Ethical Hacking and Penetration Testing Guide, CRC Press, 2015.

2.Beaver, K., Hacking for Dummies, 3rded. John Wiley &sons., 2013.

3.Council, Ec. , Computer Forensics: Investigating Network Intrusions and Cybercrime, Cengage Learning, Second Edition, 2010

4.McClure S., Scambray J., and Kurtz G, Hacking Exposed. Tata McGraw-Hill Education, 6the Edition, 2009.

5.International Council of E-Commerce Consultants by Learning, Penetration Testing Network and Perimeter Testing Ec-Council/ Certified Security Analyst Vol. 3 of Penetration Testing, Cenage Learning, 2010.

6.Davidoff, S. and Ham, J., Network Forensics Tracking Hackers through Cyberspace, Prentice Hall,2012.

7. Michael G. Solomon, K Rudolph, Ed Tittel, Broom N., and Barrett, D.,Computer, Forensics Jump Start, Willey Publishing, Inc, 2011.

PROGRAM ELECTIVE III

Subject Code	**Subject Name:** OPTIMIZATION TECHNIQUES	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
EMCS22E08	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :
The student should be made to:

- Operation research models using optimization techniques based upon the fundamentals of Engineering mathematics (minimization and Maximization of objective function).
- The problem formulation by using linear, dynamic programming, game theory and queuing models.
- The stochastic models for discrete and continuous variables to control inventory and simulation Of manufacturing models for the production decision making.
- Formulation of mathematical models for quantitative analysis of managerial problems in industry

COURSE OUTCOMES (COs) :

CO1	Linear algebra and matrices, Elements of probability theory-Elementary multivariable calculus
CO2	Recall the theoretical foundations of various issues related to linear programming modeling to formulate real-world problems as a L P model
CO3	To Understand Unconstrained optimization
CO4	To Understand constrained optimization
CO5	To learn Non-linear constrained optimization models

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**
CO3	**3**	**2**	**2**	**2**	**3**	**1**	**2**	**3**	**2**	**3**
CO4	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**
CO5	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**2**

COs / PSOs	**PSO1**	**PSO2**
CO1	**3**	**3**
CO2	**3**	**2**
CO3	**3**	**2**
CO4	**3**	**3**
CO5	**3**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					√				

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMCS22E08	OPTIMIZATION TECHNIQUES	Ty	3	0/0	0/0	3

UNIT- I 9Hrs

Mathematical preliminaries

Linear algebra and matrices-Vector space, eigen analysis-Elements of probability theory-Elementary multivariable calculus

UNIT-II 9Hrs

Linear Programming, Introduction to linear programming model - Simplex method-Duality-Karmarkar's method

UNIT-III

Unconstrained optimization 9Hrs

One-dimensional search methods - Gradient-based methods -Conjugate direction and quasi-Newton methods

UNIT-IV 9Hrs

Constrained Optimization, Lagrange theorem-FONC, SONC, and SOSC conditions

UNIT-V 9Hrs

Non-linear problems, Non-linear constrained optimization models- KKT conditions - Projection methods

Total : 45 Hrs

Reference Books:

1. An introduction to Optimization by Edwin P K Chong, Stainslaw Zak

2. Nonlinear Programming by Dimitri Bertsekas.

Subject Code: EMCS22E09	**Subject Name :** Advanced Computer Networking	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: Computer Networks	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

- To Know the concepts of Advanced Computer networks,
- To understand advanced concepts of Networking,
- To Understand the Communication technologies.

COURSE OUTCOMES (COs) :

CO1	Understand different types of networks and Standards.
CO2	To know about switching and IP addressing mechanisms
CO3	To understand functions of application layer and routing techniques.
CO4	Analyze the concept of and mathematical background behind it.
CO5	Understanding of latest advances and its applications in Networks

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**3**	**3**	**1**	**3**	**2**	**1**	**1**	**1**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**2**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**2**	**3**	**3**

COs / PSOs	**PSO1**	**PSO2**
CO1	**2**	**3**
CO2	**3**	**2**
CO3	**3**	**3**
CO4	**3**	**3**
CO5	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					√				

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
EMCS22E09	Advanced Computer Networks	Ty	3	0/0	0/0	3

Unit I : **9 Hrs.**

Wired and wireless network characteristics , Layered concepts of networking , protocols , Analysis and performance f Network. TCP/IP protocol suite- Network standards.

Unit II: **9 Hrs.**

Switching concepts-Packet , Circuit , message- ATM switching , Congestion control , VLAN , VPN , HIPERLAN , IP addressing , IPv4 and IPv6 , IP Multi casting , Concepts of MPLS

Unit III: **9 Hrs.**

Application Layer protocols- HTTP, DHCP , SMTP , Internet architecture , Internet Routing - Routing protocols and Algorithms- RIP , OSPF , IGRP , E-IGRP , IS-IS.

Unit IV: **9 Hrs.**

Information Thory: Information – Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, , Mutual information - Channel capacity, Shannon limit, Hamming Code, Cyclic Code, Convolution Code, LDPC Code.

Unit V: **9 Hrs.**

Wireless and Mobile networks. Architecture of 4G and 5G Networks , UAV , Remote pilot Aircraft system , V2X , Low power wide-area (LPWA) networks, Software defined Networking.

Total : 45 Hrs.

References:-

1. Behrouz A. Forouzan, Data Communications and Networking, Fourth Ed., Tata McGraw Hill

2. A. Tanenbaum, Computer Networks, PEARSON, 2013 .

3. R. Bose, “Information Theory, Coding and Cryptography”, TMH 2007.

Sub Code EMCS22E10	Subject Name : NATURAL LANGUAGE PROCESSING	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: Compiler Design	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

1. Provide the student with knowledge of NLP and parsing
2. Understand the Semantic analysis of speech

- Attain knowledge in automated Natural Language Generation and Machine Translation

COURSE OUTCOMES (COs) :

CO1:	Able to understand the Computational Models of Language
CO2	Able to understand and work on various NLP tasks such as, POS tagging, syntactic parsing
CO3	Able to understand NLP applications such as Machine translation system, etc.,
CO4	Analyze large volume text data generated from a range of real-world applications.
CO5	Realize semantics and pragmatics of English language for text processing

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**2**	**2**	**1**	**2**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**2**	**2**

COs/PSOs	PSO1	PSO2
CO1	3	2
CO2	3	3
CO3	3	2
CO4	3	3
CO5	3	2

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
					✓				

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/ R	C
EMCS22E10	NATURAL LANGUAGE PROCESSING	Ty	3	0/0	0/0	3

UNIT I – INTRODUCTION **9 Hrs**

Introduction to NLP – Computational Models of Language – Organization of NLP Systems, Regular Expressions and Finite State Automata – Morphology and Finite State Transducers

UNIT II – COMPUTATIONAL PHONOLOGY **9 Hrs**

The basics of phonology and phonetics, Human vocal system, Computational Phonology, Basics of text to speech, N grams: Counting words in Corpora, Simple N grams, Smoothing, Kneser – Ney Smoothing, Entropy

UNIT III – HMMs AND SPEECH RECOGNITION **9 Hrs**

HMMs (**Hid- den Markov Models**) and Speech Recognition: Speech Recognition Architecture – Overview of HMM – Advanced Methods for decoding – Training a speech Recognizer –Human Speech Recognition - Part of Speech Tagging: Rule Based, Stochastic Part-of Speech Tagging – Transformation Based Tagging-Context Free Grammars for English – Context Free Rules and Trees – Sentence Level Constructions Coordination – Agreement – Grammars and Human Processing.

UNIT IV– PARSING **9 Hrs**

Parsing with Context Free Grammars – Top down Parser – Problems with Basic Top Down Parser – Finite State Parsing Methods - Representing Meaning: Computational Desiderata for Representations – Meaning Structure of Language – First Order Predicate Calculus- Semantic Analysis: Syntax driven Semantic Analysis – Attached for a Fragment of English- Integrating Semantic Analysis into the Earley Parser, Robust Semantic Analysis

UNIT V– MACHINE TRANSLATION **9 Hrs**

Dialogue and Machine Translation - Dialogue Acts – Automatic, Plan inferential, Cue based Interpretation of Dialogue Acts – Dialogue Structure and coherences – Dialogue Managers - Language Similarities and differences – The Transfer Metaphor – The Interlingua Idea- Direct Translation – Using Statistical Techniques – Usability and System Development

Total : 45 Hrs

REFERENCE BOOK

1. 1. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.

2. C. Manning and H. Schutze , “Foundations of Statistical Natural Language Processing ”, Massachusetts Institute of Technology, 2003.

3. James Allen, Bejamin/cummings, “Natural Language Understanding”, 2nd edition, 1995.

Subject Code: EMCS22E11/ EMCF22E11	Subject Name : Edge Computing	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: Distributed Systems and Algorithms	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T / L/ ETL: Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Introduction to Edge Computing is for beginners to gain a quick understanding of the edge computing technology. The course covers various topics such as the evolution of computing industry, cloud computing basics and edge computing.

COURSE OUTCOMES (COs) : (3- 5)

CO1	This course will explore research, frameworks, and applications in Edge Computing,
CO2	The class will begin with a review of current IoT Applications
CO3	Then explore frameworks for computing using RaspberryPi
CO4	Interfacing edge to cloud applications
CO5	Analyze edge computing with others

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**1**
CO2	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**1**
CO3	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**1**
CO4	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**2**
CO5	**3**	**2**	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**3**

COs / PSOs	**PSO1**	**PSO2**
CO1	**3**	**3**
CO2	**3**	**3**
CO3	**3**	**2**
CO4	**3**	**3**
CO5	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					✓				

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
EMCS22E11/ EMCF22E11	EDGE COMPUTING	Ty	3	0/0	0/0	3

UNIT I Edge Computing Definition and Use Cases 9Hrs

Introduction to Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M

UNIT II IoT Architecture and Core IoT Modules 9Hrs

A connected ecosystem,IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment,

UNIT III RaspberryPi 9Hrs

Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera, Image & Video Processing using Pi.

UNIT IV Implementation 9Hrs

Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud ProtocolsProtocols,MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example

UNIT V Edge Computing 9Hrs

Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Edge computing and solutions, Case study – Telemedicine palliative care, Requirements, Implementation, Use case retrospective.

Total 45 Hrs

TEXT BOOK:

1. IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Publisher: Packt Publishing, 2020, ISBN: 9781839214806
2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc., 2019, ISBN: 978149204322.

REFERENCE BOOK:

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, wiley publication, 2019, ISBN: 9781119524984.
2. David Jensen, “Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent Edge, MICROSOFT AZURE

PROGRAM ELECTIVE IV

Subject Code	Subject Name **:** Data Preparation and Analysis	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
EMCS22E12	Prerequisite: Cloud Computing	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Provide insight into methods and tools for analysis and processing of the data generated by modern information systems

COURSE OUTCOMES (COs) : Students completing the course were able to

CO1	give an insight into the statistical methods of data analysis and prediction.
CO2	define business situations in which data processing methods are applicable.
CO3	demonstrate use of Query Language for extracting and preparing data
CO4	group data from different types of database management systems
CO5	use the different types of data base management systems effectively

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**2**	**3**	**2**	**3**	**2**	**2**	**3**	**1**	**3**	**3**
CO2	**3**	**1**	**1**	**2**	**3**	**3**	**2**	**3**	**3**	**1**
CO3	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**2**
CO4	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**3**
CO5	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**2**

COs / PSOs	**PSO1**	**PSO2**
CO1	**3**	**2**
CO2	**2**	**2**
CO3	**3**	**3**
CO4	**1**	**1**
CO5	**2**	**2**

3/2/1 Indicates Strength of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					√				

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
EMCS22E12	Data Preparation and Analysis	Ty	3	0/0	0/0	3

UNIT I Essential of Big Data Platform **9 Hrs**

Big Data overview – Types of Digital Data – Challenges of Conventional Systems, Intelligent data analysis , Nature of Data, Analytic Processes and Tools, Analysis vs Reporting, Modern Data Analytic Tools. **Statistical Concepts:** Statistical methods – Sampling theory – random sampling – sampling distribution – resampling- resampling techniques- statistical Inference concept- irreducible – reducible –

UNIT II Essential of Data Stream Mining **9 Hrs**

Streams Concepts- Stream Data Model and Architecture -Stream Computing, Sampling Data in a Stream-Filtering Streams- Counting Distinct Elements in a Stream- Estimating Moments-Counting Oneness in a Window-Decaying Window-Real time Analytics Platform (RTAP) Applications - Stock Market Predictions

UNIT III Hadoop **9 Hrs**

Features of Hadoop Distributed File System - Components of Hadoop -Analyzing the Data with Hadoop - Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics - Developing a Map Reduce Application -Map Reduce Working concepts -Anatomy of a Map Reduce Job run-Failures-Job Scheduling - Shuffle and Sort -Task execution -Map Reduce Types and Formats - Features

UNIT IV Hadoop Cluster **9 Hrs**

Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation – Hadoop Configuration-Security in Hadoop, Administering Hadoop, HDFS – Monitoring Maintenance-Hadoop benchmarks, Hadoop in the cloud

UNIT V Hadoop Framework components **9 Hrs**

Hive Architecture - Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper, IBM InfoSphereBigInsights and Streams - Visualizations - Visual data analysis techniques - interaction techniques - Systems and applications

Total : 45Hrs

TEXT BOOKS:

1.Michael Minelli , Michele Chambers et al, *Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses*, Wiley Publications, 2016.

2. Zikopoulos, Paul, Chris Eaton, *Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data*, TMH, 2018.

REFERENCE BOOKS:

1. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
2. Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013
3. ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, 2012

Sub Code: EMCS22E13	**Subject Name :** NETWORK SECURITY	**Ty/Lb/ETL**	**L**	**T/S Lr**	**P/R**	**C**
	Prerequisite : NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / N/W SECURITY Theory and Lab

OBJECTIVES :

- Understand OSI security architecture and classical encryption techniques. Gain basic knowledge on the number theory.
- Understand various block cipher modes.
- understands the principles of public key cryptosystems, and different message
- authentication and integrity techniques

COURSE OUTCOMES (Cos) -

Students completing the course were able to

CO1	Identify the factors and challenges in transmission of data through any network driving the need for network security
CO2	Identify the application of symmetric and asymmetric encryption systems and their vulnerability to various attacks
CO3	Formulate a complete and adequate counter measure plan and prepare against it. Formulate the enhancements for algorithms on Data integrity, Authentication, Digital Signatures based on applications
CO4	Enhance various network security applications, IPSec, Firewall, IDS, Web security, Email security, and Malicious software etc.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**3**	**3**	**1**	**3**	**2**	**2**	**1**	**2**	**1**
CO2	**2**	**2**	**1**	**3**	**2**	**2**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**2**	**2**	**1**
CO4	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**3**	**3**	**3**

COs/PSOs	PSO1	PSO2
CO1	2	1
CO2	2	1
CO3	1	2
CO4	1	2

Category	Basic Sciences	Engg Sciences	Humanities &	Program core	Program Electives	Open Electives	Practical / Project	Internships /	Soft Skills
					✓				

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMCS22E13	NETWORK SECURITY	Ty	3	00/	0/0	3

Unit – I INTRODUCTION OF N/W SECURITY & NUMBER THEORY **9 Hrs**

Introduction- Understanding of Security Concepts- Attacks and Attack Frequency- Network security Elements- Understanding of Network Performance Concepts- Network Events that can Effect Hard and Soft Errors for Flows- Analyzing Network Traffic- Finite Fields- Groups, Rings, Fields- Modular Arithmetic- The Eucledian Algorithm- Polynomial Arithematic- Finite fields of form GF(p) and GF(2n)- Number Theory: Introduction- Fermet's and Euler's Theorem- Testing for Primality- Chinese Remainder Theorem- Discrete Logarithms- Applications of Number Theory in network security algorithms

Unit – II TRADITIONAL CRYPTOGRAPHY ALGORITHMS **9 Hrs**

Symmetric Key Cryptography- Asymmetric Key Cryptography- Block Cipher Design Principles- Block Cipher Modes- Data Encryption Standard- Strength of DES- Evaluation criteria for Advanced Encryption Standard- Advanced Encryption Standard Cipher- Multiple Encryption- Triple DES- Stream Cipher and RC4 algorithm- RC5 Algorithm- Public Key cryptosystems- RSA Algorithm- Diffie Hellman Key Exchange Algorithm- ISAKMP- Elliptic Curve Arithematic- Elliptic Curve Cryptography

Unit – III ALGORITHMS &SECURITY ARCHITECTURE **9 Hrs**

Hash Functions- Secure Hash Algorithm- MAC Functions- HMAC- CMAC- MD5Algorithm- Digital Signatures- Authentication Protocols- Digital Signature Standards- Digital Signature Algorithm- Authentication Applications- Kerberos V4 and V5- Email Security- Pretty Good Privacy- IP Security Architecture- Authentication Header and ESP- Web Security Considerations- SSL/ TLS.

Unit – IV SECURITY, AUTHENTICATION,APPLICATIONS **9 Hrs**

.Security Requirements in IoT Architecture- Security in Enabling Technologies- Security Concerns in IoT Applications- Insufficient Authentication/Authorization- Insecure Access Control- Threats to Access Control, Privacy, and Availability- Security in Enabling Technologies- Security in Identification and Tracking Technologies- Security in Integration of Wireless Sensor Network and RFID- Security in Communications- Security Protocols and Privacy Issues into 6LoWPAN Stack- Security in Service Management- Introduction Security Requirements in IoT Architecture- Network Layer- Service Layer- Application–Interface Layer- Cross-Layer Threats- Threats Caused in Maintenance of IoT.

Unit – V **9 Hrs**

Wireless intrusion detection systems (WIDS)- Wireless intrusion detection systems architectures-Wireless intrusion detection events-Rogue access point detection-Wireless intrusion prevention systems-802.11 geolocation technique-Attacks on wireless networks-TCP and Trojan Attacks-Security in the IEEE 802.11 standard-IEEE 802.11 security mechanisms-WEP (Wired Equivalent Privacy)- WEP Shortcomings-Security in 802.1x-802.1x architecture-Authentication by port-Authentication procedure-The 802.11i security architecture-802.11i radio security policies

Total :45 Hrs

TEXT BOOKS:

1. Chris Chapman, Network Performance and Security, 1st Edition, 2016
2. William Stallings, Cryptography and Network Security: Principles and Practice, 7th Edition
3. Michael Gregg, The Network Security Test Lab, John Wiley & Sons, Inc, 2015
4. Shancang Li Li Da Xu, Securing the Internet of Things, Elsevier, 1st Edition, 2017.

REFERENCE BOOKS

1. Roberta Bragg, Mark Rhodes-Ousley, Keith Strassberg, Network Security: The Complete reference, Tata Mc Graw Hill, 2017
2. Hakima Chaouchi, Maryline Laurent-Maknavicius, Wireless and Mobile Network Security, 2010.

Subject Code	Subject Name : Digital Forensics and Cyber Crime Investigation.	Ty/Lb /ETL	L	T/S.Lr	P/R	C
EMCS22E14/ EMCF22001	Prerequisite : Operating System , Computer Networking , Data Structure and Web technology	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

This course

- Presents an overview of the principles and practices of digital investigation.
- Emphasize the fundamentals and importance of digital forensics.
- Presents different techniques and procedures that enable them to perform a digital investigation.

Focuses mainly on the analysis of physical storage media and volume analysis covers the major phases of digital investigation such as preservation, analysis and acquisition of artifacts that reside in hard disks and random access memory.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Students learn file forensics analysis, extract hidden files and recover deleted files
CO2	Helps students to learn various types of forensic analysis
CO3	Students will gain an understanding of the various phases in forensic analysis
CO4	Students will explain and properly document the process of digital forensics analysis
CO5	Students learn to conduct a digital investigation in an organized and systematic way

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**1**
CO3	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**

COs/PSOs	PSO1	PSO2
CO1	**3**	**2**
CO2	**2**	**2**
CO3	**2**	**2**
CO4	**3**	**2**
CO5	**2**	**3**

3/2/1 Indicates Strength of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
					✓				

Subject Code	Subject Name	Ty/Lb/ETL	L	T/S.Lr	P/R	C
EMCS22E14/ EMCF22001	**Digital Forensics and Cyber Crime Investigation.**	Ty	3	0/0	0/0	3

UNIT-I **9 hrs**

Introduction: Computer Forensic Needs, Computer forensics fundamentals, Introduction to Steps of Digital Forensics, Computer Crimes, Types of Digital forensics evidences, Legal Aspects of Digital Forensics.

UNIT-II **9 hrs**

Hardware and Software: Understanding Computer components- input and output devices, CPU, Digital Media, System software - Operating System Architecture, Application Software, File Systems, Memory organization concept, Data Storage concepts. Network: Topology, Devices, Protocols and Port, Communication media. IP Address: Types and classes.

UNIT-III **9 hrs**

Foundations: Basic Principles and methodologies for digital forensics, Design systems with forensic needs in mind. Phases of Digital Forensics. Introduction to Digital Forensics Tools, Life of a Digital Forensic Investigator. **Data Acquisition:** Principles of Digital Forensic Acquisition, Evidence Handling and Processing Digital Forensic Data.

UNIT-IV **9 hrs**

Evidence Collection: Rules of Evidence, Jurisdictions, Techniques and standards for Preservation of Data. **Evidence Analysis:** OS / File System Forensics, Application Forensics, Web Forensics, Network Forensics, Mobile Device Forensics.

UNIT-V **9 hrs**

Investigation: Computer, Network, System attacks, Attack detection and investigation, Antiforensics. Case studies on File System, Network storage, Web and Mobile.

REFERENCE BOOKS **TOTAL : 45Hrs**

1. Thomas J Holt , Adam M Bossler, Kathryn C Seigfried-Spellar, Cybercrime and DigitalForensics: An Introduction, Routledge, 2016
2. Eoghan Casey, Handbook of Digital Forensics and Investigation, Academic Press, 2017
3. Eoghan Casey, Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet, III Edition, 2016
4. Angus McKenzie Marshall, Digital Forensics: Digital Evidence in Criminal Investigations, Wiley-Blackwell, 2018

PROGRAM ELECTIVE V

Subject Code	Subject Name :	Ty/Lb/IE	L	T/S.Lr	P/R	C
EMCF22E15/ EMCS22E15	Malware Analysis	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- Exhibit knowledge to secure corrupted systems, protect personal data, and secure computer networks in an Organization
- Practice with an expertise in academics to design and implement security solutions
- Understand key terms and concepts in Cryptography, Governance and Compliance.
- Understand principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Understand the purpose of malware analysis L1, L2
CO2	Analyze various malwares and understand the behavior of malwares in real world applications L2,L3,L4
CO3	Implement different malware analysis techniques L2,L3,L4
CO4	Identify the various tools for malware analysis. L2,L3
CO5	Analyze the malware behavior in windows and android L2,L3,L4

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**2**
CO2	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**1**
CO3	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**2**	**1**	**1**
CO4	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**1**
CO5	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**1**

COs/PSOs	PSO1	PSO2	
CO1	**3**	**2**	
CO2	**3**	**2**	
CO3	**3**	**2**	
CO4	**3**	**3**	
CO5	**3**	**2**	

3/2/1 Indicates Strength of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
					√				

Subject Code	Subject Name	Ty/Lb/IE	L	T/S.Lr	P/R	C
EMCF22E15/ EMCS22E15	Malware Analysis	Ty	3	0/0	0/0	3

UNIT – I : **9 Hrs**

Malware Analysis

Malware Analysis and Reverse Engineering, Types of Malware Analysis, Purpose of Malware Analysis Limitations of Malware Analysis, The Malware Analysis Process , Malware Classes
Infectors, Network Worms, Trojan Horse Backdoors, Remote-Access Trojan, Information Stealers

UNIT – II : **9 Hrs**

Malware Deployment

Malware Infection Vectors, Speed, Stealth, Coverage, Shelf Life, Types of Malware Infection Vectors, Physical Media, E-mails. Instant Messaging and Chat, Social Networking, URL Links, File Shares, Software Vulnerabilities- **Protective Mechanisms-** The Two States of Malware, Static Malware, Dynamic Malware, Protective Mechanisms,Static Malware Protective Mechanisms, Dynamic Malware Protective Mechanisms

UNIT – III : **9 Hrs**

Malware Dependencies

Dependency Types, Environment Dependencies, Program Dependencies, Timing Dependencies, Event Dependencies, **Malware Collection-** Your Own Backyard, Scan for Malicious Files, Look for Active Rootkits, Inspect Startup Programs, Inspect Running Processes, Extract Suspicious Files, **The Portable Executable File-** The Windows Portable Executable File, The PE File Format, Relative Virtual Address, PE Import Functions.

UNIT – IV : **9 Hrs**

The Proper Way to Handle Files- File's Analysis Life Cycle, Transfer, Analysis, Storage, **Inspecting Static Malware-** Static Analysis Techniques, File Type Identification, Antivirus Detection, Protective Mechanisms Identification, PE Structure Verification

UNIT – V : **9 Hrs**

Static Malware

Inspecting Static Malware-Static Analysis Techniques, ID Assignment-File Type Identification, Antivirus Detection, Protective Mechanisms Identification, PE Structure Verification, Dynamic Analysis-Analyzing Host Behavior, Analyzing Network Behavior

TEXT BOOKS **TOTAL : 45 Hrs.**

1.Christopher C. Elisan "Advance Malware Analysis", Mc Craw Hill Education

REFERENCE BOOKS:

1. Cameron H. Malin, Eoghan Casey, James M. Aquilina and Curtis W. Rose, Malware Forensics Field Guide for Windows Systems, Syngress, Elsevier, 2014
2. Ken Dunham, Saeed Abu-Nimeh, Michael Becher and Seth Fogie, Mobile Malware Attacks and Defense, Syngress, Elsevier, 2009
3. Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides by Cameron H. Malin, Eoghan Casey, James M. Aquiline 1 st Edition.
4. The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory by Michael Hale Ligh, Kindle Edition

Subject Code: EMCS22E16	Subject Name : Advanced Cloud Computing	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: Cloud Computing	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

- Identify the technical foundations of cloud systems architectures.
- Analyze the problems and solutions to cloud application problems.
- Apply principles of best practice in cloud application design and management.
- Identify and define technical challenges for cloud applications and assess their importance.

COURSE OUTCOMES (COs) :

CO1	Understand the fundamental principles of cloud computing.
CO2	Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
CO3	Analyze the performance of Cloud Computing.
CO4	Learn the Concept of Cloud Infrastructure Model.
CO5	Understand the concept of Cloud Security.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	2	3	2	2	2	3	2
CO2	3	3	3	2	3	2	2	2	3	2
CO3	3	2	3	2	3	2	2	3	2	3
CO4	3	2	2	2	3	2	2	2	3	2
CO5	3	3	2	2	3	2	2	2	3	2

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	2
CO5	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					√				

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
EMCS22E16	Advanced Cloud Computing	Ty	3	0/0	0/0	3

UNIT I -Introduction 9 Hrs

Introduction, Case Study Background, Understanding Cloud Computing, Fundamental Concepts and Models, Cloud-Enabling Technology, Fundamental Cloud Security

UNIT II-Cloud Computing Mechanisms 9 Hrs

Cloud Infrastructure Mechanisms, Specialized Cloud Mechanisms, Cloud Management Mechanisms, Cloud Security Mechanisms.

UNIT III- Cloud Computing Architecture 9 Hrs

Fundamental Cloud Architectures, Advanced Cloud Architectures, Specialized Cloud Architectures.

UNIT IV-Working with Clouds 9 Hrs

Cloud Delivery Model Considerations, Cost Metrics and Pricing Models, Service Quality Metrics and SLAs

UNIT V- Case Studies 9 Hrs

Case Study Conclusions, Industry Standards Organizations, Mapping Mechanisms to Characteristics, Data Center Facilities (TIA-942), Emerging Technologies, Cloud Provisioning Contracts, Cloud Business Case Template.

Total : 45 Hrs

TEXT BOOKS:

1. Cloud Computing Concepts, Technology & Architecture,"Thomas Erl, Zaigham Mahmood, and Ricardo Puttini"

REFERENCE BOOKS:

1. Erl, Thomas, Robert Cope, and Amin Naserpour. *Cloud computing design patterns*. Prentice Hall Press, 2015.

2. Etro, Federico. "The economics of cloud computing." Cloud technology: concepts, methodologies, tools, and applications. IGI Global, 2015. 2135-2148.

Subject Code EMCS22E17	Subject Name: GAME THEORY	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/ R**	**C**
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

To familiarize with the process of game design and development

- To learn the processes, mechanics, issues in game design
- To understand the architecture of game programming
- To know about game engine development, modeling, techniques and frameworks

COURSE OUTCOMES (COs) :

CO1	Develop game programming skills in various gaming models.
CO2	To create interactive games
CO3	Do a literature survey on applications of Game Theory in Computer Science and Engineering
CO4	T o understands Game Design Principles
CO5	To Design Game Development

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**
CO3	**3**	**2**	**2**	**2**	**3**	**1**	**2**	**2**	**2**	**3**
CO4	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**
CO5	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

COs / PSOs	**PSO1**	**PSO2**
CO1	**3**	**3**
CO2	**3**	**2**
CO3	**3**	**2**
CO4	**3**	**3**
CO5	**3**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					√				

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMCS22E17	GAME THEORY	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION 9 Hrs.

Elements of Game Play – Artificial Intelligence – Getting Input from the Player - Sprite Programming – Sprite Animation - Multithreading – Importance of Game Design – Game Loop.

UNIT II 3D GRAPHICS FOR GAME PROGRAMMING 9 Hrs**.**

Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces.

UNIT III GAME DESIGN PRINCIPLES 9 Hrs.

Character Development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding, Case study : Tetris.

UNIT IV GAMING ENGINE DESIGN 9 Hrs.

Renderers, Software Rendering, Hardware Rendering, and Controller Based Animation, Spatial Sorting, Level of Detail, Collision Detection, Standard Objects, and Physics, Case study : The Sims

UNIT V GAME DEVELOPMENT 9 Hrs

Developing 2D and 3D Interactive Games Using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle Games, Single Player Games, Multi-Player Games. Case study: Mine craft.

TOTAL : 45 Hrs

TEXT BOOKS:

1. David H. Eberly, ―3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics‖, Second Edition, Morgan Kaufmann, 2010.

2. Jung Hyun Han, ―3D Graphics for Game Programming‖, First Edition, Chapman and

Hall/CRC, 2011.

REFERENCES:

1 Jonathan S. Harbour, ―Beginning Game Programming‖, Course Technology, Third Edition PTR, 2009.

2. Ernest Adams and Andrew Rollings, ―Fundamentals of Game Design‖, Third Edition, Pearson Education, 2014.

3. Scott Rogers, ―Level Up: The Guide to Great Video Game Design‖, First Edition, Wiley, 2010.

4. Jim Thompson, Barnaby Berbank-Green, and NicCusworth, ―Game Design: Principles,

Practice, and Techniques - The Ultimate Guide for the Aspiring Game Designer‖, First Edition, Wiley, 2008.

Subject Code EMCS22E18/ EMCF22E18	Subject Name : Block Chain Technology	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

Know the concepts of blockchain technologies

- understand primary objective of this course is to cover the technical aspects of crypto currencies, block chain technologies, and distributed consensus.
- familiarize potential applications for Bit coin-like crypto currencies

COURSE OUTCOMES (COs) :

CO1	Understand emerging abstract models for Block chain Technology
CO2	Analyse the concept of bit coin and mathematical background behind it
CO3	Apply the tools for understanding the background of crypto currencies
CO4	Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain
CO5	Understanding of latest advances and its applications in Block Chain Technology

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	1	3	2	1	1	1	3
CO2	3	3	3	3	3	1	1	2	3	3
CO3	3	3	3	3	3	2	1	2	2	3
CO4	3	3	3	3	3	2	1	2	2	2
CO5	3	3	3	3	3	1	1	2	3	3

COs / PSOs	PSO1	PSO2
CO1	2	3
CO2	3	2
CO3	3	3
CO4	3	3
CO5	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
				√				

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
EMCS22E18/ EMCF22E18	Block Chain Technology	Ty	3	0/0	0/0	3

UNIT I- INTRODUCTION 9 Hrs.

Basic of Blockchain Architecture – Challenges – Applications – Block chain Design Principles -The Blockchain Ecosystem - The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).

UNIT II- CRYPTOGRAPHIC FUNDAMENTALS 9 Hrs

Cryptographic basics for crypto currency - a short overview of Hashing, cryptographic algorithm – SHA 256,signature schemes, encryption schemes and elliptic curve cryptography- Introduction to Hyperledger- Hyperledger framework - Public and Private Ledgers.

UNIT III-BIT COIN 9 Hrs

Bit coin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin .Bitcoin blockchain, challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their uses.

UNIT IV-ETHEREUM 9 Hrs

Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity -Smart Contracts - some attacks on smart contracts. Ethereum and Smart Contracts- The Turing Completeness of Smart Contract Languages and verification challenges- comparing Bitcoin scripting vs. Ethereum Smart Contracts

UNIT V- HYPERLEDGER 9 Hrs

Understanding Hyperledger Fabric, Overview of Open source Hyperledger project, Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric.Case studies/ Enabling Technologies and applications- Application of blockchain in privacy and security, IoT and smart cities, Business and Industry, Data management, e-Governance

Total Hours: 45

Text Books:

1. Melanie Swan,"Block Chain: Blueprint for a New Economy",O"Reilly, 1st edition – 2015.
2. Daniel Drescher, "Block Chain Basics", Apress; 1stedition, 2017
3. Anshul Kaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi.
4. Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing, first edition – 2012

Reference Books:

1. Ritesh Modi, "Solidity Programming Essentials: A Beginner"s Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing

Program Elective Lab I

Subject Code: EMCS22EL1	Subject Name : ADVANCED DATA SCIENCE LAB	T / L/ ETP/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Artificial Intelligence	Lb	0	0/0	4/0	2

T/L/ : Theory/Lab L : Lecture T : Tutorial P : Practical/Project R : Research C: Credits T/L Theory/Lab

OBJECTIVE:

- To understand arrays and describe data structures using numpy libraries.
- To apply panda library for data analysis.
- To understand models and analyze data using visualization.

COURSE OUTCOMES (COs) : By doing this course students will

CO1	Describe the data structures provided by numpy library for arrays and vectorized computation.
CO2	Explain data structures provided by pandas library for data analysis
CO3	Perform data wrangling, cleaning and transformation using python
CO4	Use matplot lib for plotting and visualizing the datasets
CO5	Demonstrate data aggregation and time series analysis using python programming Language

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	3	1	2	3	1	2	3
CO2	2	1		3	3	2			2	
CO3	1	3	3			2		3	2	3
CO4	2			3	3	3	3		3	
CO5	1	3	3	3	3	2	3		2	3

COs / PSOs	PSO1	PSO2
CO1	2	2
CO2	2	3
CO3	2	2
CO4	2	3
CO5	2	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
							√		

Subject Code:	Subject Name : ADVANCED DATA SCIENCE LAB	Ty / L/ ETP/IE	L	T / S.Lr	P/ R	C
EMCS22EL1	Prerequisite: Artificial Intelligence	Lb	0	0/0	4/0	2

LIST OF EXPERIMENTS

1. Implement Data Manipulation using Numpy.
2. Implement Data Manipulation using Pandas.
3. Building Random Forest Model.
4. Computing descriptive statistics using pandas.
5. Handling missing data using pandas.
6. Exploring Machine Learning Dataset.
7. Plotting and Visualizing data.
8. Plotting and Analyzing Time Series Data.

Total : 60 Hrs.

Subject Code: EMCS22EL2	Subject Name : Machine learning Lab	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: Nil	Lb	0	0/0	4/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :
Provide insight into methods and tools for analysis and processing of the data generated by modern information systems

COURSE OUTCOMES (COs) : Students completing the course were able to

CO1	Effectively use the various machine learning tools
CO2	Understand and implement the procedures for machine learning algorithms
CO3	Design Python programs for various machine learning algorithms
CO4	Apply appropriate datasets to the Machine Learning algorithms
CO5	Analyze the graphical outcomes of learning algorithms with specific datasets

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	1	3	3	3	2	2
CO2	3	1	2	1	3	3	2	3	1	3	3	1
CO3	2	3	3	2	3	3	2	2	3	2	1	2
CO4	2	3	3	2	3	3	3	2	2	3	3	2
CO5	3	3	2	2	3	2	3	3	3	3	2	2

COs / PSOs	PSO1	PSO2
CO1	3	2
CO2	2	2
CO3	3	3
CO4	1	1
CO5	2	2

3/2/1 Indicates Strength of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							√					

Course Code	Course Title	Ty/Lb/ETL	L	T/S.Lr	P/R	C
EMCS22EL2	Machine Learning Lab	**Lb**	**0**	**0/0**	**4/0**	**2**

OBJECTIVE:

- To get practical Knowledge on implementing machine learning algorithms in real time problem for getting solutions.
- To implement supervised learning and their application.
- To understand unsupervised learning like clustering and EM algorithms.
- To understand the theoretical and practical aspects of probabilistic graphical models.

LIST OF EXPERIMENTS

1. Implementation the concept of decision tree with suitable data set from real world problem and classify the data set to produce new sample.
2. Detecting spam mails using support vector machine.
3. Implementation facial recognition application with artificial neural network.
4. Study and implement Amazon toolkit:Sagemaker
5. Implement character recognition using Multilayer Perceptron
6. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points select appropriate data set for your experiment and draw graphs
7. Implement sentiment analysis using random forest optimization algorithm
8. 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 Python Library Classes.
9. Choose best machine learning algorithm to implement online fraud detection.
10. Mini-project: student work in team on any socially relevant problem that needs a machine learning based solution, and evaluate the model performance.

Total : 60 Hrs.

Subject Code EMCS22EL3	Subject Name Formal Languages and Finite Automata lab	Ty/Lb/ETL	L	T/SLr	P/R	C
	Prerequisite: Nil	Lb	0	0/0	4/0	2

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

COURSE OUTCOMES (COs) :

CO1	Understand the practical approaches of how a compiler work
CO2	Understand and analyze the role of syntax and semantics of Programming languages in compiler construction
CO3	Apply the techniques and algorithms used in Compiler Construction in compiler component design
CO4	To use different tools in construction of the phases of a compiler for the mini Language
CO5	To Understand machine code generation from the abstract syntax tree generated by the parser

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**
CO3	**3**	**2**	**2**	**2**	**3**	**1**	**2**	**2**	**2**	**3**
CO4	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**
CO5	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

COs / PSOs	PSO1	PSO2
CO1	**3**	**3**
CO2	**3**	**2**
CO3	**3**	**2**
CO4	**3**	**3**
CO5	**3**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
							√		

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMCS22EL3	Formal Languages and Finite Automata lab	Lb	0	0/0	4/0	2

1) Write a C Program to Scan and Count the number of characters, words, and lines in a file.

2) Write a C Program to implement NFAs that recognize identifiers, constants, and operators of the mini Language.

3) Write a C Program to implement DFAs that recognize identifiers, constants, and operators of the mini Language.

4) Design a lexical analyzer for the given language. The lexical analyzer should ignore redundant spaces,

Tabs and new lines, comments etc.

5) Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools.

6) Design Predictive Parser for the given language

7) Design a LALR bottom up parser for the given language

8) Convert the BNF rules into Yacc form and Write code to generate abstract syntax tree.

9) A program to generate machine code from the abstract syntax tree generated by the parser.

Total : 60 Hrs.

Program Elective Lab II

Subject Code EMCS22EL4	Subject Name **:** Data Preparation and Analysis Lab	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: Nil	Lb	0	0/0	4/0	2

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :
Learn pre-processing method for multi-dimensional data , data cleaning mechanisms and data exploratory analysis

COURSE OUTCOMES (COs) : Students completing the course were able to

CO1	execute pre-processing method for multi-dimensional data
CO2	practice on data cleaning mechanisms
CO3	demonstrate various data exploratory analysis
CO4	analyze classification techniques
CO5	Execute various missing handling mechanisms

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**1**	**3**	**2**	**3**	**2**	**2**	**3**	**1**	**3**	**3**
CO2	**3**	**1**	**1**	**2**	**3**	**3**	**2**	**3**	**3**	**1**
CO3	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**2**
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**3**
CO5	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**2**

COs / PSOs	**PSO1**	**PSO2**
CO1	**3**	**2**
CO2	**3**	**2**
CO3	**1**	**3**
CO4	**2**	**1**
CO5	**3**	**2**

3/2/1 Indicates Strength of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
							✓		

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMCS22EL4	Data Preparation and Analysis Lab	Lb	00/	0/0	4/0	2

1. Install, configure and run Hadoop and HDFS

2. Execute word count / frequency programs using MapReduce

3. Implement an MR program that processes a weather dataset R

4. Execute Linear and logistic Regression

5. Implement SVM / Decision tree classification techniques

6. Execute clustering techniques

7. Visualize data using any plotting framework

8. Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop / R

9. Execute various missing handling mechanisms

10. Implement various noisy handling mechanisms.

Total : 60 Hrs.

Subject Code : EMCS22EL5	Subject Name : Network Security lab	Ty/Lb/ ETL	L	T/SLr	P/ R	C
	Prerequisite : Networks	Lb	0	0/0	4/0	2

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- Demonstrate various network security applications, IPSec, Firewall, IDS, Web Security, Email Security and Malicious software etc.,

COURSE OUTCOMES (Cos) :

Students completing the course were able to

CO1	Identify the security issues in the network and resolve it.
CO2	Analyse the vulnerabilities in any computing system and hence be able to design a security solution.
CO3	Evaluate security mechanisms using rigorous approaches by key ciphers and Hash functions.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10
CO1	**3**	**2**	**3**	**2**	**1**	**3**	**2**	**1**	**3**	**3**
CO2	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**3**	**3**	**3**
CO3	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**3**

COs/PSOs	PSO1	PSO2
CO1	2	1
CO2	2	1
CO3	3	2

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
							✔		

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMCS22EL5	Network Security Lab	Lb	0	0/0	4/0	2

1. Implement the following Substitution & Transposition Techniques concepts:
   a) Caesar Cipher b) Playfair Cipher c) Hill Cipher d) Vignere Cipher e) Rail fence – row & Column Transformation
2. Implement the following algorithms a) DES b) RSA Algorithm c) Diffie-Hellman d) MD5 e) 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.
   (Net Stumbler) Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w).
8. Implement the Blowfish algorithm logic.

Total : 60 Hrs.

Subject Code	Subject Name :	Ty/Lb/ETL	L	T/S.Lr	P/R	C
EMCS22EL6/EMCF22L01	Digital Forensics and Cyber Crime Investigation Lab	Lb	0	0/0	4/0	2

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- To introduce students to Scientific , philosophy, integrity, scene investigation procedures, criminalities, and the role of the criminalist as they relate to digital crime scene investigation
- To analyze a particular media if any information of evidentiary value is contained within it and generate report of those findings using several forensics tools.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Practices and basic knowledge about VMware and various file system.
CO2	Show in Open source forensics tools
CO3	The student will have hands on experience on all the stages of cybercrime investigation using several forensics tools like FTK, Encase, CyberCheck.
CO4	To Tracing IP address
CO5	To deal real time cyber security issues.

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**2**	**2**	**1**	**3**	**1**	**1**	**2**	**2**	**2**	**3**
CO2	**2**	**1**	**2**	**3**	**1**	**1**	**2**	**2**	**2**	**3**
CO3	**2**	**1**	**2**	**3**	**2**	**2**	**1**	**2**	**3**	**3**
CO4	**2**	**2**	**3**	**3**	**2**	**1**	**2**	**1**	**3**	**3**
CO5	**2**	**2**	**3**	**3**	**2**	**1**	**2**	**1**	**3**	**3**

COs/PSOs	PSO1	PSO2
CO1	**1**	**2**
CO2	**1**	**2**
CO3	**1**	**2**
CO4	**1**	**2**
CO5	**1**	**2**

3/2/1 Indicates Strength of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
							√		

Subject Code	Subject Name	Ty/Lb/ETL	L	T/SLr	P/R	C
EMCS22EL6/ EMCF22L01	**DIGITAL FORENSICS AND CYBER CRIME INVESTIGATION LAB**	Lb	0	0/0	4/0	2

The students will learn many of the cardinal principles and techniques of digital crime scene investigation. The necessity of a rigorous scientific approach will be stressed. This lab uses an intensive, hands-on style to learn the basics of digital crime scene management and the recognition, evaluation, enhancement, documentation, control, and collection of evidence. Scenes will encompass criminal and non-criminal activities including Computer Intrusions, Cyber stalking, violent crime, and crime committed using Mobile devices and Network Related crimes

The primary aim of the course is to introduce students to scientific, philosophy, integrity, scene investigation procedures, criminalities, and the role of the criminalist as they relate to digital crime scene investigation

List of Exercises

- Open Source Forensic Tools
- Analyze an Image file using FTK
- Analyze an Image file using Encase
- Analyze an Image file using Cybercheck
- Deleted File Recovery in NTFS
- Disk Forensics and Data Recovery
- Steganography
- Key loggers
- Network monitors
- Acquisition and analysis using Mobile Check
- Examining Email messages

IP Tracking.

Total : 60 Hrs.

Audit Course I & II

Audit Course I & II							
S.No	Course Code	Course Name	TY/LB/ IE	Teaching Scheme			
				L	T/S.Lr	P/R	C
1	EMCC22I01	English for Research paper Writing	IE	2	0/0	0/0	0
2	EMCC22I02	Disaster Management	IE	2	0/0	0/0	0
3	EMCC22I03	Sanskrit for Technical Knowledge	IE	2	0/0	0/0	0
4	EMCC22I04	Value Education	IE	2	0/0	0/0	0
5	EMCC22I05	Constitution of India	IE	2	0/0	0/0	0
6	EMCC22I06	Pedagogy Studies	IE	2	0/0	0/0	0
7	EMCC22I07	Stress Management by Yoga	IE	2	0/0	0/0	0
8	EMCC22I08	Personality Development through Life Enlightenment Skills	IE	2	0/0	0/0	0
9	EMCC22I09	Research Publication Ethics	IE	2	0/0	0/0	0

Subject Code: EMCC22I01	Subject Name: ENGLISH FOR RESEARCH PAPER WRITING	Ty/Lb/IE	L	T/S.Lr	P/R	C
	Prerequisite: Nil	Ty	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives To know the art of writing the research paper and thesis
To Ensure the good quality of paper at very first-time submission .

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

CO1	Understand that how to improve your writing skills and level of readability
CO2	Learn about what to write in each section
CO3	Understand the skills needed when writing a Title

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	1	1	1	1	3	1	1	1	3
CO2	1	1	1	1	1	3	1	1	1	3
CO3	1	1	1	1	1	3	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	1	1

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✓

Subject Code	Subject Name	Ty/Lb/IE	L	T/S.Lr	P/R	C
EMCC22I01	English for Research Paper Writing	IE	2	0/0	0/0	0

Unit I **5 Hrs**

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

Unit II **5 Hrs**

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

Unit III **5 Hrs**

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

Unit IV **5 Hrs**

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

Unit V **5 Hrs**

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

Unit VI **5 Hrs**

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Reference Books: **TOTAL HOURS: 30**

1. Goldbort R (2016) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2016) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (2018), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2017

Subject Code: EMCC22I02	Subject Name: DISASTER MANAGEMENT	Ty/Lb/IE	L	T/S .Lr	P/R	C
	Prerequisite: Nil	Ty	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

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

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

CO1	Evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO2	Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO3	Understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	1	1	1	1	3	1	1	1	1
CO2	1	1	1	1	1	3	1	1	1	1
CO3	1	1	1	1	1	3	1	1	1	1

COs / PSOs	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	1	1

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✔

Subject Code	Subject Name	Ty/Lb/IE	L	T/S.Lr	P/R	C
EMCC22I02	Disaster Management	Ty	2	0/0	0/0	0

Unit I **5 Hrs**

Introduction

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

Unit II **5 Hrs**

Repercussions Of Disasters And Hazards: Economic Damage, Loss OfHuman 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 **5 Hrs**

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 WithSpecial Reference To Tsunami; Post-Disaster Diseases And Epidemics

Unit IV **5 Hrs**

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 AndCommunity Preparedness.

Unit V **5 Hrs**

Risk Assessment : Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Unit VI **5 Hrs**

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

TOTAL HOURS: 30

SUGGESTED READINGS:

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

Subject Code: EMCC22I03	Subject Name: SANSKRIT FOR TECHNICAL KNOWLEDGE	Ty/Lb/IE	L	T/S.Lr	P/R	C
	Prerequisite: Nil	Ty	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

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

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

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

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	1	1	1	1	3	1	1	1	1
CO2	1	1	1	1	1	3	1	1	1	1
CO3	1	1	1	1	1	3	1	1	1	1

COs / PSOs	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	1	1

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✔

Subject Code	Subject Name	Ty/Lb/IE	L	T/S.Lr	P/R	C
EMCC22I03	Sanskrit for Technical Knowledge	Ty	2	0/0	0/0	0

Unit I **10 hrs**

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

Unit II **10 hrs**

Order, Introduction of roots, Technical information about Sanskrit Literature

Unit III **10 hrs**

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

TOTAL HOURS : 30 HRS

Reference Books:

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

Subject Code: EMCC22I04	Subject Name : VALUE EDUCATION	Ty/Lb/IE	L	T/S .Lr	P/R	C
	Prerequisite: Nil	Ty	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives .

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

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

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

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	1	1	1	1	3	1	1	1	1
CO2	1	1	1	1	1	3	1	1	1	1
CO3	1	1	1	1	1	3	1	1	1	1

COs / PSOs	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	1	1

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✔

Subject Code	Subject Name	Ty/Lb/IE	L	T/S.Lr	P/R	C
EMCC22I04	Value Education	Ty	2	0/0	0/0	0

Unit 1: **6 Hrs**

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

Unit 2: 8 **Hrs**

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

Unit 3: 8 **Hrs**

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

Unit 4: 8 **Hrs**

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 hrs

Reference:

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

Subject Code: EMCC22I05	Subject Name : CONSTITUTION OF INDIA	Ty/Lb/ IE	L	T/S .Lr	P/R	C
	Prerequisite: Nil	Ty	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

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

COURSE OUTCOMES (COs) : At the end of this course the students would be able to know

CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
CO3	. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
CO4	Discuss the passage of the Hindu Code Bill of 1956.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	1	1	1	1	3	1	1	1	1
CO2	1	1	1	1	1	3	1	1	1	1
CO3	1	1	1	1	1	3	1	1	1	1
CO4	1	1	1	1	1	3	1	1	1	1

COs / PSOs	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	1	1
CO4	1	1

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✓

Subject Code	Subject Name	Ty/Lb/ETL	L	T/S.Lr	P/R	C
EMCC22I05	Constitution of India	Ty	2	0/0	0/0	0

Unit 1: **6 hrs**

History of Making of the Indian Constitution:

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

Unit 2: **6 hrs**

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 and Fundamental Duties.

Unit 3: **6 hrs**

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 4: **6 hrs**

Local Administration:

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

Unit 4: **6 hrs**

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 hrs

Reference Books:

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

Subject Code: EMCC22I06	Subject Name : PEDAGOGY STUDIES	Ty/Lb/ ETL	L	T/S .Lr	P/R	C
	Prerequisite: Nil	Ty	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives Students will be able to: 4. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers. 5. Identify critical evidence gaps to guide the development.

COURSE OUTCOMES (COs) : At the end of this course the students would be able to know

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

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	1	1	1	1	3	1	1	1	1
CO2	1	1	1	1	1	3	1	1	1	1
CO3	1	1	1	1	1	3	1	1	1	1

COs / PSOs	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	1	1

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✔

Subject Code	Subject Name	Ty/Lb/ETL	L	T/S.Lr	P/R	C
EMCC22I06	Pedagogy Studies	Ty	2	0/0	0/0	0

Unit I: Introduction and Methodology: 6 hrs

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

Unit II:

Thematic overview: 6 hrs

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

Unit III: Evidence on the effectiveness of pedagogical practices 6 hrs

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

Unit IV: Professional development: 6 hrs

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

Unit V: Research gaps and future directions: 6 hrs

Research design, Contexts, Pedagogy, Teacher education, Curriculum and Assessment, Dissemination and research impact.

TOTAL HOURS: 30

Reference Books:

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.

- www.pratham.org/images/resource%20working%20paper%202.pdf.

Subject Code: EMCC22I07	**Subject Name:** STRESS MANAGEMENT BY YOGA	**Ty/Lb/ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite : **Basic Knowledge of Yoga**	Ty	2	0/0	0/0	0

To Understand the Basic Concepts of Yoga
To Gain knowledge on Ashtanga yoga
To Acquire knowledge of Techniques and Practice of Yogasanas
To Understand stress and the causes. To Attain the knowledge about stress busting through yoga

CO1	Understand the Basic Concepts of Yoga
CO2	Gain knowledge on Ashtanga yoga
CO3	To Understand stress and the causes
CO4	Acquire knowledge of Techniques and Practice of Yogasanas
CO5	Attain the knowledge about stress busting through yoga

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	1	1	1	1	1	3	1	1	1	1
CO2	1	1	1	1	1	3	1	1	1	1
CO3	1	1	1	1	1	1	1	1	1	1
CO4	1	1	1	1	1	3	1	1	1	1
CO5	1	1	1	1	1					

COs / PSOs	**PSO1**	**PSO2**
CO1	1	1
CO2	1	1
CO3	1	1
CO4	1	1
CO5	1	1

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✔

Subject Code	Subject Name	Ty/Lb/ETL	L	T/S.Lr	P/R	C
EMCC22I07	Stress Management by Yoga	Ty	2	0/0	0/0	0

Unit 1: **6 hrs**

What is stress - Symptoms of stress - Why is stress helpful - Why is stress harmful - Stress versus burnout - Main types of stress - Know your stressors - Tips to Manage Stress

Unit 2: **6 hrs**

Strength, Weaknesses, Opportunities and Threats (SWOT) Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem. Emotional Intelligence, What is Emotional Intelligence, emotional quotient why Emotional Intelligence matters, Emotion Scales. Managing Emotions

Unit 3: **6 hrs**

What is Yoga – Definition and Its Branches - Hatha Yoga – Kundalini Yoga – Tantra Yoga – Kriya Yoga – Introduction To Ashtanga Yoga

Unit 4: **6 hrs**

Mechanism of Stress related diseases: Psychic, Psychosomatic, Somatic and Organic phase. Role of Meditation & Pranayama on stress – physiological aspect of Meditation. Constant stress & strain, anxiety, conflicts resulting in fatigue among Executive. Contribution of Yoga to solve the stress related problems of Executive

Unit 5: **6 hrs**

Meaning and definition of Health – various dimensions of health (Physical, Mental, Social and Spiritual) – Yoga and health – Yoga as therapy. Physical fitness. Stress control exercise – Sitting meditation, Walking meditation, Progressive muscular relaxation, Gentle stretches and Massage.

TOTAL HOURS : 30 Hrs

Reference Books:

1. *Andrews, Linda Wasmer., (2005). Stress Control for peace of Mind. London: Greenwich Editions Lalvani, Vimla., (1998). Yoga for stress. London: Hamlyn*
2. *Nagendra, H.R., and Nagarathana, R., (2004). Yoga perspective in stress management. Bangalore: Swami Vivekananda Yoga Prakashana.*
3. *Nagendra, H.R., and Nagarathana, R., (2004). Yoga practices for anxiety & depression. Bangalore: Swami Sukhabodhanandha Yoga Prakashana.*
4. *Sukhabodhanandha, Swami., (2002). Stress Management. Banglore: Prasanna trust.*
5. Udupa, K.N., (1996). Stress management by Yoga. NewDelhi: Motilal Banaridass Publishers Private Limited

Subject Code: EMCC22I08	**Subject Name :** PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	**Ty/Lb/ ETL**	**L**	**T/ S. Lr**	**P/R**	**C**
	Prerequisite: Nil	Ty	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

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

COURSE OUTCOMES (COs) : At the end of this course the students would be able to know

CO1	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
CO2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity
CO3	Study of Neetishatakam will help in developing versatile personality of students.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	1	1	1	1	1	3	1	1	1	1
CO2	1	1	1	1	1	3	1	1	1	1
CO3	1	1	1	1	1	3	1	1	1	1

COs / PSOs	**PSO1**	**PSO2**
CO1	1	1
CO2	1	1
CO3	1	1

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✓

Subject Code	Subject Name	Ty/Lb/ETL	L	T/S.Lr	P/R	C
EMCC22I08	Personality Development through life Enlightenment Skills	Ty	2	0/0	0/0	0

Unit 1: **10 hrs**

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 2: **10 hrs**

Approach to day to day work and duties.

Shrimad BhagwadGeeta: 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 3: **10 hrs**

Statements of basic knowledge.

Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18 Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

Reference Books: **TOTAL HOURS : 30 Hrs**

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

Subject Code: EMCC22I09	Subject Name : Research and Publication Ethics	Ty / Lb/ ETP/IE	L	T / S.Lr	P/ R	C
	Prerequisite: core subjects	T	2	0/0	0/0	2

T/L/ : Theory/Lab L : Lecture T : Tutorial P : Practical/Project R : Research C: Credits T/L Theory/Lab

OBJECTIVE:

- To understand the philosophy of science and ethics, research integrity and publication ethics.
- To identify research misconduct and predatory publications.
- To understand indexing and citation databases, open access publications, research metrics (citations, h-index, impact Factor, etc.).

COURSE OUTCOMES (COs) : By doing this course students will

CO1	Understand the ethical issues related to Research and Publication
CO2	Get to know about different types of plagiarism and ways for avoiding plagiarism
CO3	Know about best practices and guidelines in publication ethics and also learns to avoid Publication misconduct
CO4	Get to know about Violation of publication ethics, authorship and contributor ship and get to identify about Predatory publishers and journals.
CO5	Get to know about various open sources database and research metrics like indexing, citation etc.,

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	3	3	2	3	3	2	3
CO2	2	3	3	3	3	2	3	3	2	3
CO3	2	3	3	3	3	2	3	3	2	3
CO4	2	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	2	3	3	2	3

COs / PSOs	PSO1	PSO2
CO1	2	3
CO2	2	3
CO3	2	3
CO4	2	3
CO5	2	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit Course
										✔

Subject Code: EMCC22I09	Subject Name : Research and Publication Ethics	Ty / Lb/ ETP/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Core subjects	IE	2	0/0	0/0	0
T/L/ : Theory/Lab L : Lecture T : Tutorial P : Practical/Project R : Research C: Credits T/L Theory/Lab						

Unit 1. Introduction **6 Hrs.**

Introduction to philosophy: Definition, nature and scope, concept, branches - Ethics: Definition, moralphilosophy, nature of moral judgments and reactions – Ethics with respect to Science and Research Intellectual honesty and research integrity.

Unit II: Scientific Conduct **6 Hrs.**

Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP) Redundant Publications: Duplicate and over lapping publications, salami slicing – Selective reportingand misrepresentation of data.

Unit III: Publication Ethics -I **6 Hrs.**

Publication ethics: Definition, introduction and importance – Best practices/standards setting initiativesand guidelines: COPE, WAME etc. Publication misconduct: definition, Concept, problems that lead to unethical behavior and vice-versa, types.

Unit IV: Publication Ethics – II **6 Hrs.**

Violation of publication ethics, authorship and contributor ship – Identification of publication misconduct, complaints and appeals – Predatory publishers and journals – Subject specific ethicalissues, Complaints and appeals: examples and fraud from India and Abroad.

Unit V: Data Bases and Research Metrics **6 Hrs.**

Open Access publication and Initiatives – Indexing databases – Citation databases, Web of Science,Scopus, etc. – Impact factor of journals as per Journal Citation report .SNIP, SJR, IPP, Cite Score - Metrics: h-index,gindex,i10index,altmetrics – Conflict of interest.

Total : 30 Hrs.

References:

1. Bird A 2006, Philosophy of Science, Routledge
2. MacIntyre &Alasdair, 1967, A Short History of Ethics, London.
3. Chaddah, P20 1 8, Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN: 9789387480865.
4. On Being a Scientist: A Guide to Responsible Conduct in Research, 2009, National Academy of Sciences, National Academy ofEngineering and Institute of Medicine. 3rd edition, National Academies Press.
5. Resnik, D. B 201 1, what is ethics in research & why is it important. National Institute of Environmental Health Sciences,pp.1—10. https://www.niehs.nih.gov/research/reso_uuces/bioethics/whatis/index.cfm
6. Bcall, J 2012, Predatory publishers are corrupting open access, Nature, Vol. 489, no.7415,pp. 179—179. https://d0i.org/lO.1 03 8/48917%,Ethics in Science Education, 2019Indian National Science Academy (INSA), Research and Governance,