KONGU ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

PERUNDURAI ERODE – 638 060

TAMILNADU INDIA

Estd : 1984

REGULATIONS, CURRICULUM & SYLLABI – 2024

(CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION)

(For the students admitted from the academic year 2024 - 2025)

MASTER OF ENGINEERING DEGREE IN COMPUTER SCIENCE ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

KONGU
Assuring the Best

M.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2024
(For the candidates admitted in the academic year 2024-25 onwards)

SEMESTER – I													
Course Code	Course Title	Hours / Semester						Credit	Maximum Marks			Category	Type
		CI		LI	TW	SL	TH		CA	ESE	Total		
		L	T	P									
Theory/Theory with Practical													
24AMT13	Mathematical Foundations for Computer Science	45	15	0	60	0	120	4	40	60	100	FC	A
24GET11	Introduction to Research	30	15	0	45	0	90	3	40	60	100	FC	C
24MST11	Data Structures and Analysis of Algorithms	45	0	0	45	0	90	3	40	60	100	PC	C
24MST12	Machine Learning Techniques	45	0	0	45	0	90	3	40	60	100	PC	C
24MST13	Communication Networks	45	15	0	60	0	120	4	40	60	100	PC	C
24MST14	Multicore Architectures	45	0	0	45	0	90	3	40	60	100	PC	C
Practical / Employability Enhancement													
24MSL11	Data Structures and Analysis of Algorithms Laboratory	0	0	0	30	0	30	1	60	40	100	PC	
24MSL12	Machine Learning Techniques Laboratory	0	0	0	30	0	30	1	60	40	100	PC	
Total Credits to be earned								**22**					

CI – Classroom Instructions, LI – Laboratory Instructions, TW – Term Work, SL – Self Learning, L – Lecture, T – Tutorial, P – Practical, C – Credit, TH – Total Hours, CA – Continuous Assessment, ESE – End Semester Examination

Type: A – Analytical, D – Design using Hardware, S – Simulation using Coding, C – Concept, OC – Online course, OT - others

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Boards of Studies - CSE

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M.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2024
(For the candidates admitted in the academic year 2024-25 onwards)

SEMESTER – II

Course Code	Course Title	Hours / Semester						Credit	Maximum Marks			Category	Type
		CI		LI	TW	SL	TH		CA	ESE	Total		
		L	T	P									
Theory/Theory with Practical													
24MST21	Deep Learning Techniques	45	0	0	45	0	90	3	40	60	100	PC	C
24MST22	Data Analytics	45	0	0	45	0	90	3	40	60	100	PC	A
24MST23	Security in Computing	45	30	0	45	0	120	4	40	60	100	PC	A
	Professional Elective – I	45	0	0	45	0	90	3	40	60	100	PE	
	Professional Elective – II	45	0	0	45	0	90	3	40	60	100	PE	
	Professional Elective - III	45	0	0	45	0	90	3	40	60	100	PE	
Practical / Employability Enhancement													
24MSL21	Deep Learning Techniques Laboratory	0	0	0	30	0	30	1	60	40	100	PC	
24MSL22	Data Analytics Laboratory	0	0	0	30	0	30	1	60	40	100	PC	
Total Credits to be earned								**21**					

CI – Classroom Instructions, LI – Laboratory Instructions, TW – Term Work, SL – Self Learning, L – Lecture, T – Tutorial, P – Practical, C – Credit, TH – Total Hours, CA – Continuous Assessment, ESE – End Semester Examination

Type: A – Analytical, D – Design using Hardware, S – Simulation using Coding, C – Concept, OC – Online course, OT - others

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M.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2024
(For the candidates admitted in the academic year 2024-25 onwards)

SEMESTER – III													
Course Code	Course Title	Hours / Semester						Credit	Maximum Marks			Category	Type
		CI		LI	TW	SL	TH		CA	ESE	Total		
		L	T	P									
Theory/Theory with Practical													
	Professional Elective - IV	45	0	0	45	0	90	3	40	60	100	PE	
	Professional Elective - V	45	0	0	45	0	90	3	40	60	100	PE	
	Professional Elective - VI	45	0	0	45	0	90	3	40	60	100	PE	
Practical / Employability Enhancement													
24MSP31	Project Work - I	0	0	240	0	0	240	8	50	50	100	EC	
Total Credits to be earned								17					

CI – Classroom Instructions, LI – Laboratory Instructions, TW – Term Work, SL – Self Learning, L – Lecture, T – Tutorial, P – Practical, C – Credit, TH – Total Hours, CA – Continuous Assessment, ESE – End Semester Examination

Type: A – Analytical, D – Design using Hardware, S – Simulation using Coding, C – Concept, OC – Online course, OT - others

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M.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2024
(For the candidates admitted in the academic year 2024-25 onwards)

SEMESTER – IV													
Course Code	Course Title	Hours / Semester						Credit	Maximum Marks			Category	Type
		CI		LI	TW	SL	TH		CA	ESE	Total		
		L	T	P									
Practical / Employability Enhancement													
24MSP41	Project Work - II	0	0	360	0	0	360	12	50	50	100	EC	
Total Credits to be earned								12					

CI – Classroom Instructions, LI – Laboratory Instructions, TW – Term Work, SL – Self Learning, L – Lecture, T – Tutorial, P – Practical, C – Credit, TH – Total Hours, CA – Continuous Assessment, ESE – End Semester Examination

Type: A – Analytical, D – Design using Hardware, S – Simulation using Coding, C – Concept, OC – Online course, OT - others

Total Credits : 72

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M.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2024
(For the candidates admitted in the academic year 2024-25 onwards)

LIST OF PROFESSIONAL ELECTIVE COURSES															
S. No.	Course Code	Course Title	Hours / Week						Credit	Maximum Marks			Category	Type
			CI		LI	TW	SL	TH						
			L	T	P					CA	ESE	Total		
SEMESTER - II														
ELECTIVE – I														
1	24MSE01	Data Mining Techniques	45	0	0	45	0	90	3	40	60	100	PE	C
2	24MSE02	Business Intelligence	45	0	0	45	0	90	3	40	60	100	PE	C
3	24MSE03	Cloud Computing	45	0	0	45	0	90	3	40	60	100	PE	C
4	24MSE04	Compiler Design Techniques	45	0	0	45	0	90	3	40	60	100	PE	C
ELECTIVE – II														
5	24MSE05	Advanced Parallel Architecture and Programming	45	0	0	45	0	90	3	40	60	100	PE	C
6	24MSE06	Internet of Things	45	0	0	45	0	90	3	40	60	100	PE	C
7	24MSE07	Vehicular Adhoc Networks	45	0	0	45	0	90	3	40	60	100	PE	C
8	24MSE08	Modern Information Retrieval Techniques	45	0	0	45	0	90	3	40	60	100	PE	C
ELECTIVE – III														
9	24MSE09	Randomized Algorithms	45	0	0	45	0	90	3	40	60	100	PE	C
10	24MSE10	Social Network Analysis	45	0	0	45	0	90	3	40	60	100	PE	C
11	24MSE11	Advanced Database Technology	45	0	0	45	0	90	3	40	60	100	PE	C
12	24MSE12	Software Defined Networking	45	0	0	45	0	90	3	40	60	100	PE	C

CI – Classroom Instructions, LI – Laboratory Instructions, TW – Term Work, SL – Self Learning, L – Lecture, T – Tutorial, P – Practical, C – Credit, TH – Total Hours, CA – Continuous Assessment, ESE – End Semester Examination

Type: A – Analytical, D – Design using Hardware, S – Simulation using Coding, C – Concept, OC – Online course, OT - others

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M.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2024
(For the candidates admitted in the academic year 2024-25 onwards)

S. No	Course Code	Course Title	Hours / Week						Credit	Maximum Marks			Category	Type
			CI		LI	TW	SL	TH						
			L	T	P					CA	ESE	Total		
SEMESTER - III														
ELECTIVE – IV														
13	24MSE13	Speech and Natural Language Processing	45	0	0	45	0	90	3	40	60	100	PE	C
14	24MSE14	Intelligent System Design	45	0	0	45	0	90	3	40	60	100	PE	C
15	24MSE15	Mobile and Pervasive Computing	45	0	0	45	0	90	3	40	60	100	PE	C
16	24MSE16	Nature Inspired Optimization Techniques	45	0	0	45	0	90	3	40	60	100	PE	C
17	24MSE17	Security Practices	45	0	0	45	0	90	3	40	60	100	PE	C
ELECTIVE – V														
18	24MSE18	Digital Image Processing and Computer Vision	45	0	0	45	0	90	3	40	60	100	PE	C
19	24MSE19	Data Science	45	0	0	15	30	90	3	40	60	100	PE	OC
20	24MSE20	Information Storage Management	45	0	0	45	0	90	3	40	60	100	PE	C
21	24MSE21	Reinforcement Learning	45	0	0	45	0	90	3	40	60	100	PE	C
22	24MSE22	Virtualization Techniques	45	0	0	45	0	90	3	40	60	100	PE	C
ELECTIVE – VI														
23	24MSE23	User Interface Design	45	0	0	45	0	90	3	40	60	100	PE	C
24	24MSE24	Blockchain Technologies	45	0	0	45	0	90	3	40	60	100	PE	C
25	24MSE25	Sentiment Analysis	45	0	0	45	0	90	3	40	60	100	PE	C
26	24GET13	Innovation Entrepreneurship and Venture Development	45	0	0	45	0	90	3	40	60	100	PE	C

CI – Classroom Instructions, LI – Laboratory Instructions, TW – Term Work, SL – Self Learning, L – Lecture, T – Tutorial, P – Practical, C – Credit, TH – Total Hours, CA – Continuous Assessment, ESE – End Semester Examination

Type: A – Analytical, D – Design using Hardware, S – Simulation using Coding, C – Concept, OC – Online course, OT – others

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ACADEMIC CELL ★ KONGU ENGINEERING COLLEGE ★

24AMT13 - MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE							
Programme & Branch	**M.E.ComputerScienceandEngineering**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1**	**FC**	**3**	**1**	**0**	**4**

Preamble	Thiscourseisdesignedtoprovidethesolidfoundationonmathematicalandstatisticalknowledgefordesigningvariousconceptsincomputing,managingdatabases,artificialintelligence,compileranddesign.	
Unit – I	**Estimation Theory:**	**9+3**
Estimators-Characteristics of estimators - Unbiased estimators - Methods of Estimation: Method of Maximum Likelihood Estimation –Method of Moments.		
Unit – II	**MultivariateAnalysis:**	**9+3**
Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components – Population principal components – Principal components from standardized variables.		
Unit – I	**VectorSpaces:**	**9+3**
Vector space–Subspaces–Lineardependenceandindependence–Basisanddimension–Rowspace,Columnspace andNullSpace—Rankandnullity.		
Unit – IV	**NumberTheory:**	**9+3**
Divisibility - Prime numbers –Greatest Common Divisor– Euclid's algorithm – Fundamental theorem of arithmetic – Fermat's Little theorem – Congruence: Linear Congruences – Solution of congruences –System of Linear Congruences: Chinese remainder theorem.		
Unit – V	**GraphTheory:**	**9+3**
Graphs and Graph Models – Graph Terminology and Special Types of Graphs. – Representing Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton Paths – Shortest-Path Problems: Dijkstra's Algorithm - Warshall's Algorithm – Graph Coloring.		
Lecture:45, Tutorial:15, Total:60		

REFERENCES:

1.	GuptaS.C. and KapoorV.K."FundamentalsofMathematicalStatistics",12th Edition, SultanChand andSons, 2022.
2.	RichardA.JohnsonandDeanW.Wichern,"AppliedMultivariateStatisticalAnalysis",6thEdition,PearsonEducation,New Jersey,2019.
3.	Howard Anton, Anton Kaul, "Elementary Linear Algebra" 12th Edition, John Wiley & Sons, 2019.
4.	Thomas Koshy,"Elementary Number Theory with Applications", 2nd Edition, Academic Press,2007.
5.	Kenneth H. Rosen. ," Discrete Mathematics and its Applications ", 8th Edition, Tata McGraw Hill Education, New Delhi 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	compute estimators using various estimation methods.	Applying(K3)
CO2	apply the concepts of multivariate analysis in solving Engineering problems	Applying(K3)
CO3	understandtheconceptsof linearalgebra tosolvepractical problems.	Understanding(K2)
CO4	handle networksecurityrelatedproblemsusingnumber theoryconcepts.	Applying(K3)
CO5	apply graph theoretic models in scheduling and networking problems.	Applying(K3)

Mapping of COs with POs and PSOs

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

1–Slight,2–Moderate,3–Substantial,BT-Bloom'sTaxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		40	60				100
CAT2		40	60				100
CAT3		30	70				100
ESE		30	70				100

* ±3% may be varied (CAT 1 & 2 – 60 marks & ESE – 100 marks)

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Board of Studies - S H / Maths

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24GET11 - INTRODUCTION TO RESEARCH									
(Common to all ME / MTech Branches & MCA)									
Programme & Branch	All ME/MTech branches & MCA	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	NIL	1 / 3#	FC	30	15	0	45	90	3

Preamble	This course will familiarize the fundamental concepts/techniques adopted in research, problem formulation and patenting. also, will disseminate the process involved in collection, consolidation of published literature and rewriting them in a presentable form using latest tools.

Unit - I	Concept of Research:	6+3

Meaning and Significance of Research: Skills, Habits and Attitudes for Research - Time Management - Status of Research in India. Why, How and What a Research is? - Types and Process of Research - Outcome of Research - Sources of Research Problem - Characteristics of a Good Research Problem - Errors in Selecting a Research Problem - Importance of Keywords - Literature Collection – Analysis - Citation Study - Gap Analysis - Problem Formulation Techniques.

Unit - II	Research Methods and Journals:	6+3

Interdisciplinary Research - Need for Experimental Investigations - Data Collection Methods - Appropriate Choice of Algorithms / Methodologies / Methods - Measurement and Result Analysis - Investigation of Solutions for Research Problem – Interpretation - Research Limitations. Journals in Science/Engineering - Indexing and Impact factor of Journals - Citations - h Index - i10 Index – Journal Policies - How to Read a Published Paper - Ethical issues Related to Publishing - Plagiarism and Self-Plagiarism.

Unit - III	Paper Writing and Research Tools:	6+3

Types of Research Papers - Original Article/Review Paper/Short Communication/Case Study - When and Where to Publish? - Journal Selection Methods. Layout of a Research Paper - Guidelines for Submitting the Research Paper - Review Process - Addressing Reviewer Comments. Use of tools / Techniques for Research - Hands on Training related to Reference Management Software -End Note, Software for Paper Formatting like LaTeX/MS Office. Introduction to Origin, SPSS, ANOVA etc., Software for detection of Plagiarism.

Unit - IV	Effective Technical Thesis Writing/Presentation:	6+3

How to Write a Report - Language and Style - Format of Project Report - Use of Quotations - Method of Transcription Special Elements: Title Page - Abstract - Table of Contents - Headings and Sub-Headings - Footnotes - Tables and Figures - Appendix - Bibliography etc. - Different Reference Formats. Presentation using PPTs.

Unit - V	Nature of Intellectual Property:	6+3

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

REFERENCES:

1.	DePoy, Elizabeth, and Laura N. Gitlin, "Introduction to Research-E-Book: Understanding and Applying Multiple Strategies", Elsevier Health Sciences, 2015.
2.	Walliman, Nicholas, "Research Methods: The basics", Routledge, 2017.
3.	Bettig Ronald V., "Copyrighting culture: The political economy of intellectual property", Routledge, 2018.

*includes Term Work(TW) & Online / Certification course hours

Semster1: ME / MTech , Semester 3: MCA

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	list the various stages in research and categorize the quality of journals.	Analyzing (K4)
CO2	formulate a research problem from published literature/journal papers	Evaluating (K5)
CO3	write, present a journal paper/ project report in proper format	Creating (K6)
CO4	select suitable journal and submit a research paper.	Applying (K3)
CO5	compile a research report and the presentation	Applying (K3)

Mapping of COs with POs

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	1		
CO2	3	2	3		
CO3	3	3	1		
CO4	3	2	1		
CO5	3	2	1		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Blooms Category*	Remembering (K1) %	Understanding (K2) %	Applying(K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		30	40	30			100
CAT2		30	40	30			100
CAT3			30	40	30		100
ESE		30	40	30			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

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Signature of the Chairman
Board of Studies - Technology

PS

24MST11 - DATA STRUCTURES AND ANALYSIS OF ALGORITHMS

Programme & Branch	M.E & Computer Science and Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	1	PC	45	0	0	45	90	3

Preamble	Provides insight into the intrinsic nature of the problem as well as possible solution techniques, independent of programming language/ programming paradigm/computer hardware/ implementation aspect.	
Unit – I	**Introduction:**	**9**
The Role of Algorithms in Computing- Growth of Functions - Analysis of Recursive and Non-recursive Functions – Lists - Heap Sort – Quick Sort – Sorting in Linear Time.		
Unit – II	**Advanced Data Structures:**	**9**
Binary Search Trees - Red-Black Trees - Augmenting Data Structures - B- Trees - Binomial Heaps - Fibonacci Heaps.		
Unit – III	**Algorithm Design Techniques:**	**9**
Overview of Basic Design Techniques: Divide and Conquer (Strassen's Matrix Multiplication) – Dynamic Programming (Rod Cutting) - Greedy Algorithms(Huffman Codes) – String Matching: Naive Algorithm - Rabin Karp Algorithm - String matching with finite automata — Knuth-Morris-Pratt Algorithm - Computational Geometry: Line Segment Properties - Determining segments intersection – Convex Hull – Closest pair of points.		
Unit – IV	**Graph Algorithms:**	**9**
Elementary Graph Algorithms - Minimum Spanning Trees - Single Source Shortest Paths - All Pairs Shortest Paths - Maximum Flow.		
Unit – V	**NP and Approximation Algorithm:**	**9**
NP-Completeness: Polynomial Time verification, NP Completeness and Reducibility - NP Completeness Proofs - NP Complete Problems - Approximation Algorithms: Vertex Cover Problem -Traveling Salesman Problem - Sum of Subset Problem.		

REFERENCES:

1.	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Fourth Edition, PHI Learning Private Limited, 2022.
2.	Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2023.
3.	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
4.	Weiss Mark Allen, "Data Structures and Algorithm Analysis in C++", 3rd Edition, Pearson Education, New Delhi, 2007.
5.	Donald E. Knuth, "The Art of Computer Programming", Volumes 1 & 3 Pearson Education, 2009.

*includes Term Work(TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	analyze algorithms and prove their correctness for searching and sorting	Analyzing (K4)
CO2	Determine appropriate data structure as applicable to specified problem definition	Applying (K3)
CO3	design algorithms using different Algorithm Design Techniques and apply them to real world problem	Applying (K3)
CO4	summarize the major graph algorithms and apply on standard problems	Applying (K3)
CO5	outline the significance of NP-completeness and apply Approximation algorithm	Applying (K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		15	75	10			100
CAT2		25	75				100
CAT3		25	75				100
ESE		20	70	10			100

* ±3% may be varied (CAT 1 ,2 & 3 – 50 marks & ESE – 100 marks)

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Board of Studies - CSE

[P.SANTHIYA]

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SSH

24MST12 - MACHINE LEARNING TECHNIQUES

Programme & Branch	M.E & Computer Science and Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	1	PC	45	0	0	45	90	3

Preamble	Provides a concise introduction to the fundamental concepts of machine learning and popular machine learning algorithms.	
Unit – I	**Introduction:**	**9**
Machine Learning Definition and Basics - Learning Models: Supervised :– unsupervised – Semi Supervised – Reinforcement Learning - Linear regression – Logistic regression - Gradient Descent Algorithm – Regularization - SoftMax		
Unit – II	**Classification and Clustering:**	**9**
Classification: Decision Boundary - Skewed Class - Naïve Bayes' Algorithm - Support Vector Machines – Decision Tree - Random Forests – Testing the Algorithm and Network – ANN – Clustering: K -Means - -Nearest Neighbor (KNN) - Principal Components Analysis (PCA)		
Unit – III	**Reinforcement Learning:**	**9**
Components of Reinforcement Learning - Key Participants of a Reinforcement Learning System - Environment State Transitions and Actions - Agent's Objective - Methods for Finding Optimal Policies - Policy Iteration Method for Optimal Policy – Algorithms: Monte Carlo Learning - Estimating Action Values with TD Learning - Exploration vs Exploitation Trade-Off - Q-learning – Scaling through function approximation		
Unit – iV	**Design and analysis of Machine Learning Experiments:**	**9**
Introduction - Factors, Response, and Strategy of Experimentation - Response Surface Design - Randomization, Replication, and Blocking - Guidelines for Machine Learning Experiments- Cross validation and resampling methods - Comparing two/more algorithm – Comparison over multiple datasets.		
Unit – V	**Applications:**	**9**
Natural Language Processing: Complexity of NLP – Algorithms - Anomaly Detection: Anomaly vs Classification – Model - Multivariate Gaussian Distribution - Anomalies in Time Series - Recommender Systems: Features and user preferences known and unknown – New user – Tracking changes in user preferences.		

REFERENCES:

1.	Gopinath Rebala, Ajay Ravi, Sanjay Churiwala, "An Introduction to Machine Learning", Springer, 2019.
2.	Ethem Alpaydin, "Introduction to Machine Learning", 4th Edition, Prentice Hall of India, 2020.
3.	Tom M. Mitchell, "Machine Learning", 1st Edition, McGraw-Hill Education, India, 2013.
4.	James G, Witten D, Hastie T, Tibshirani R, "An Introduction to Statistical Learning with Applications in R", 1st edition, Springer, 2017.
5.	Aurélien Géron, Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition, O'reilly, 2017

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	illustrate the foundations of machine learning and apply regression techniques to solve the problems	Applying (K3)
CO2	apply supervised learning and unsupervised learning techniques to solve real time problems	Applying (K3)
CO3	demonstrate reinforcement algorithm for the given problems	Applying (K3)
CO4	design and analyze the performance of machine learning algorithms	Analyzing (K4)
CO5	develop machine learning modes for the given use cases	Applying (K3)

*includes Term Work(TW) & Online / Certification course hours

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		30	70				100
CAT2		40	60				100
CAT3		30	60	10			100
ESE		40	50	10			100

* ±3% may be varied (CAT 1 ,2 & 3 – 50 marks & ESE – 100 marks)

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RSL

24MST13 - COMMUNICATION NETWORKS

Programme & Branch	M.E & Computer Science and Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	1	PC	45	15	0	60	120	4

Preamble	To understand the working principle of various communication protocols, wireless transmissions. It also enables to design architecture that make a network more flexible and easier to manage.

Unit - I	**9+3**
Network models, Application Layer : Web and HTTP– SMTP–DNS- Transport Layer: services – multiplexing and demultiplexing – Reliable data transfer and classic TCP Congestion control–Network layer: Forwarding and Routing –IPV4– Routing algorithms– Data link Layer: Error detection and correction techniques	
Unit - II	**9+3**
Introduction: Fundamentals of wireless transmission, Electromagnetic spectrum, characteristics of wireless channel– multiple access techniques– Wireless LANs: Fundamentals– IEEE 802.11: Fundamental–Physical Layer–MAC layer –CSMA/CA mechanism– Bluetooth: Specifications – Transport Protocol Group: Radio layer, Baseband layer, Piconet, Operational states	
Unit - III	**9+3**
Introduction– Issues in Ad Hoc Networks–MAC protocols: Issues and design goals –MACAW–Routing protocols: Issues in designing routing protocols– DSDV-DSR- Transport layer : Issues and design goals of Transport layer protocol- TCP over ad hoc wireless network: Feedback TCP, Split-TCP	
Unit - IV	**9+3**
Introduction- History of Software Defined Networking - Modern data center - Traditional switch architecture -Purpose of SDN - Evolution of SDN - Working of SDN - Control plane and data plane	
Unit - V	**9+3**
Open Flow specification - drawbacks of open SDN - SDN via APIs - SDN via hypervisor-based overlays - SDN via networking device - SDN controllers: WMware, Nicira, Open Flow related	

REFERENCES:

1.	Kurose James F. and Ross Keith W., "Computer Networking: A Top-Down Approach", 8th Edition, Pearson Education, New Delhi, 2022.
2.	C. Siva Ram Murthy and B.S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Pearson, 2006.
3.	Paul Göransson., Chuck Black., and Timothy Culver," Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann, Second Edition, 2017
4.	Behrouz A. Forouzan, "Data Communications and Networking", McGraw-Hill, 6th Edition, 2022
5.	Tanenbaum, Andrew S., Nick Feamster and David Wetherall, "Computer Networks", 6th Edition, Prentice Hall of India, New Delhi, 2022

*includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Explore the basics of Computer Networks and various protocols.	Applying (K3)
CO2	Demonstrate the working of wireless LAN network	Applying (K3)
CO3	Explore the operation of various protocols in ad hoc networks	Applying (K3)
CO4	Interpret the operation of SDN	Applying (K3)
CO5	Elaborate OpenFlow and SDN Controllers	Applying (K3)

Mapping of COs with POs

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

1 -- Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		30	70				100
CAT2		30	70				100
CAT3		35	65				100
ESE		30	70				100

* ±3% may be varied (CAT 1,2 & 3 – 50 marks & ESE -- 100 marks)

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Board of Studies - CSE

ACADEMIC CELL ★ KONGU ENGINEERING COLLEGE ★

P. S. NANDHINI

NPS

24MST14 - MULTICORE ARCHITECTURES

Programme & Branch	M.E & Computer Science and Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	1	PC	45	0	0	45	90	3

Preamble	This course will introduce the concepts of multi-core computer architectures and focuses on delivering an in depth exposure in memory-subsystems and interconnects and few introductory sessions on advanced superscalar processors	
Unit – I	**Fundamentals of Quantitative Design and Analysis:**	**9**
Classes of Computers – Classes of Parallelism and Parallel Architecture – Defining Computer Architecture – Trends in Technology, Power, Energy and Cost – Dependability – Measuring, Reporting and Summarizing Performance – Quantitative Principles of Computer Design – Case Studies: Chip Fabrication cost and Power Consumption in computer systems.		
Unit – II	**Memory Hierarchy Design:**	**9**
Introduction – Optimizations of Cache Performance – Memory Technology and Optimizations – Virtual Memory and Virtual Machines – Design of Memory Hierarchies – Case Studies: Optimizing Cache performance and The Impact of various memory system organizations.		
Unit – III	**Data-Level Parallelism in Vector, SIMD, and GPU Architectures:**	**9**
Introduction – Vector Architectures – SIMD Instruction Set Extensions for Multimedia – Graphics Processing Units – Detecting and Enhancing Loop Level Parallelism – Comparison of a GPU and a MIMD With Multimedia SIMD – Case Studies.		
Unit – IV	**TLP and Multiprocessors with OpenMP**	**9**
Centralized Shared-Memory Architectures – Performance of Symmetric Shared-Memory Multiprocessors – Distributed Shared - Memory and Directory-Based Coherence – Synchronization basics – Models of Memory Consistency introduction – Inter Connection Networks – Buses, Crossbar and Multi-stage interconnection networks – Performance and Energy Efficiency of the Intel i7 920 Multicore- Parallel Programming with OpenMP – Parallelizing a simple loop.		
Unit – V	**RLP and DLP in Warehouse Scale Computers:**	**9**
Programming Models and Workloads for Warehouse scale Computers – Computer Architecture of Warehouse-Scale Computers – Domain Specific Architectures: Introduction – Guidelines for DSAs – Example Domain: Deep Neural Network – Google's Tensor Processing Unit, an interface Data Center Accelerator.		

REFERENCES:

1.	John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", 6th Edition, Morgan Kaufmann, Elsevier, 2019.
2.	Rohit Chandra (Author), Ramesh Menon, "Parallel Programming in OpenMP", Elsevier , 2000.
3.	Kai Hwang , Naresh Jotwani, "Advance Computer Architecture: Parallelism, Scalability, Programmability", 3rd Edition, McGraw Hill Education,2017

*includes Term Work(TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	examine the classes of parallelism, power, energy and cost in computer system	Analyzing (K4)
CO2	analyze the importance of memory hierarchy and benefits of cache memory	Analyzing (K4)
CO3	explain the architecture of Vector/GPU processor and make use of loop level parallelism to achieve Data Level Parallelism	Applying (K3)
CO4	critically analyze cache coherence issues using different memory architectures and different types of inter connection networks	Analyzing (K4)
CO5	inspect the architectures of GPUs, Warehouse scale computers and Domain specific architecture	Analyzing (K4)

Mapping of COs with POs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1			
CO2	3	1	1			
CO3	3	1	1			
CO4	3	1	1			
CO5	3	1	1			

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		40	45	15			100
CAT2		40	45	15			100
CAT3		40	45	15			100
ESE		40	40	20			100

* ±3% may be varied (CAT 1,2 & 3 – 50 marks & ESE – 100 marks)

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N.P.SARAVANAN

PS

24MSL11 - DATA STRUCTURES AND ANALYSIS OF ALGORITHMS LABORATORY

Programme& Branch	M.E & Computer Science and Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	1	PC	0	0	30	0	30	1

Preamble	Provides insight into the intrinsic nature of the problem as well as possible solution techniques, independent of programming language/ programming paradigm/computer hardware/ implementation aspect.

LIST OF EXPERIMENTS / EXERCISES:

1.	Implement any two sorting algorithms
2.	Implement Binary Search Trees
3.	Implement Red-Black trees – Insertion and Display
4.	Implement Binomial Heap and Fibonacci heaps algorithms
5.	Implement Strassen's matrix multiplication algorithm using Algorithm Design Techniques
6.	Implement Huffman code using Algorithm Design Techniques
7.	Implement String Matching algorithms (any two)
8.	Implement Graph algorithms
9.	Solve NP Problems sum of Subset problem
10.	Implement Travelling sales person problem

REFERENCES/ MANUAL /SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate the use of data structure for solving the given problem	Applying (K3) Precision(S3)
CO2	choose and employ appropriate design technique to solve real world problems	Applying (K3) Precision(S3)
CO3	apply operations like searching, insertion, deletion and traversing on various data structures	Applying (K3) Precision(S3)

Mapping of COs with POs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	2		
CO2	3	1	2	2		
CO3	3	1	2	2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

*includes Term Work(TW) & Online / Certification course hours

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[P. GANTHIYA]

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SSH

24MSL12 - MACHINE LEARNING TECHNIQUES LABORATORY

Programme & Branch	M.E & Computer Science and Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	1	PC	0	0	30	0	30	1

Preamble	Exposed to apply the various supervised, unsupervised learning algorithms to solve real time problems

LIST OF EXPERIMENTS / EXERCISES:

1.	Implement linear regression to predict the value of the attributes
2.	Implement a binary classification model using Logistic regression
3.	Implement Supervised Learning Algorithms
4.	Implement Unsupervised Learning Algorithms
5.	Implement PCA for dimensionality reduction
6.	Implement multi-layer perceptron for the given data
7.	Analyze the performance of different algorithms
8.	Demonstrate the sentiment analysis process with the sample dataset
9.	develop a fake news detection system
10.	develop a model to detect anomalies in time series data

REFERENCES/ MANUAL /SOFTWARE:

1.	Operating System: Windows/Linux
2.	Software: Weka / R/Rapid Miner / Python / Cloud framework
3.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply linear and non-linear techniques for classification problems	Applying (K3) Precision(S3)
CO2	make use of supervised and unsupervised techniques for real world problems	Applying (K3) Precision(S3)
CO3	identify and implement appropriate machine learning algorithms for the real-world problem	Applying (K3) Precision(S3)

Mapping of COs with POs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2			
CO2	3	3	2			
CO3	3	3	2			

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

*includes Term Work(TW) & Online / Certification course hours

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SR

24MST21 - DEEP LEARNING TECHNIQUES

Programme & Branch	M.E & Computer Science and Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	2	PC	45	0	0	45	90	3

Preamble	This course will help the students to understand the fundamental concepts in the design of deep neural networks and to implement its various architectures. It also explores different dimensions of deep learning applications.	
Unit – I	**Foundations of Deep Learning:**	**9**
Linear Regression: Softmax Regression – The image Classification dataset – Implementation of Softmax Regression from Scratch - Concise Implementation of Softmax Regression. **Multilayer Perceptrons:** MLP- Implementation of MLP from Scratch - Concise Implementation of MLP - Model Selection, Underfitting, and Overfitting - Weight Decay – Dropout - Forward & Backward Propagation, and Computational Graphs - Numerical Stability and Initialization.		
Unit – II	**Convolutional Neural Networks:**	**9**
Convolutional Neural Networks: Fully-Connected Layers to Convolutions - Convolutions for Images - Padding and Stride - Multiple Input and Multiple Output Channels – Pooling. **Modern Convolutional Neural Networks:** LeNet – AlexNet – VGG – NiN – GoogleLeNet - Batch Normalization – ResNet – DenseNet		
Unit – III	**Recurrent Neural Networks:**	**9**
Recurrent Neural Networks: Sequence Models - Text Preprocessing - Language Models and the Dataset – RNN – Implementation of RNN from Scratch - Concise Implementation of RNN - Backpropagation Through Time. **Modern Recurrent Neural Networks:** GRU – LSTM – Deep RNN – Bi-RNN - Machine Translation and the Dataset - Encoder-Decoder Architecture - Sequence to Sequence Learning - Beam Search		
Unit – IV	**Attention Mechanisms and Transformers:**	**9**
Attention Cues - Attention Pooling - Attention Scoring Functions - Bahdanau Attention - Multi-Head Attention - Self-Attention and Positional Encoding - The Transformer Architecture - Transformers for Vision - Large-Scale Pretraining with Transformers.		
Unit – V	**Recommender Systems and Generative Adversarial Networks:**	**9**
Recommender Systems : Overview of Recommender Systems - The MovieLens Dataset - Matrix Factorization - AutoRec: Rating Prediction with Autoencoders - Personalized Ranking for Recommender Systems - Neural Collaborative Filtering for Personalized Ranking - Sequence-Aware Recommender Systems - Feature-Rich Recommender Systems - **Generative Adversarial Networks:** GAN - Deep Convolutional Generative Adversarial Networks		

REFERENCES:

1.	Aston Zhang, "Dive into Deep Learning", Link: https://classic.d2l.ai/chapter_preface/index.html
2.	Andrew Glassner, "Deep Learning: A Visual Approach", https://archive.org/details/deep-learning-a-visual-approach/mode/2up
3.	Indra den Bakker, "Python Deep Learning Cookbook", 1st Edition, Packt Publishing, October 2017.
4.	Josh Patterson and Adam Gibson, "Deep Learning – A Practitioner"s Approach", 1st Edition, O"Reilly Series, August 2017
5.	Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", 1st Edition, MIT Press, 2016.
6.	François Chollet, "Deep Learning with Python", Second Edition, https://sourestdeeds.github.io/pdf/Deep%20Learning%20with%20Python.pdf

*includes Term Work(TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the concepts of regression and multilayer perceptron to solve simple problems	Applying (K3)
CO2	exemplify the concepts of CNN models and apply it for solving computer vision related problems	Applying (K3)
CO3	apply the concepts of RNN models for solving natural language processing and time series prediction problems	Applying (K3)
CO4	make use of Tensorflow/keras frameworks to build attention-based models in deep learning.	Applying (K3)
CO5	utilize deep learning methods for developing recommender systems and Generative Adversarial Networks for solving real world problems	Applying (K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		30	70				100
CAT2		30	70				100
CAT3		60	40				100
ESE		50	50				100

* ±3% may be varied (CAT 1 ,2 & 3 – 50 marks & ESE – 100 marks)

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S. Ramya
[S. RAMYA]

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24MST22 - DATA ANALYTICS									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**Nil**	**2**	**PC**	**45**	**0**	**0**	**45**	**90**	**3**
Preamble	This course helps students to understand the concepts of data analytics and its lifecycle. The course also focuses on application of statistical techniques, time series analysis, text mining and Hadoop for analysing big data and building solutions.								
Unit - I	**Introduction:**								**9**
Data Cleaning and Preparation: Handling missing data-Data Transformation-Data wrangling: join, Combine, and Reshape-Hierarchical Indexing - Combining and Merging Datasets - Reshaping and Pivoting									
Unit - II	**Statistical Analysis:**								**9**
Hypothesis Testing-difference of means - Chi-Square Test-Students t-test - Welch's t-test-Wilcoxon Rank-Sum Test - Type I and Type II Errors-Power and Sample Size-ANOVA -Analysis of variance - Correlation Analysis-Regression analysis.									
Unit - III	**Time Series Analysis:**								**9**
Overview of Time Series Analysis-Box-Jenkins Methodology-Autoregressive Models-Moving Average Models-ARMA and ARIMA Models-Additional Methods.									
Unit - IV	**Text Analysis:**								**9**
Text Analysis Steps-Part-of-Speech (POS) Tagging, Lemmatization, and Stemming-A Text Analysis Example-Collecting raw text-Representing text-Term Frequency—Inverse Document Frequency (TFIDF)-Categorizing Documents by Topics- Sentiment Analysis- Gaining Insights.									
Unit - V	**Bigdata Analytics:**								**9**
Use Cases - Mapreduce - Apache Hadoop-Yet Another Resource Negotiator (YARN)-The Hadoop Ecosystem-Pig-Hive-HBase-Mahout-NoSQL.									

REFERENCES:

1.	Wes McKinney, "Python for Data Analysis", 3rd Edition, O'Reilly Media Publication, 2022.
2.	EMC Education Services (Editor), "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", 1st Edition, John Wiley & Sons,2015.
3.	Douglas C. Montgomery GeorgeC. Runger, "Applied Statistics and Probability for Engineers", 6th Edition, John Wiley & Sons, 2016.
4.	Albright S Christian, Winston Wayne L and Zappe Christopher, "Data analysis and Decision Making", NA Edition, South Western College Publication, 2010.

*includes Term Work(TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the data types and make use of exploratory data analysis with the real time data.	Applying (K3)
CO2	interpret and communicate the outcomes of estimation and hypothesis tests in the context of a problem.	Applying (K3)
CO3	make use of time series models and testing forecasting accuracy tests with the real time data.	Applying (K3)
CO4	employ text analytics techniques for building solutions for text mining problem.	Applying (K3)
CO5	apply hadoop and map reduce for data analytics applications.	Applying (K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		40	60				100
CAT2		40	60				100
CAT3		50	50				100
ESE		40	60				100

* ±3% may be varied (CAT 1 ,2 & 3 – 50 marks & ESE – 100 marks)

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ACADEMIC CELL
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Dr. K. NIRMALADEVI

BD

24MST23 - SECURITY IN COMPUTING									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**Nil**	**2**	**PC**	**45**	**30**	**0**	**45**	**120**	**4**

Preamble	Able to learn the basic concepts in computer security including software vulnerability analysis and defense, networking and wireless security, applied cryptography, as well as ethical, legal, social and economic facets of security	
Unit – I	**Introduction to Mathematical Foundations of Cryptography:**	**9+3**
Integer arithmetic, Modular arithmetic, Linear Congruence - Algebraic Structures – GF Fields – Primes - Chinese Remainder Theorem - quadratic congruence.		
Unit – II	**Symmetric-Key Encipherment:**	**9+3**
Substitution Ciphers–Transposition Ciphers - Stream and Block Ciphers – DES Structure – Multiple Des - AES – Transformations - Key Expansion - Use Of Modern Block Ciphers		
Unit – III	**Asymmetric-Key Encipherment and Key Management:**	**9+3**
Asymmetric-Key Cryptography: Introduction - RSA Cryptosystem– Rabin Cryptosystem - Elgamal Cryptosystem - Elliptic Curve Cryptosystems - Key Management: Symmetric-Key Distribution – Kerberos - Symmetric-Key Agreement - Public-Key Distribution		
Unit – IV	**Integrity and Authentication:**	**9+3**
Message Integrity-Message Authentication - Cryptographic Hash Functions - SHA-512 – Digital Signature: Services - Attacks On Digital Signature - Digital Signature Schemes - Entity Authentication: Introduction - Passwords - Challenge-Response - SSL and TLS - IPsec		
Unit – V	**Management and Incidents:**	**9+3**
Security Planning - Business Continuity Planning – Handling Incidents - Risk Analysis –Physical Threats To Systems Legal Issues and Ethics: Protecting Programs and Data – Information and The Law – Rights Of Employees and Employers – Software Failures – Computer Crime– Ethical Issues In Computer Security – Privacy Rights		

REFERENCES:

1.	Behrouz A.Forouzan, - Cryptography and Network Security, Tata McGraw-Hill, Special Indian Edition,2008
2.	Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", 5th Edition, Prentice Hall, 2018.
3.	William Stallings - Cryptography and Network Security,7th Edition, Pearson, 2017.

*includes Term Work(TW) & Online / Certification course hours

[B. BOS]

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the mathematical foundations in security principles	Applying (K3)
CO2	make use of symmetric encryption techniques for security problems	Applying (K3)
CO3	employ different asymmetric encryption techniques for enhancing security	Applying (K3)
CO4	apply authentication protocols in the design of the secured applications	Applying (K3)
CO5	apply the legal and ethical issues of security and management	Applying (K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT 1		40	60				100
CAT 2		50	50				100
CAT 3		60	40				100
ESE		50	50				100

* ±3% may be varied (CAT 1 ,2 & 3 – 50 marks & ESE – 100 marks)

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24MSL21 - DEEP LEARNING TECHNIQUES LABORATORY

Programme & Branch	M.E & Computer Science and Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	2	PC	0	0	30	0	30	1

Preamble	This course deals with various algorithms to enable computers to learn data without being explicitly programmed. An insight into various types of deep learning algorithms, strategies for model generation and evaluation.

LIST OF EXPERIMENTS / EXERCISES:

1.	Explore the various deep learning libraries like PyTorch, TensorFlow, MXNet, etc.,
2.	Predict house prices using multi-layer neural network
3.	Test the performance of multi-layer neural network with various activation and loss functions
4.	Demonstrate a simple application for Image classification using CNN
5.	Develop a simple application for Object detection in Images
6.	Create a simple application using LSTM for text classification
7.	Build a simple application for Text Summarization using LSTM
8.	Implement the attention mechanism in the neural network
9.	Build a simple application for video classification using CNN
10.	Implement collaborative filtering-based Recommendation system

REFERENCES/ MANUAL /SOFTWARE:

1.	Operating System : Windows/Linux
2.	Software : Anaconda/Python
3.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	build skills to established DL tools/libraries and in building self-learning skills in the field of designing, training and deploying simple neural networks for solving different practical/engineering problems.	Applying (K3), Precision (S3)
CO2	identify and develop various CNN/LSTM based models to solve engineering or real-world problems.	Applying (K3), Precision (S3)
CO3	implement attention mechanism and recommendation system to develop diverse applications.	Applying (K3), Precision (S3)

Mapping of COs with POs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	1	1		
CO2	3	3	2	1		
CO3	3	3	1	1		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

*includes Term Work(TW) & Online / Certification course hours

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S. RAMYA

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KND

24MSL22 - DATA ANALYTICS LABORATORY

Programme& Branch	M.E & Computer Science and Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	2	PC	0	0	30	0	30	1

Preamble	This course focuses on providing hands on experience in designing and implementing data analytics techniques for providing solutions to the real-world problems.

LIST OF EXPERIMENTS / EXERCISES:

1.	Demonstrate the missing data handling approaches for the given data set.
2.	Perform exploratory data analysis with simple visualizations using real time data.
3.	Demonstrate data wrangling concepts using sample dataset.
4.	Computing summary statistics using real time data.
5.	Demonstrate testing of hypothesis for small and large sample tests for real-time problems.
6.	Apply simple linear and multiple linear regression models to real dataset.
7.	Apply Time series model AR , ARMA and ARIMA and testing Forecasting accuracy tests.
8.	Perform Topic modeling using real time data.
9.	Demonstrate the sentiment analysis process with the sample dataset.
10.	Demonstrate the Hadoop and map reduce concept using sample dataset.

REFERENCES/ MANUAL /SOFTWARE:

1.	Operating System : Windows/Linux
2.	Software : Python / R
3.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate the data preprocessing concepts and show the visualization results using real time data.	Applying (K3), Precision (S3)
CO2	apply different statistical analysis, time series analysis and text analysis to real data set.	Applying (K3), Precision (S3)
CO3	experiment Hadoop and map reduce concepts using sample dataset.	Applying (K3), Precision (S3)

Mapping of COs with POs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	
CO2	3	2	1	1	1	
CO3	3	2	1	1	1	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

*includes Term Work(TW) & Online / Certification course hours

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(Dr. K. NIRMALADEVI)

24MSP31 - PROJECT WORK I									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**Nil**	**3**	**EC**	**0**	**0**	**240**	**0**	**240**	**8**

Preamble	It provides practical exposure to the students and an opportunity to apply the computational mathematics concepts to solve the real world problems. It also gives opportunity to the students to work in a team.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	formulate specific problem statements for ill-defined real life problems with reasonable assumptions and constraints.	Creating (K6), Precision (S3)
CO2	perform literature search in the area of interest.	Evaluating (K5), Precision (S3)
CO3	conduct experiments, design and analysis, solution iterations and document the results.	Evaluating (K5), Precision (S3)
CO4	perform error analysis and synthesize the results and arrive at scientific conclusions.	Evaluating (K5), Precision (S3)
CO5	document the results in the form of technical report and give oral presentation	Creating (K6), Precision (S3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

*includes Term Work(TW) & Online / Certification course hours

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24MSP41 - PROJECT WORK II

Programme & Branch	M.E & Computer Science and Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	4	EC	0	0	360	0	360	12

Preamble	It provides practical exposure to the students and an opportunity to apply the computational mathematics concepts to solve the real world problems. It also gives opportunity to the students to work in a team.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	formulate specific problem statements for ill-defined real life problems with reasonable assumptions and constraints.	Creating (K6), Precision (S3)
CO2	perform literature search in the area of interest.	Evaluating (K5), Precision (S3)
CO3	conduct experiments, design and analysis, solution iterations and document the results.	Evaluating (K5), Precision (S3)
CO4	perform error analysis and synthesize the results and arrive at scientific conclusions.	Evaluating (K5), Precision (S3)
CO5	document the results in the form of technical report and give oral presentation	Creating (K6), Precision (S3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

*Includes Term Work (TW) & Online / Certification course hours

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RRR/ KND

24MSE01 - DATA MINING TECHNIQUES									
Programme & Branch	**M.E. & Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**Nil**	**2**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	This course provides students with an overview of the data mining process and techniques for preprocessing. It also make the students to gain knowledge of various data mining techniques and also prepare them for taking research in the area of data mining and its applications.

Unit – I	**Introduction:**	**9**
Data Mining - Steps in Knowledge Discovery Process- Kinds of Data and Patterns–Technologies used-Targeted applications - Major issues in Data Mining - Data objects and attribute types - Statistical descriptions of data - Data Visualization- Measuring data similarity and dissimilarity.		
Unit – II	**Data Preprocessing:**	**9**
Data Cleaning, Integration, Reduction, Transformation and Discretization, Mining Frequent Patterns - Frequent Itemset Mining Methods.		
Unit – III	**Classifier:**	**9**
Decision Tree Induction-Bayesian Classification - Rule based Classification - classification by Back Propagation – Support Vector Machines – Lazy Learners – Model Evaluation and Selection - Techniques to improve Classification Accuracy - k-Nearest Neighbor Classifier.		
Unit – IV	**Cluster Analysis:**	**9**
Partitioning Methods–Hierarchical Methods–Density based Methods - Grid based Methods - Evaluation of Clustering – Outliers and Outlier analysis - Outlier detection Methods - Statistical Approaches.		
Unit – V	**Application:**	**9**
Mining Complex data types - Statistical Data Mining - Data Mining foundations -Visual and Audio Data Mining – Applications - Ubiquitous and invisible Data Mining - Social impacts of Data Mining.		

REFERENCES:

1.	Han Jiawei and Kamber Micheline, "Data Mining: Concepts and Techniques", 3rd Edition, Morgan Kaufmann Publishers, 2012.
2.	Berson Alex, and Smith Stephen J., "Data Warehousing, Data Mining and OLAP", 13th Reprint, Tata McGraw Hill, New Delhi, 2013.
3.	Gupta G.K., "Introduction to Data Mining with Case Studies", 2nd Edition, Prentice Hall India, New Delhi, 2011.

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe the different data mining techniques and identify different types of data	Applying (K3)
CO2	apply data preprocessing and frequent itemset mining methods for the given problem	Applying (K3)
CO3	summarize the characteristics of classification methods and use them for solving a problem	Applying (K3)
CO4	summarize and demonstrate the working of different clustering and outlier methods	Applying (K3)
CO5	apply data mining concepts in various applications	Applying (K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		35	65				100
CAT2		40	60				100
CAT3		40	60				100
ESE		35	65				100

* ±3% may be varied (CAT 1 ,2 & 3 – 50 marks & ESE – 100 marks)

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(Dr. K. NIRMALADEVI)

NSP

24MSE02 - BUSINESS INTELLIGENCE									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**Nil**	**2**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	To provide an overview of the technology of BI and the application of BI to an organization's strategies and goal with improved application development and high scale deployment.	
Unit – I	**Introduction to Business Intelligence:**	**9**
Introduction to Digital Data and its Types – Structured, Semi-structured and Unstructured Data - Introduction to OLTP and OLAP – Architectures – Data Models – Role of OLAP in BI – OLAP Operations – Business Intelligence - BI Definition and Evolution – BI Concepts - BI Component Framework – BI Process, Users, Applications – BI Roles – BI Best Practices– Popular BI Tools.		
Unit – II	**Data Integration:**	**9**
Need for Data Warehouse – Definition of Data Warehouse – Data Mart – Ralph Kimball's Approach vs. W.H.Inmon's Approach – Goals of Data Warehouse – ETL Process – Data Integration Technologies – Data Quality – Data Profiling – Case Study from Healthcare domain – Kettle Software: Introduction to ETL using Pentaho Data Integration.		
Unit – III	**Multidimensional Data Modeling:**	**9**
Basics of Data Modeling – Types of Data Model – Data Modeling Techniques – Fact Table – Dimension Table – Dimensional Models- Dimensional Modeling Life Cycle – Designing the Dimensional Model - Measures, Metrics, KPIs and Performance Management – Understanding Measures and Performance – Measurement System - Role of metrics – KPIS - Analyze Data using MS Excel 2010.		
Unit – IV	**Basics of Enterprise Reporting:**	**9**
Reporting Perspectives - Report Standardization and Presentation - Practices - Enterprise Reporting Characteristics - Balanced Scorecard - Dashboards - Creating Dashboards- Scorecards Vs Dashboards - Analysis - Enterprise Reporting using MS Access / MS Excel.		
Unit – V	**BI Applications and Case Studies:**	**9**
Understanding Business Intelligence and Mobility – Business Intelligence and Cloud Computing – Business Intelligence for ERP Systems – Social CRM and Business Intelligence - Case Studies : Good Life HealthCare Group, Good Food Restaurants Inc., Ten To Ten Retail Stores.		

REFERENCES:

1.	Prasad N., Seema Acharya, "Fundamentals of Business Analytics", 2nd Edition, Wiley-India Publication, 2016.
2.	Efraim Turban, Ramesh Sharda, Dursun Delen, David King, "Business Intelligence: A Managerial Approach", 2nd Edition, Pearson Education, 2014.
3.	David Loshin, "Business Intelligence", 5th Edition, Morgan Kaufmann Publishers, San Francisco, 2007.

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the key elements of data warehouse and business intelligence in BI tools	Applying (K3)
CO2	apply the concepts and technology of BI space in any domain	Applying (K3)
CO3	apply multidimensional model for integration and reporting services	Applying (K3)
CO4	summarize the functionalities of key performance indicators	Applying (K3)
CO5	apply BI to mobile, cloud, ERP and social CRM systems	Applying (K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		55	45				100
CAT2		55	45				100
CAT3		55	45				100
ESE		55	45				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

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(N. Sasipriyaa)

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RSM
(MG)

24MSE03 - CLOUD COMPUTING

Programme & Branch	M.E. & Computer Science and Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	2	PE	45	0	0	45	90	3

Preamble	This course gives the idea of evolution of cloud computing and its services available today, which may led to the design and development of simple cloud service. It also focuses on key challenges and issues around cloud computing.

Unit – I	**Cloud Computing Basics:**	9

Defining Cloud computing – Cloud Types - Characteristics of Cloud computing- Cloud Architecture - Cloud Computing Stack - Infrastructure as a service- Platform as a Service - Software as a Service – Identity as a Service - Compliance as a Service.

Unit – II	**Platforms and Virtualization:**	9

Abstraction and Virtualization – Load Balancing and Virtualization – Hypervisors – Machine Imaging – Porting Applications – Capacity Planning

Unit – III	**Managing and Securing the Cloud:**	9

Administrating the cloud – Cloud Management Products – Cloud Management Standards - Securing the cloud – Securing Data – Establishing Identity and Presence.

Unit – IV	**Cloud Based Storage:**	9

Digital Universe- Provisioning Cloud Storage – Cloud Backup Solutions – Cloud Storage Interoperability. Mobile Cloud: Mobile Market – Smartphones with the cloud – Mobile web services – Service types – Service Discovery.

Unit – V	**Cloud based services and Tools:**	9

Openstack – Overview of services - Conceptual architecture - Controller - Compute - Block Storage - Object Storage – Networking - Environment – Security - Identity service - Image service - Installation - Google Web Services- Amazon Web Services- Microsoft Cloud Services.

REFERENCES:

1.	Barrie Sosinsky, "Cloud Computing Bible", 1st Edition, Wiley Publishing, 2015.
2.	Kai Hwang, Geoffrey C Fox & Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Reprint Edition, Morgan Kauffmann , 2017.
3.	Rajkumar Buyya, James Broberg & Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Edition, Wiley, 2013.
4.	www.openstack.org

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe the main concepts, key technologies, strengths and limitations of cloud computing and apply the same for internet computing	Applying (K3)
CO2	outline the underlying principle of abstraction, virtualization, load balancing, capacity planning and apply in virtual resource management	Applying (K3)
CO3	identify the core issues in cloud security and apply remedial measures	Applying (K3)
CO4	Analyze the various interoperability and storage issues in modern cloud platforms	Analyze (K4)
CO5	Examine and use appropriate open stack components to set up a private cloud environment and explore cloud based services	Analyze (K4)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		70	30				100
CAT2		70	30				100
CAT3		55	25	20			100
ESE		60	25	15			100

* ±3% may be varied (CAT 1 & 2 – 60 marks & ESE – 100 marks)

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[Geetha M]

PCDK

24MSE04 - COMPILER DESIGN TECHNIQUES									
Programme & Branch	**M.E.- Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**SL+**	**Total**	**Credit**
Prerequisites	**Nil**	**2**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	The course is intended to make the students learn the basic techniques that underlie the practice of Compiler Construction and to introduce the theory and tools that can be used to perform syntax-directed translation of a high-level programming language into an executable code with optimization techniques.	
Introduction:	**Introduction**	**9**
Language Processors - Structure of a compiler – Evolution of Programming Languages- Applications of Compiler Technology – Programming Language Basics - The Lexical Analyzer Generator -Parser Generator- Compiler Tools: Lex and YACC. Intermediate Code Generation techniques: Variants of Syntax trees-Three Address Code.		
Optimization:	**Optimization**	**9**
Introduction - Early Optimizations: Constant-Expression Evaluation - Scalar Replacement of Aggregates-Algebraic Simplifications and Reassociation -Value Numbering - Copy Propagation-Sparse Conditional Constant Propagation. Redundancy Elimination: Common Subexpression Elimination - Invariant Code Motion- Partial-Redundancy Elimination- Redundancy Elimination and Reassociation- Code Hoisting. Loop Optimizations: Induction Variable Optimizations - Unnecessary Bounds Checking Elimination.		
Unit – III	**Instruction Level Parallelism**	**9**
Processor Architectures - Code-Scheduling Constraints- Basic-Block Scheduling -Global Code Scheduling -Software Pipelining.		
Unit – IV	**Optimizing for Parallelism and Locality**	**9**
Basic Concepts- Matrix-Multiply-An Example -Iteration Spaces - Affine Array Indexes - Data Reuse -Array data dependence Analysis- Finding Synchronization - Free Parallelism- Pipelining.		
Unit – V	**Inter procedural Analysis and Register Allocation**	**9**
Basic Concepts–Need for Inter procedural Analysis–A Logical Representation of Data Flow – A Simple Pointer-Analysis Algorithm. Register Allocation: Register allocation and Assignment-Local Methods-Graph Coloring.		

REFERENCES:

1.	Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools", 2nd Edition, Pearson Education, 2013.
2.	Steven S. Muchnick, "Advanced Compiler Design Implementation", 1st Edition, Morgan Kaufman Publishers, Elsevier Science, India, 2008.
3.	Richard Y. Kain, "Advanced Computer Architecture: A Systems Design Approach", 1st Edition, Prentice Hall, 2011.

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe different phases of compiler and design a simple scanner and parser by using its pattern	Applying (K3)
CO2	survey various code optimization techniques to improve the performance of a program in terms of speed and space	Applying (K3)
CO3	demonstrate the architectural design of the system for compilation	Applying (K3)
CO4	apply optimization techniques to optimize programs in real time	Applying (K3)
CO5	optimize functions and demonstrate how to store data and access from registers	Applying (K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		40	60				100
CAT2		55	45				100
CAT3		55	45				100
ESE		45	55				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

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NPS

24MSE05 – ADVANCED PARALLEL ARCHITECTURE AND PROGRAMMING									
Programme & Branch	**M.E. & Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**NIL**	**2**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	This course provides an understanding of the fundamental principles and engineering trade-offs involved in designing modern parallel computing systems as well as to teach parallel programming techniques necessary to effectively utilize these machines. It also explores key machine performance characteristics of parallel programming.	
Unit – I	**Parallel Architecture and Foundations of Parallel Programming:**	**9**
Parallel Architecture: Need, Convergence, Design issues – Parallel Application Case Studies – The von Neumann architecture - Processes, multitasking, and threads – Modifications to the von Neumann Model – Parallel Hardware and Software – Input and Output – Performance – Parallel Program Design – Writing and Running Parallel Programs.		
Unit – II	**Message Passing Paradigm:**	**9**
Basic MPI programming – MPI_Init and MPI_Finalize – MPI communicators – SPMD programs – message passing – MPI_Send and MPI_Recv – message matching – MPI I/O – parallel I/O – collective communication – derived types – Performance evaluation of MPI programs – A Parallel Sorting Algorithm.		
Unit – III	**Shared Memory Paradigm Pthreads:**	**9**
Basics of Pthreads – Execution, Error checking of threads – Matrix-Vector Multiplication – Critical sections – Busy waiting – Mutexes – Producer-Consumer Synchronization and Semaphores – Barriers and Condition variables – Read Write locks – Caches, Cache Coherence and False sharing – Thread-Safety – Pthreads case study.		
Unit – IV	**Shared Memory Paradigm OpenMP:**	**9**
Basic OpenMP constructs – The Trapezoidal Rule – Scope of Variables – Reduction Clause – Parallel for Directive – Loops in OpenMP – Scheduling loops – Synchronization in OpenMP – Case Study: Producer Consumer problem– Cache Issues – Threads safety in OpenMP.		
Unit – V	**OpenCL Language:**	**9**
Introduction to OpenCL – OpenCL example – Platforms, Contexts and Devices – OpenCL programming in C – Simple Programs.		

REFERENCES:

1.	Peter S. Pacheco, "An introduction to parallel programming", Morgan Kaufmann, 2011.
2.	David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture: A Hardware/ Software Approach", Morgan Kaufmann, Elsevie,2013
3.	Munshi Aaftab, Gaster R. Benedict,"OpenCL Programming Guide", Addision-Wesley, 2011

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	examine the issues in Parallel Architecture and Programming	Applying (K3)
CO2	develop message passing parallel programs using MPI framework	Applying (K3)
CO3	build shared memory parallel programs using Pthreads	Applying (K3)
CO4	experiment with OpenMP for shared memory applications	Applying (K3)
CO5	solve the given problem with parallel programs using OpenCL	Applying (K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		55	45				100
CAT2		45	55				100
CAT3		60	40				100
ESE		60	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

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N P Saravanan

PSN

24MSE06- INTERNET OF THINGS									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**NIL**	**2**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	This course provides a thorough understanding of IoT and its applications. It enables to design, develop and analyze the various tools for building IoT applications and also to develop IoT infrastructure for various real time applications.	
Unit – I	**Introduction to Internet of Things and Design Methodology:**	**9**
Definition and Characteristics of IoT - Physical Design of IoT - IoT Protocols - IoT Communication Models - IoT Communication APIs - IoT enabled Technologies - IoT Levels and Templates - M2M - Difference between M2M and IoT - Software defined networks - Network function virtualization - IoT Platform design Methodologies.		
Unit – II	**IoT Architecture and Protocols:**	**9**
Four Pillars of IoT - DNA of IoT - Middleware for IoT: Overview - Communication middleware for IoT - LBS and Surveillance Middleware - Protocol Standardization for IoT - Efforts - M2M and WSN Protocols - SCADA and RFID Protocols - Unified Data Standards.		
Unit – III	**Introduction to Python and IoT Physical Devices:**	**9**
Language features of Python - Data types - Data structures - Control of flow – Functions – Modules – Package - File handling – Date/time operations – Classes - Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib - Introduction to Raspberry PI - Interfaces (serial, SPI, I2C)Programming - Python program with Raspberry PI with focus of interfacing external gadgets - Controlling output - Reading input from pins.		
Unit – IV	**Cloud Storage and Analysis:**	**9**
Various Real time applications of IoT - Connecting IoT to cloud - Cloud Storage for IoT - Data Analytics for IoT - Software and Management Tools for IoT.		
Unit – V	**IoT Privacy, Security and Vulnerabilities Solutions:**	**9**
Introduction-Vulnerabilities of IoT - Security Requirements -Threat Analysis-Use Cases And Misuse Cases-IoT Security Tomography -Layered Attacker Model-Identity Management And Establishment-Access Control - Secure Message Communication-Security Models -Protocols For IoT.		

REFERENCES:

1.	Arshdeep Bahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach", Universities Press, 2015 for units- 1,3,4
2.	Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", 1st Edition, CRC Press, 2012 for unit 2
3.	Raj Kamal, "Internet of Things: Architecture and Design Principles", McGraw Hill , 2017 for unit 5
4.	Simon Monk, "Raspberry Pi Cookbook", First Edition, O'Reily, 2014
5.	http://www.steves-internet-guide.com/mqtt/
6.	https://cloud.ibm.com/docs/solution-tutorials?topic=solution-tutorials-gather-visualize-analyze-iot-data

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe the physical and logical design of IoT and point out an appropriate IoT level and develop design methodologies for a given application	Applying (K3)
CO2	examine the suitable protocol and middleware for the given application	Applying (K3)
CO3	carry out the given IoT experiment by recalling the basic concepts and packages of Python for interfacing with devices	Applying (K3)
CO4	develop simple real time applications, upload the data onto the cloud and perform data analytics	Applying (K3)
CO5	identify the security threats against a given IoT system and develop countermeasures for the identified threats and IoT applications using Cooja Simulator and Raspberry Pi	Applying (K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		45	55				100
CAT2		50	50				100
CAT3		55	45				100
ESE		55	45				100

* ±3% may be varied (CAT 1 & 2 – 60 marks & ESE – 100 marks)

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P.S. NANDHINI

24MSE07– VEHICULAR ADHOC NETWORKS

Programme & Branch	M.E. – Computer Science and Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Communication Networks	2	PE	45	0	0	45	90	3

Preamble	This course provides an overview about vehicular adhoc networks, its challenges and applications. This course also provides theories such as vehicular mobility modeling, physical and MAC layer considerations, application level coding, composition and security aspects.	
Unit – I	**Introduction to VANET:**	9
Introduction: Basic principles and challenges, past and ongoing VANET activities – Cooperative vehicular safety applications: Enabling technologies, cooperative system architecture, safety applications – Information dissemination in VANETs – VANET convenience and efficiency applications.		
Unit – II	**Vehicular Mobility Modeling:**	9
Introduction – random models – flow and traffic models – behavioral models – trace and survey-based models – integration with network simulators – design framework for realistic vehicular mobility models.		
Unit – III	**Physical Layer:**	9
Standards overview – Wireless propagation theory – Channel metrics – Measurement theory – Empirical channel characterization at 5.9 GHz – Future directions.		
Unit – IV	**MAC layer and Scalability aspects:**	9
Challenges and requirements – MAC approaches for VANETs – Communication based on IEEE 802.11p – Performance evaluation and modeling – Aspects of congestion control – Open issues.		
Unit – V	**Application level coding and Security:**	9
Application level message coding: Introduction to the application environment – message dispatcher – example applications – datasets – predictive coding – architecture analysis – Data security in Vehicular networks: challenges – models – infrastructure – cryptographic protocols – privacy protection mechanisms – implementation aspects.		

REFERENCES:

1.	H. Hartenstein and K. P. Laberteaux, VANET: Vehicular Applications and InterNetworking Technologies, First Edition, Wiley, 2010
2.	P. H.-J. Chong, I. W.-H. Ho, Vehicular Networks: Applications, Performance Analysis and Challenges, Nova Science Publishers, 2019.
3.	C. Sommer, F. Dressler, Vehicular Networking, Cambridge University Press, 2015.
4.	M. Emmelmann, B. Bochow and C. C. Kellum, Vehicular Networking: Automotive Applications and Beyond, Wiley, 2010.

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Identify the suitable architecture for the challenges in VANET applications	Applying (K3)
CO2	Design a suitable mobility model for the vehicular networks	Applying (K3)
CO3	Predict the suitable configurations for the physical layer of vehicular networks	Applying (K3)
CO4	Propose the suitable configurations for the MAC layer of vehicular networks	Applying (K3)
CO5	Model the application level and security aspects of vehicular networks	Applying (K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		75	25				100
CAT2		75	25				100
CAT3		75	25				100
ESE		75	25				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

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BKK/
SSH

24MSE08– MODERN INFORMATION RETRIEVAL TECHNIQUES

Programme & Branch	M.E & Computer Science and Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	2	PE	45	0	0	45	90	3

Preamble	This course discusses about the basic concepts of IR, and various modeling techniques with different ways of indexing and searching mechanisms to build a text or multimedia based IR system.

Unit – I	Introduction and Classic IR Models:	9

Information Retrieval - The IR Problem - The IR System - Search Interfaces Today - Visualization in Search Interfaces - Modeling – Boolean Model – Term Weighting – TF-IDF Weighting – Vector Model – Set Theoretic Models – Algeraic Models – Latent Semantic Indexing Model – Neural Network Model - Probabilistic Models - Retrieval Evaluation – Retrieval Metrics.

Unit – II	Relevance Feedback, Languages and Query Properties:	9

A Framework for feedback methods - Explicit Relevance feedback - Implicit feedback through local analysis - Global analysis - Documents: Metadata - Documents formats - Queries - Query Language – Query Properties.

Unit – III	Text Operations, Indexing and Searching:	9

Text Properties - Document Preprocessing - Text Compression – Text Classification – Characterization of Text Classification – Unsupervised Algorithms – Supervised Algorithms – Decision Tree – K-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation Metrics – Accuracy and Error – Indexing and Searching – Inverted Indexes – Sequential Searching – Multidimensional Indexing.

Unit – IV	Web Retrieval and Web Crawling:	9

The Web – Search Engine Architectures – Cluster Based Architecture – Distributed Architectures – Search Engine Ranking – User Interaction –Browsing – Web Crawling – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

Unit – V	Applications:	9

Enterprise Search - Tasks - Architecture – Library Systems – Online Public Access Catalogues – IR System and Document Databases – Digital Libraries – Architecture and Fundamentals.

REFERENCES:

1.	Ricardo Baeza-Yate, Berthier Ribeiro-Neto, "Modern Information Retrieval the concepts and technology behind search", 2nd Edition, Pearson Education, Asia, 2011.
2.	Chowdhury G.G., "Introduction to Modern Information Retrieval", 2nd Edition, Neal-Schuman Publishers, 2003.
3.	Daniel Jurafsky and James H. Martin, "Speech and Language Processing", 1st Edition, Pearson Education, 2000.

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe the basic concepts of information retrieval and apply term weighting strategy in various models	Applying (K3)
CO2	Carry out relevance feedback and describe query properties	Applying (K3)
CO3	Apply statistical methods to perform text operations, indexing and searching	Applying (K3)
CO4	Describe web retrieval process and make use of web crawler for information retrieval	Applying (K3)
CO5	apply IR techniques in digital library	Applying (K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		50	50				100
CAT2		50	50				100
CAT3		50	50				100
ESE		50	50				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

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KS

24MSE09- RANDOMIZED ALGORITHMS									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**NIL**	**2**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	In this course, the power of randomization in the design and analysis of algorithms is introduced. The most widely used techniques for the analysis of randomized algorithms and the behaviour of random structures from a theoretical perspective are covered

Unit – I	**Introduction:**	**9**
Min-Cut Algorithm -Binary Planar Partitions - A Probabilistic Recurrence- Computation Model and Complexity Classes-Game-theoretic techniques: Game Tree Evaluation-The Minimax principle-Randomness and Non-uniformity -Moments and deviations: Occupancy Problems, Markov and Chebyshev Inequalities		
Unit – II	**Tail Inequalities:**	**9**
Chernoff Bound - Routing in a parallel Computer - A wiring Problem – Martingales - The probabilistic method Overview - Maximum Satisfiability - Expanding Graphs - Lovasz Local Lemma - Method of Conditional Probabilities.		
Unit – III	**Markov Chains:**	**9**
A 2-SAT Example- Markov Chains- Random Walks on Graphs-Electrical Networks- Cover Times- Graph Connectivity-Expanders and Rapidly Mixing Random Walks - Probability Amplification by Random Walks on Expanders		
Unit – IV	**Data Structures:**	**9**
Fundamental Data-structuring problem - Random Treaps - Skip Lists -Hash Tables Universal Family of Hash Functions -Perfect Hashing - Graph algorithms- All-pairs Shortest Paths - Min-cut Problem - Minimum Spanning Trees.		
Unit – V	**Randomized Computational Geometry:**	**9**
Randomized Incremental Construction - Convex Hulls in the Plane - Delaunay Triangulations - Trapezoidal Decompositions - Random Sampling - Linear Programming Randomized Approximation Schemes-PRAM model and its sorting-Byzantine Agreement		

REFERENCES:

1.	Rajeev Motwani and Prabhakar Raghavan, "Randomized Algorithms", 1st Edition, Cambridge University Press, Reprint 2010 for Units (I to V)
1.	Michael Mitzenmacher and Eli Upfal, "Probability and Computing: Randomized Algorithms and Probabilistic Analysis", Cambridge University Press, 2005
2.	Grimmett and Stirzaker, "Probability and Random Processes", Oxford, 2001.

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the basic concepts in the design and analysis of randomized algorithms	Applying (K3)
CO2	develop tail inequalities and different probability that are frequently used in algorithmic application	Applying (K3)
CO3	determine the use of Markov chains and Random walks in the different practical applications	Applying (K3)
CO4	discover the applications of data structures and graph algorithms	Applying (K3)
CO5	examine the different geometrical, parallel and distributed algorithms for various randomness applications.	Applying (K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		50	50				100
CAT2		50	50				100
CAT3		50	50				100
ESE		45	55				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

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[K. Sangeetha]

24MSE10 - SOCIAL NETWORK ANALYSIS									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**Nil**	**2**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	This course studies the properties of graph with its application in social network analysis. It also explores some of the surprising and beautiful discoveries achieved with Social Network Analysis and its applications.

Unit – I	**Graph Theory and Social Networks:**	**9**

Graphs: Basic Definitions- Paths and Connectivity- Distance and Breadth First Search-Network Dataset: An overview. Strong and Weak Ties: Triadic Closure- The Strength of Weak Ties- Tie Strength and Network Structure in Large Scale Data- Tie Strength, Social Media, and Passive Engagement- Closure, Structural Holes, and Social Capital. Networks in their Surrounding Contexts: Homophily – Mechanism Underlying Homophily - Selection and Social Influence- Affiliation. Positive and Negative Relationships: Structural Balance- Characterizing the Structure of Balanced Networks – Application of Structural Balance – A Weaker Form of Structural Balance.

Unit – II	**Game Theory and Interaction in Networks:**	**9**

Games: What is Game?- Reasoning about Behavior in Game- Best Responses and Dominant Strategies- Nash Equilibrium- Multiple Equilibria- Coordination Games, The Hawk-Dove Game-Mixed Strategies-Examples and Empirical Analysis- Pareto Optimality and Social Optimality. Evolutionary Game Theory: Fitness as a Result of interaction- Evolutionarily Stable Strategies- A General Description of Evolutionarily Stable Strategies- Relationship between Evolutionarily and Nash Equilibria- Evolutionarily Stable Mixed Strategies. Modeling Network Traffic using Game Theory: Traffic at Equilibrium- Braess's Paradox. Matching Markets: Bipartite Graphs and Perfect Matchings -Valuations and Optimal Assignments.

Unit – III	**Information Networks and the World Wide Web:**	**9**

The Structure of the Web: The World Wide Web- Information Networks, Hypertext, and Associative Memory- The Web as a Directed Graph- The Bow-Tie Structure of the Web. Link Analysis and Web Search: Searching the Web: The problem of Ranking- Link Analysis using Hubs and Authorities- Page Rank- Applying Link Analysis in Modern Web Search.

Unit – IV	**Network Dynamics - Population Models:**	**9**

Information Cascades: Following the Crowd- A Simple Herding Experiment- Bayes Rule: A model of Decision Making-Making under Uncertainty- Baye's Rule in the Herding Experiment- A Simple, General Cascade Model- Sequential Decision Making and Cascades. Network Effects: The Economy Without Network Effects- The Economy with Network Effects- Stability, Instability and Tipping Points- A Dynamic View of the Market- Industries with Network Goods- Mixing Individual Effects with Population-Level Effects. Power Laws and Rich-Get-Richer Phenomena: Popularity as Network Phenomenon-Power Laws- Rich-Get-Richer Models-The Unpredictability of Rich-Get-Richer Model-The Long Tail-The Effect of Search Tools and Recommendation Systems.

Unit – V	**Network Dynamics – Structural Models:**	**9**

Cascading Behavior in Networks: Diffusion in Network-Modeling diffusion through a Network- Cascades and Clusters- Diffusion, Thresholds, and the Role of Weak Ties- Extensions of the Basic Cascade Model- Knowledge, Thresholds and Collective Action. The Small-World Phenomenon: Six Degrees of Separation- Structure and Randomness- Decentralized Search- Modeling the process of Decentralized Search- Empirical Analysis and Generalized Models- Core Periphery Structures and Difficulties in Decentralized Search. Epidemics: Diseases and the Networks that transmit them-Branching Processes- The SIR Epidemic Model- The SIS Epidemic Model-Synchronization- Transient Contacts and the Danger of Concurrency.

REFERENCES:

1.	David Easley, Jon Klienberg, "Networks, Crowds, and Markets: Reasoning about a Highly Connected World", 1st Edition, Cambridge University Press, 2010, for Units I, II, III, IV,V.
2.	Stanley Wasserman, Katherine Faust, "Social Networks Analysis: Methods and Applications", 1st Edition, Cambridge University Press, 2010.
3.	Charles Kadushin, "Understanding Social Networks: Theories, Concepts, and Findings", 1st Edition, Oxford University Press, 2012.

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the concepts of graph theory for analysis of social networks distribution	Applying (K3)
CO2	utilize game theory for decision making in the context of social networking	Applying (K3)
CO3	employ different link ar. alysis and web search techniques for solving the given problem	Applying (K3)
CO4	analyze network behavior based on population model	Analyzing (K4)
CO5	demonstrate the aggregate behavior of the social networks based on structural model	Applying (K3)

Mapping of COs with POs

COs/POs/PSOs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1			
CO2	3	2	1			
CO3	3	1	2			
CO4	3	3	2			
CO5	3	2	1			

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category *	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		50	50				100
CAT2		50	50				100
CAT3		60	40	15			100
ESE		40	40	10			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

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NPS

24MSE11- ADVANCED DATABASE TECHNOLOGY

Programme & Branch	M.E & Computer Science and Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	2	PE	45	0	0	45	90	3

Preamble	To provide an in-depth and up-to-date presentation of the most important aspects of database systems and applications, and related technologies for real time applications.	
Unit - I	**Relational Model:**	**9**
Relational Model – Database Schema – ER Model – complex attributes – mapping cardinalities – removing redundant attributes – reducing ER to relational schema – relational database design – normal forms		
Unit - II	**Parallel and Distributed Databases:**	**9**
Database System Architectures: Centralized database systems - Server System Architectures - Parallel Systems - Distributed Systems - Parallel and distributed data storage: Data partitioning – replication – parallel indexing Parallel and distributed query processing: parallel sort – parallel join - Parallel and Distributed Transaction Processing: distributed transactions – commit protocols – concurrency control in distributed databases – replication.		
Unit - III	**Object and Object-Relational Databases and XML:**	**9**
Object Database Concepts - The ODMG Object Model and the Object Definition Language - Object Database Conceptual Design - Structured, Semi structured, and Unstructured Data - XML Hierarchical (Tree) Data Model - XML Documents, DTD, and XML Schema - Storing and Extracting XML Documents from Databases - XML Languages		
Unit - IV	**Advanced Database Models and Systems:**	**9**
Active Database Concepts and Triggers - Temporal Database Concepts - Spatial Database Concepts - Multimedia Database Concepts - Introduction to Deductive Databases - Information Retrieval and Web Search -Information Retrieval (IR) Concepts - Retrieval Models - Types of Queries in IR Systems - Text Preprocessing - Inverted Indexing -Evaluation Measures of Search Relevance - Web Search and Analysis - Trends in Information Retrieval.		
Unit - V	**NOSQL Databases and Big Data Storage Systems:**	**9**
NOSQL Systems - The CAP Theorem - Document-Based NOSQL Systems and MongoDB - NOSQL Key-Value Stores - Column-Based or Wide Column NOSQL Systems - NOSQL Graph Databases and Neo4j - Big Data - Introduction to MapReduce and Hadoop - Hadoop Distributed File System (HDFS) - MapReduce: Additional Details - Hadoop v2 alias YARN		

REFERENCES:

1.	Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2019
2.	R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2017.
3.	Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Sixth Edition, Pearson Education, 2015.
4.	C. J. Date, A.Kannan and S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	design and implement relational databases.	Applying (K3)
CO2	design a semantic based database to meaningful data access	Applying (K3)
CO3	represent the data using XML database for better interoperability	Applying (K3)
CO4	embed the rule set in the database to implement intelligent databases	Applying (K3)
CO5	design and implement NoSQL database.	Applying (K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		60	40				100
CAT2		60	40				100
CAT3		60	40				100
ESE		60	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

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24MSE12 – SOFTWARE DEFINED NETWORKING									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**Nil**	**2**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	This course provides insight on basics of software defined networking and how it is changing the way communications networks are managed, maintained, and secured.	
Unit – I	**Introduction**	**9**
Traditional switch Architecture, Autonomous and Dynamic Forwarding Table- need for SDN- The Genesis of SDN, How SDN works, The OpenFlow Specification, OpenFlow 1.0 and OpenFlow Basics, OpenFlow 1.1 and OpenFlow 1.3		
Unit – II	**SDN in Data Center**	**9**
SDN in the Data Center, SDN Use Cases in the Data Center, Open SDN versus Overlays in the Data Center, SDN in other Environments, SDN Applications, SDN Open Source, Switch Implementation, Controller Implementation, SDN Futures		
Unit – III	**SDN Control Plane**	**9**
Distributed Control plane, Centralized Control plane, OpenFlow, SDN Controllers, Network Programmability, Data Center concepts and constructs, The Virtualized Multitenant Data Center, SDN solution for Data Center Network		
Unit – IV	**SDN and NFV:**	**9**
Network Function Virtualization: Virtualization and Data plane I/O, Service Engineered path - Service Locations and Chaining. Network Topology and Topological Information Abstraction: Network Topology, Traditional methods, LLDP, BGP-TE / LS, ALTO, I2RS Topology. Building an SDN Framework: The Juniper SDN Framework, Open Daylight Controller/Framework.		
Unit – V	**SDN Use cases:**	**9**
Use cases for Bandwidth Scheduling, Manipulation and calendaring, Data Center Overlays, Big Data and Network Function Virtualization, Input Traffic Monitoring, Classification, and Triggered Actions.		

REFERENCES:

1.	Paul Goransson, Chuck Black, "Software Defined Networks: A Comprehensive Approach", 1st Edition, Morgan Kaufmann, June 2014.
2.	Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies", O'Reilly Media, August 2013.
3.	https://www.opennetworking.org/wp-content/uploads/2019/10/NG-SDN-Tutorial-Session-2.pdf

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	experiment the data plane and control plane of software defined networks	Applying (K3)
CO2	demonstrate the role of software defined network in different networking environment	Applying (K3)
CO3	employ openflow protocol to determine the operations of software defined network	Applying (K3)
CO4	model software defined controller for various networking applications	Applying (K3)
CO5	use software defined network to solve the given network problems	Applying (K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		70	30				100
CAT2		70	30				100
CAT3		60	40				100
ESE		60	40				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

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KD

24MSE13 - SPEECH AND NATURAL LANGUAGE PROCESSING									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**Nil**	**3**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	The course provides the foundation knowledge on speech production and perception along with processing of speech signal and also deals with the basics of text processing and then it also covers some of the most interesting applications of text mining.	
Unit – I	**Words and Morphology:**	**9**
Introduction - Models and Algorithms – Words – Morphology - Morphological Parsing using Finite State Transducers - FST Lexicon and Rules - Porter Stemmer - Spelling Errors - Error Pattern - Non-Word Error - Probabilistic Models - Applying Bayesian Methods to Spelling – Weighted Automata and Segmentation - N-grams - Smoothing – Backoff.		
Unit – II	**Tagging and Grammar:**	**9**
Part of Speech Tagging - Tagsets for English - Rule Based Tagging - Stochastic Part of Speech Tagging – Transformation-Based Tagging - CFG for English - Context Free Rule - Sentence-Level Constructions - Noun Phrase - Coordination-Agreement - Verb Phrase and Sub categorization -Auxiliaries – Parsing - Top Down Parsing - Bottom Up Parsing - Earley Algorithm.		
Unit – III	**Features and Unificataion:**	**9**
Features and Unification – Structures - Unification of Structure - Features and Structures in Grammar – Implementing Unification - Parsing with Unification Constraints - Probabilistic CFG - Probabilistic Lexicalize CFG – Dependency Grammar.		
Unit – IV	**Semantics:**	**9**
Semantic Analysis - Syntax Driven Semantic Analysis - Attachments for a Fragment of English - Integrating Semantic analysis into Earley Parser - Word Sense Disambiguation and Information Retrieval.		
Unit – V	**Advanced Topics:**	**9**
Computational Phonology - HMM and Speech Recognition – Discourse - Dialogue and Conversation - Deep Learning and Natural Language Processing.		

REFERENCES:

1.	Daniel Jurafsky and James H. Martin, "Speech and Language Processing", Pearson Education, 2017.
2.	Christopher Manning and Hinrich Schuetze," Foundations of Statistical Natural Language Processing", MIT Press, 2000.
3.	Li Deng and Yang Liu, " Deep Learning in Natural Language Processing", Springer,2018

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	use morphological analysis and Finite State Transducers to analyze word structure	Applying (K3)
CO2	apply Probabilistic approaches for Spelling and use N-grams for Language Modelling	Applying (K3)
CO3	make use of CFG and Probabilistic Parsing to analyze sentences	Applying (K3)
CO4	apply Semantic in word sense disambiguation and Information Retrieval	Applying (K3)
CO5	make use of Computation Phonology and HMM for Speech recognition and Text to Speech conversion	Applying (K3)

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		65	35				100
CAT2		65	35				100
CAT3		50	35				100
ESE		70	30				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

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K. Ponnusamy

(K. Devendran)

SR

24MSE14 – INTELLIGENT SYSTEM DESIGN

Programme & Branch	M.E. & Computer Science and Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	**Nil**	**3**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	This course deals with designing intelligent systems using various techniques like search and heuristics, making use of logic in knowledge representation and reasoning, and employing machine learning techniques with data sets. The role of fuzzy and neural systems in building intelligent systems will also be discussed.	
Unit – I	**Problem Solving and Searching:**	**9**
Evolution of Modern Computational Intelligence - Problem Solving by Search - Informed (Heuristic) Search - Iterative Search - Adversarial Search.		
Unit – II	**Logic and Knowledge Base Systems:**	**9**
Knowledge Representation and Reasoning - Rule-Based Expert Systems - Managing Uncertainty in Rule Based Expert Systems.		
Unit – III	**Fuzzy and Neural Systems:**	**9**
Fuzzy Expert Systems – Artificial Neural Networks - Advanced Artificial Neural Networks.		
Unit – IV	**Learning from Data:**	**9**
Machine Learning – Decision Trees Evolutionary Algorithms - Evolutionary Meta heuristics.		
Unit – V	**Bio-Inspired Intelligence:**	**9**
Swarm Intelligence - Hybrid Intelligent Systems.		

REFERENCES:

1.	Crina Grosanand, Ajith Abraham, "Intelligent Systems – A modern approach", Springer – Verlag Berlin Heidelberg, 1st Edition,2011.
2.	Robert J. Schalkoff, "Intelligent Systems Principles, Paradigms and Pragmatics", Jones and Bartlett Publishers, LLC, 2011.First Edition
3.	N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2005. Illustrated Edition

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply search techniques and heuristics for solving problems	Applying (K3)
CO2	make use of logic in knowledge representation and reasoning	Applying (K3)
CO3	identify the role of fuzzy and neural systems in building intelligent systems	Applying (K3)
CO4	build the machine learning techniques using datasets	Applying (K3)
CO5	employ bio-inspired algorithms and build hybrid intelligence systems	Applying (K3)

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		75	25				100
CAT2		65	35				100
CAT3		56	35				100
ESE		65	35				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

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[S.RAMYA]

PSN

24MSE15 - MOBILE AND PERVASIVE COMPUTING									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**Nil**	**3**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	This course provides an understanding of wireless and mobile communication concepts through various layers of mobile networking. It also helps to realize the pervasive and context aware computing architectures, systems and applications.	
Unit – I	**Introduction to Wireless Environment:**	**9**
Introduction to wireless communication-Wireless Transmission- Medium Access Control- Wireless MAC protocols – Comparison of 2G, 3G, 4G looking ahead 5G systems.		
Unit – II	**Mobile Communication:**	**9**
GSM - Bluetooth - Mobile network layer-Mobile transport layer - File system support for mobility support - Mobile execution environments and applications.		
Unit – III	**Pervasive Communication:**	**9**
Past, Present, Future – Application Examples – Device Technology – WAP and Beyond – Pervasive Web Application Architecture: Example Application.		
Unit – IV	**Context Aware Computing:**	**9**
Structure and Elements of Context-aware Pervasive Systems: Abstract architecture – Infrastructures - Middleware and toolkits, Context-aware mobile services: Context for mobile device users – Location-based services- Ambient service- Enhancing Context-aware mobile services and Context aware artifacts.		
Unit – V	**Context-Aware Pervasive System:**	**9**
Context-aware sensor networks – A framework for Context aware sensors – Context-aware security systems – Constructing Context-aware pervasive system- Future of Content aware systems.		

REFERENCES:

1.	Schiller Jochen, "Mobile Communication", 2nd Edition, PHI/Pearson Education, 2009, for Units – I and II
2.	Burkhardt Jochen, Henn Horst and Hepper Stefan, Schaec Thomas and Rindtorff Klaus, "Pervasive Computing Technology and Architecture of Mobile Internet Applications", Addison Wesley Reading, 2007, for Unit-III
3.	Seng Loke, "Context-Aware Pervasive Systems: Architectures for a New Breed of Applications", 1st Edition, Auerbach Publications, 2006, for Unit – IV and V
4.	Natalia Silvis, "Pervasive Computing Engineering Smart Systems", Springer, 2017

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Analyze the operation and performance of wireless protocols	Analyze(K4)
CO2	Apply the concepts and principles of various mobile communication technologies	Applying (K3)
CO3	Analyze the working of protocols that support mobility	Analyze(K4)
CO4	Identify the architecture of pervasive computing and apply them in pervasive computing	Applying (K3)
CO5	Apply context aware computing and design pervasive systems for real time examples	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3		
CO2	3	3	3	3		
CO3	3	3	3	3		
CO4	3	3	3	3		
CO5	3	3	3	3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		30	50	20			100
CAT2		55	35	10			100
CAT3		60	40				100
ESE		50	40	10			100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

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Board of Studies - CSE

[Dr. P.S. Nandhini]

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SR

24MSE16 - NATURE INSPIRED OPTIMIZATION TECHNIQUES									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**Nil**	**3**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	This course helps the learners to understand the algorithms that are inspired by naturally occurring phenomena. The focus is on abstracting nature inspired techniques which influence computing.	
Unit - I	**Introduction to Algorithms and Analysis of Algorithms:**	**9**
Introduction to Algorithms: Newton"s Method – Optimization - Search for Optimality - No-Free-Lunch Theorems - Nature-Inspired Metaheuristics - Brief History of Metaheuristics. **Analysis of Algorithms:** Introduction - Analysis of Optimization Algorithms - Nature-Inspired Algorithms - Parameter Tuning and Parameter Control.		
Unit - II	**Simulated Annealing and Genetic Algorithms:**	**9**
Simulated Annealing: Annealing and Boltzmann Distribution - Parameters - SA Algorithm - Unconstrained Optimization - Basic Convergence Properties - SA Behavior in Practice - Stochastic Tunneling. Genetic Algorithms : Introduction - Genetic Algorithms - Role of Genetic Operators - Choice of Parameters - GA Variants - Schema Theorem - Convergence Analysis.		
Unit - III	**Particle Swarm and Cat Swarm Optimization:**	**9**
Particle Swarm Optimization: Swarm Intelligence - PSO Algorithm - Accelerated PSO – Implementation - Convergence Analysis - Binary PSO. Cat Swarm Optimization: Natural Process of the Cat Swarm - Optimization Algorithm – Flowchart - Performance of the CSO Algorithm.		
Unit - IV	**TLBO Algorithm, Cuckoo Search and Bat Algorithms:**	**9**
TLBO Algorithm: Introduction - Mapping a Classroom into the Teaching-Learning-Based optimization – Flowchart. Cuckoo Search: Cuckoo Life Style - Details of COA – flowchart - Cuckoos' Initial Residence Locations - Cuckoos' Egg Laying Approach - Cuckoos Immigration - Capabilities of COA. Bat Algorithms: Echolocation of Bats - Bat Algorithms – Implementation - Binary Bat Algorithms - Variants of the Bat Algorithm - Convergence Analysis.		
Unit – V	**Other Algorithms:**	**9**
Ant Algorithms - Bee-Inspired Algorithms - Harmony Search - Hybrid Algorithms.		

REFERENCES:

1.	Xin-She Yang, "Nature-Inspired Optimization Algorithms", 1st Edition, Elsevier, 2014.
2.	Omid Bozorg-Haddad, "Advanced Optimization by Nature-Inspired Algorithms" Springer Volume 720, 2018.
3.	Srikanta Patnaik, Xin-She Yang, Kazumi Nakamatsu, "Nature-Inspired Computing and Optimization Theory and Applications", Springer Series, 2017.

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the basic concepts of optimization techniques	Applying (K3)
CO2	identify the parameter which is to be optimized for an application	Analyzing (K4)
CO3	analyze and develop mathematical model of different swarm optimization algorithms	Analyzing (K4)
CO4	select suitable optimization algorithm for a real time application	Analyzing (K4)
CO5	examine and recommend solutions for optimization-based applications	Analyzing (K4)

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		60	25	15			100
CAT2		45	30	25			100
CAT3		45	30	25			100
ESE		40	40	20			100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

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S. Ramya
[S. RAMYA]

NS

24MSE17 SECURITY PRACTICES									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**Basics of networks and security**	**3**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	The course provides core fundamentals of system and web security concepts, detailed study of Privacy and Storage security and related Issues.	
Unit – I	**SYSTEM SECURITY:**	**9**
Building a secure organization- A Cryptography primer- detecting system Intrusion- Preventing system Intrusion- Fault tolerance and Resilience in cloud computing environments- Security web applications, services and servers.		
Unit – II	**NETWORK SECURITY:**	**9**
Internet Security - Botnet Problem- Intranet security- Local Area Network Security - Wireless Network Security - Wireless Sensor Network Security- Cellular Network Security- Optical Network Security- Optical wireless Security.		
Unit – III	**SECURITY MANEGEMENT:**	**9**
Information security essentials for IT Managers- Security Management System - Policy Driven System Management- IT Security - Online Identity and User Management System - Intrusion and Detection and Prevention system.		
Unit – IV	**CYBER SECURITY AND CRYPTOGRAPHY:**	**9**
Cyber Forensics- Cyber Forensics and Incidence Response - Security e-Discovery - Network Forensics - Data Encryption- Satellite Encryption - Password based authenticated Key establishment Protocols.		
Unit – V	**PRIVACY AND STORAGE SECURITY:**	**9**
Privacy on the Internet - Privacy Enhancing Technologies - Personal privacy Policies - Detection of Conflicts in security policies- privacy and security in environment monitoring systems. Storage Area Network Security - Storage Area Network Security Devices - Risk management - Physical Security Essentials.		

REFERENCES:

1.	John R.Vacca, Computer and Information Security Handbook, Second Edition, Elsevier 2013.
2.	Michael E. Whitman, Herbert J. Mattord, Principal of Information Security, Fourth Edition, Cengage Learning, 2012.

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	**Understand the core fundamentals of system security.**	Applying (K3)
CO2	Apply the security concepts related to networks in wired and wireless scenario.	Applying (K3)
CO3	Implement and Manage the security essentials in IT Sector.	Applying (K3)
CO4	Able to explain the concepts of Cyber Security and encryption Concepts.	Applying (K3)
CO5	Able to attain a through knowledge in the area of Privacy and Storage security and related Issues.	Applying (K3)

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		60	40				100
CAT2		70	30				100
CAT3		70	30				100
ESE		60	40				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

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Board of Studies - CSE

(Dr. N. Shanthi)

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NSP

24MSE18 - DIGITAL IMAGE PROCESSING AND COMPUTER VISION

Programme & Branch	M.E. & Computer Science and Engineering	Sem	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	3	PE	45	0	0	45	90	3

Preamble	Provides basic knowledge about image, its representation and preprocessing and prepares the students to perform analysis of processed data.	
Unit - I	**Digital Image Fundamentals**	**9**
Introduction - Elements of Visual Perception- Light and the Electromagnetic Spectrum- Image Sensing and Acquisition- Image Sampling and Quantization-Some Basic Relationships between Pixels- Introduction to the Basic Mathematical Tools used in Digital Image Processing		
Unit - II	**Intensity Transformations and Spatial Filtering**	**9**
Basic Intensity Transformation Functions- Histogram Processing- Fundamentals of Spatial Filtering-Smoothing Spatial Filters- Sharpening Spatial Filters- Highpass, Bandreject, and Bandpass Filters from Lowpass Filters- Combining Spatial Enhancement Methods. Wavelet and Other Image Transforms: Fourier-Related Transforms - Walsh-Hadamard Transforms - Slant Transform - Haar Transform - Wavelet Transforms.		
Unit - III	**Image Restoration and Reconstruction**	**9**
A Model of the Image Degradation/Restoration process - Noise Models - Restoration in the Presence of Noise only—Spatial Filtering - Periodic Noise Reduction using Frequency Domain Filtering - Linear, Position - Invariant Degradations - Estimating the Degradation Function - Inverse Filtering - Minimum Mean Square Error (Wiener) Filtering - Constrained Least Squares Filtering- Geometric Mean Filter.		
Unit - IV	**Image Compression and Segmentation**	**9**
Image Compression and Watermarking: Huffman Coding - Golomb Coding - Arithmetic Coding - LZW Coding - Run-length Coding. Segmentation: Fundamentals Point, Line, and Edge Detection -Thresholding - Segmentation by Region Growing and by Region Splitting and Merging - Region Segmentation using Clustering and Super pixels.		
Unit – V	**3D geometry, correspondence, 3D from intensities**	**9**
3D geometry, correspondence, 3D from intensities: 3D vision tasks - Basics of projective geometry- A single perspective camera- Scene reconstruction from multiple views - Two cameras, stereopsis - 3D information from radiometric measurements.		

REFERENCES:

1.	Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", 4th edition, Pearson, 2018
2.	Distante , Arcangelo, Distante, Cosimo, "Handbook of Image Processing and Computer Vision", Springer International Publishing, 2020
3.	Milan Sonka, Vaclav Hlavac , Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4th edition, Cengage Learning, 2015

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply image fundamentals and mathematical tools necessary for image processing.	Applying (K3)
CO2	identify the significances of image transformations and spatial filtering	Applying (K3)
CO3	examine the fundamentals of image restoration and reconstruction	Applying (K3)
CO4	explore different compression and segmentation methods for different images	Applying (K3)
CO5	recognize the need for 3d vision and develop an application using it	Applying (K3)

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		65	35				100
CAT2		65	35				100
CAT3		65	35				100
ESE		65	35				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

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(N. Sasipriyaa)

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KV

24MSE19 - DATA SCIENCE									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**NIL**	**3**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	This course provides a broad introduction to different ways that the data scientists learn from data, including statistical reasoning, mathematical model computation and communication.	
Unit – I	**Introduction:**	**9**
Data Science - Computer Science, Data Science, and Real Science – Properties of Data – Classification and Regression - Data Munging - Languages for Data Science - Collecting Data - Cleaning Data – Crowdsourcing		
Unit – II	**Scores and Rankings:**	**9**
The Body Mass Index (BMI) - Developing Scoring Systems - Z-scores and Normalization - Advanced Ranking Techniques - Arrow's Impossibility Theorem - Statistical Analysis - Statistical Distributions - Sampling from Distributions - Statistical Significance - Permutation Tests and P-values - Bayesian Reasoning		
Unit – III	**Visualizing Data:**	**9**
Exploratory Data Analysis - Developing a Visualization Aesthetic - Chart Types - Great Visualizations- Reading Graphs - Interactive Visualization.		
Unit – IV	**Mathematical Models:**	**9**
Philosophies of Modeling - A Taxonomy of Models - Baseline Models - Evaluating Models -Evaluation Environments - Linear Algebra - The Power of Linear Algebra - Visualizing Matrix Operations - Factoring Matrices - Eigenvalues and Eigenvectors - Eigenvalue Decomposition		
Unit – V	**Linear and Logistic Regression:**	**9**
Linear Regression - Better Regression Models - Regression as Parameter Fitting - Simplifying Models through Regularization - Classification and Logistic Regression - Issues in Logistic Classification - Distance and Network Methods - Measuring Distances - Nearest Neighbor Classification - Graphs, Networks, and Distances – PageRank – Clustering.		

REFERENCES:

1.	Steven S. Skiena, "The Data Science Design Manual", 1st Edition, Springer, 2017.
2.	Igual, Laura, and Santi Seguí. "Introduction to Data Science." Introduction to Data Science. Springer, Cham, 2017

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	make use of the concepts of data science and data munging for building applications	Applying (K3)
CO2	utilize statistical methods for solving problems	Applying (K3)
CO3	apply appropriate data visualization technique for communicating the result	Applying (K3)
CO4	experiment with mathematical model for data science applications	Applying (K3)
CO5	apply different the machine learning techniques available for solving the given problem and propose an optimized solution	Applying (K3)

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		45	55				100
CAT2		50	50				100
CAT3		40	60				100
ESE		40	60				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

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SK

24MSE20– INFORMATION STORAGE MANAEGMENT									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**Nil**	**3**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	This course offers essential details about various storage systems, storage networking technologies and business continuity solutions along with management techniques in order to store, manage, and protect digital information in classic, virtualized, and cloud environments.	
Unit – I	**Storage Systems:**	**9**
Introduction - evolution of storage architecture, key characteristics of data center - virtualization, and cloud computing. Data center environment: Host (or computer), connectivity, storage, and access to data, direct attached storage, storage design based on application requirements and disk performance - VMware ESXi. Data Protection: RAID implementations, techniques, levels, impact of RAID on disk performance. Intelligent Storage System: Components, storage provisioning, types and intelligent storage implementations.		
Unit – II	**Storage Networking Technologies:**	**9**
Fibre channel SAN components – FC SAN connectivity – FC protocol stack – FC addressing – zoning – FC SAN topologies – virtualization in SAN. iSCSI – FCIP – FCoE – Network Attached Storage (NAS): components, I/O operation, file sharing protocols, file level virtualization. Object based storage platform – unified storage platform.		
Unit – III	**Backup, Archive and Replication:**	**9**
Business continuity terminologies – BC planning life cycle – failure analysis – BC technology solutions – Backup and archive: purpose, methods, architecture, operations, topologies, targets, data deduplication, backup in virtualized environment and data archive. Local replication in classic and virtual environments – Remote replication in classic and virtual environment.		
Unit – IV	**Cloud Computing:**	**9**
Cloud enabling technologies – characteristics of cloud computing – benefits of cloud computing – cloud service models – cloud deployment models: public cloud, private cloud, community cloud, hybrid cloud. Cloud computing infrastructure: physical infrastructure, virtual infrastructure, applications and platform software, cloud management and service creation tools. Cloud challenges – cloud adoption considerations.		
Unit – V	**Securing and Managing Storage Infrastructure:**	**9**
Information security framework – risk triad – storage security domains – security implementations in storage networking: FC SAN, NAS, IP SAN – Securing storage infrastructure in virtualized and cloud environments – monitoring the storage infrastructure – storage infrastructure management activities – storage infrastructure management challenges – developing an ideal solution – Information lifecycle management (ILM) – storage tiering.		

REFERENCES:

1. EMC Corporation, "Information Storage and Management", 2nd Edition, Wiley, 2012.
2. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 2003.
3. Marc Farley, "Building Storage Networks", 2nd Edition, Tata McGraw Hill, Osborne, 2001.

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	demonstrate the various storage systems and RAID implementations	Applying (K3)
CO2	identify various storage networking technologies and its components	Applying (K3)
CO3	apply business continuity solutions – backup and replication, and archive for managing fixed content	Applying (K3)
CO4	make use of cloud computing concepts for information storage	Applying (K3)
CO5	use the storage security framework and practice storage monitoring and management activities	Applying (K3)

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		75	25				100
CAT2		75	25				100
CAT3		75	25				100
ESE		75	25				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

RG

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(CS. KAVITHA)

SR

24MSE21 - REINFORCEMENT LEARNING									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**Nil**	**3**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**
Preamble	This course will provide a solid introduction to the field of reinforcement learning and explore the core challenges and approaches, including generalization and exploration with reinforcement learning algorithms.								
Unit – I									**9**
Introduction: Reinforcement Learning – Examples-Elements of Reinforcement Learning – Limitations and Scope – **Multi –armed Bandits :** A k-armed Bandit Problem - Action-value Methods - The 10-armed Testbed - Incremental Implementation - Tracking a Non-stationary Problem - Optimistic Initial Values - Gradient Bandit Algorithms									
Unit – II									**9**
Finite Markov Decision processes: The Agent – Environment Interface - Goals and Rewards - Returns and Episodes - Unified Notation for Episodic and Continuing Tasks - Policies and Value Functions - **Dynamic programming**: Policy Evaluation (Prediction) - Policy Improvement - Policy Iteration - Value Iteration -Asynchronous Dynamic Programming - Generalized Policy Iteration									
Unit – III									**9**
Monte carlo methods: Monte Carlo Prediction - Monte Carlo Estimation of Action Values - Monte Carlo Control - Monte Carlo Control without Exploring Starts - Off-policy Prediction via Importance Sampling -Incremental Implementation - Off-policy Monte Carlo Control - **Temporal Difference Learning:** TD Prediction - Advantages of TD Prediction Methods - Optimality of TD(0) - Sarsa: On-policy TD Control - Q-learning: Off-policy TD Control									
Unit – IV									**9**
n-step Bootstrapping: n-step Sarsa - n-step Off-policy Learning - n-step Tree Backup Algorithm - **Planning and Learning with Tabular Methods:** Models and Planning – Dyna - Integrated Planning, Acting, and Learning - Prioritized Sweeping - Expected vs. Sample Updates - Trajectory Sampling - Real-time Dynamic Programming - Planning at Decision Time - Heuristic Search - Rollout Algorithms - Monte Carlo Tree Search									
Unit – V									**9**
On-policy Prediction with Approximation: Value-function Approximation - The Prediction Objective (VE) - Stochastic-gradient and Semi-gradient Methods - Linear Methods - Feature Construction for Linear Methods - Selecting Step - Size Parameters Manually - **On-policy Control with Approximation:** Episodic Semi-gradient Control - Semi-gradient n-step Sarsa - Average Reward: A New Problem Setting for Continuing Tasks - Policy Gradient Methods									
REFERENCES:									
1.	Sutton and Barto," Reinforcement Learning: An Introduction", The MIT Press, 2nd Edition,2018								
2.	Marco Wiering and Martijn van Otterlo, "Reinforcement Learning: State-of-the-Art (Adaptation, Learning, and Optimization)", Volume-12, Springer ,2012								

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe the key features of reinforcement learning that distinguishes it from AI and non-interactive machine learning and apply for an application	Applying(K3)
CO2	devise an appropriate solution for the given RL problem	Applying(K3)
CO3	Implement common RL algorithms	Applying(K3)
CO4	Use performance metrics based on multiple criteria to evaluate RL algorithms	Applying(K3)
CO5	Make use of Stochastic –gradient and Semi –gradient methods for On – policy Prediction and Control	Applying(K3)

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		40	60				100
CAT2		40	60				100
CAT3		35	65				100
ESE		40	60				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

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Board of Studies - CSE

ACADEMIC CELL * KONGU ENGINEERING COLLEGE *

[S. RAMYA]

SSH

24MSE22 VIRTUALIZATION TECHNIQUES									
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**Nil**	**3**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	Virtual machine allows the creation of an environment that is not logically tied to the underlying hardware. The cloud is essentially a virtual environment that arises from the combination of multiple virtual machines into one powerful entity. Therefore, the process of virtualization is a key element in the creation of cloud platforms and infrastructure.	
Unit - I	**Overview of Virtualization:**	**9**
Basics of Virtualization - Virtualization Types – Desktop Virtualization – Network Virtualization – Server and Machine Virtualization – Storage Virtualization – System-level or Operating Virtualization – Application Virtualization- Virtualization Advantages – Virtual Machine Basics – Taxonomy of Virtual machines - Process Virtual Machines – System Virtual Machines – Hypervisor - Key Concepts.		
Unit - II	**Server Consolidation:**	**9**
Hardware Virtualization – Virtual Hardware Overview - Server Virtualization – Physical and Logical Partitioning - Types of Server Virtualization – Business cases for Sever Virtualization – Uses of Virtual server Consolidation – Planning for Development – Selecting server Virtualization Platform.		
Unit - III	**Network Virtualization:**	**9**
Design of Scalable Enterprise Networks - Virtualizing the Campus WAN Design – WAN Architecture- WAN Virtualization - Virtual Enterprise Transport Virtualization–VLANs and Scalability - Theory Network Device Virtualization Layer 2 - VLANs Layer 3 VRF Instances Layer 2 - VFIs Virtual Firewall Contexts Network Device Virtualization - Data-Path Virtualization Layer 2: 802.1q - Trunking Generic Routing Encapsulation – IPsec-L2TPv3 Label Switched Paths - Control-Plane Virtualization.		
Unit - IV	**Virtualizing Storage:**	**9**
SCSI- Speaking SCSI- Using SCSI buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI – SAN backup and recovery techniques – RAID – SNIA Shared Storage Model – Classical Storage Model – SNIA Shared Storage Model – Host based Architecture – Storage based architecture – Network based Architecture – Fault tolerance to SAN – Performing Backups – Virtual tape libraries.		
Unit - V	**Virtual Machines Products:**	**9**
Xen Virtual machine monitors- Xen API – VMware – VMware products – VMware Features – Microsoft Virtual Server – Features of Microsoft Virtual Server.		

REFERENCES:

1.	William von Hagen, "Professional Xen Virtualization", 1st Edition, Wrox Publications, January, 2008.
2.	Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", Illustrated Edition, A Press 2005.
3.	Kumar Reddy, Victor Moreno, "Network virtualization", 1st Edition, Cisco Press, July, 2006.

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	compile all types of virtualization techniques	Applying (K3)
CO2	design and planning of server consolidation	Applying (K3)
CO3	create a virtual machine and to extend it to a virtual network	Applying (K3)
CO4	analyse the intricacies of server, storage and network virtualizations	Applying (K3)
CO5	demonstrate tge various virtual machine products	Applying (K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		50	50				100
CAT2		50	50				100
CAT3		50	50				100
ESE		50	50				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

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(Dr. S. SHANTHI)

CS

24MSE23 - USER INTERFACE DESIGN

Programme & Branch	M.E. & Computer Science and Engineering	Sem	Category	L	T	P	SL*	Total	Credit
Prerequisites	NIL	3	PE	45	0	0	45	90	3

Preamble	UID deals with design of responsive web application using Full Stack Web Development –MEAN MongoDB, ExpressJS, AngularJS and NodeJS.	
Unit – I	**Introduction to NoSQL Database - MongoDB:**	**9**
What is NoSQL Database - Why to Use MongoDB - Difference between MongoDB & RDBMS - Download & Installation - Common Terms in MongoDB – Implementation of Basic CRUD Operations using MongoDB.		
Unit – II	**Introduction to Server-side JS Framework – Node.js:**	**9**
Introduction - What is Node JS – Architecture – Feature of Node JS - Installation and setup - Creating web servers with HTTP (Request and Response) – Event Handling - GET and POST implementation - Connect to NoSQL Database using Node JS – Implementation of CRUD operations.		
Unit – III	**Introduction to TypeScript:**	**9**
TypeScript : Introduction to TypeScript – Features of TypeScript – Installation setup – Variables – Datatypes – Enum – Array – Tuples – Functions – OOP concepts – Interfaces – Generics – Modules – Namespaces – Decorators – Compiler options – Project Configuration.		
Unit – IV	**Introduction to Client-side JS Framework – Basics of Angular:**	**9**
Introduction to Angular - Needs and Evolution – Features – Setup and Configuration – Components and Modules – Templates – Change Detection – Directives – Data Binding - Pipes – Nested Components.		
Unit – V	**Client-side JS Framework – Forms and Routing in Angular:**	**9**
Template Driven Forms - Model Driven Forms or Reactive Forms - Custom Validators - Dependency Injection - Services - RxJS Observables HTTP - Routing.		

REFERENCES:

1.	Electronic Resources at **https://infytq.infosys.com**
2.	Nathan Rozentals, "Mastering TypeScript", 2nd Edition, Packt Publishing, 2017.
3.	Nathan Murray, Ari Lerner, Felipe Coury, Carlos Taborda, "ng-book, The Complete Book on Angular 6", Createspace Publisher, 2018.

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	demonstrate NoSQL Database CURD operations using MongoDB	Applying (K3)
CO2	develop server-side applications using Node JS	Applying (K3)
CO3	make use of Type Script to build web application	Applying (K3)
CO4	employ Angular features and create component-based web pages	Applying (K3)
CO5	design a Full Stack web application	Applying (K3)

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		40	60				100
CAT2		40	60				100
CAT3		40	60				100
ESE		40	60				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

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Board of Studies - CSE

ACADEMIC CELL
KONGU ENGINEERING COLLEGE

C.SAGANA.

JG

24MSE24 - BLOCKCHAIN TECHNOLOGIES									
Programme & Branch	**M.E. & Computer Science and Engineering**	**Sem**	**Category**	**L**	**T**	**P**	**SL***	**Total**	**Credit**
Prerequisites	**Nil**	**3**	**PE**	**45**	**0**	**0**	**45**	**90**	**3**

Preamble	The widespread popularity of digital cryptocurrencies has led the foundation of Blockchain. This course covers both the conceptual as well as application aspects of Blockchain. This includes the fundamental design and architectural primitives of Blockchain, the system and the security aspects, along with various use cases from different application domains.
Unit - I	**Introduction to Blockchain:** **9**
Financial transaction – Ledger – trustless system – Elements of blockchain – types – Byzantine General Problems – benefits – challenges – Components and structure of blockchain: blocks – chain – hashing – digital signatures – example – miners – validators – smart contracts - speed – decentralization Vs distributed systems.	
Unit - II	**Cryptography behind Blockchain:** **9**
Principles – historical perspectives – classical cryptography- types – symmetric – asymmetric – signatures – hashing. Bitcoin: History – Why bitcoin – keys and addresses – transactions – blocks – bitcoin network – wallets.	
Unit - III	**Consensus:** **9**
Practical Byzantine fault tolerance algorithm – Proof of Work - Proof of Stake - Proof of Authority - Proof of Elapsed time Cryptocurrency Wallets: Introduction to cryptocurrency wallets - Transactions - Types of cryptocurrency wallets – Tenancy - Alternate Blockchains.	
Unit - IV	**Hyperledger and Enterprise Blockchains:** **9**
History - Hyperledger projects - Hyperledger Burrow - Hyperledger Sawtooth - Hyperledger Fabric - Hyperledger Iroha - Hyperledger Indy - Tools in Hyperledger – Deploy a simple application on IBM cloud.	
Unit - V	**Ethereum:** **9**
Introducing Ethereum - Components of Ethereum - Ethereum accounts - Ethereum network - Ethereum clients - Ethereum gas - Ethereum virtual machine - Ethereum block – Ether - Basics of Solidity - Ethereum Development.	

REFERENCES:

1.	Brenn Hill, Samanyu Chopra, Paul Valencourt, "Blockchain Quick Reference: A guide to exploring decentralized blockchain application development", 1st Edition, Packt Publishing, 2018.
2.	Andreas Antonopoulos, "Mastering Bitcoin: Programming the open blockchain", 2nd Edition, O'Reilly Media, 2017.
3.	Melanie Swan, "Blockchain: Blueprint for a New Economy", 1st Edition, O'Reilly Media, 2015.

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	illustrate the workings of blockchain	Applying (K3)
CO2	apply various cryptographic algorithms in blockchain	Applying (K3)
CO3	demonstrate different cryptocurrency used in blockchain	Applying (K3)
CO4	deploy a simple application using Hyperledger on IBM cloud	Applying (K3)
CO5	develop a distributed application using Ethereum and Solidity	Applying (K3)

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		70	30				100
CAT2		70	30				100
CAT3		70	30				100
ESE		70	30				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

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Board of Studies - CSE

J. Gowtham

(J. GOWTHAMI)

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RKM/
PCDK

24MSE25 - SENTIMENT ANALYSIS							
Programme & Branch	**M.E & Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**PE**	**3**	**0**	**0**	**3**
Preamble	To extract the opinions and sentiments from natural language text using computational methods. For analyzing the sentiment analysis problem from a linguistic angle to help readers understand the underlying structure of the problem and the language constructs commonly used to express opinions and sentiments and presenting computational methods to analyze and summarize opinions.						
Unit – I	**Introduction to Sentiment Analysis**						**9**
Introduction: Sentiment Analysis Applications - Sentiment Analysis Research - Sentiment Analysis as Mini NLP. The Problem of Sentiment Analysis: Definition of Opinion - Affect, Emotion, and Mood in sentiment analysis - Document Sentiment Classification: Supervised Sentiment Classification - Unsupervised Sentiment Classification.							
Unit – II	**Subjectivity Classification and Challenges**						**9**
Subjectivity - Sentence Subjectivity Classification - Sentence Sentiment Classification - Dealing with Conditional Sentences - Dealing with Sarcastic Sentences - Emotion Classification of Sentences							
Unit – III	**Aspect Sentiment Classification and Sentiment Lexicon Generation**						**9**
Aspect Sentiment Classification-Supervised Learning-Lexicon-Based Approach-Pros and Cons of the Two ApproachesDictionary-Based Approach - Corpus-Based Approach-Identifying Sentiment Words from a Corpus-Dealing with Context-Dependent Sentiment Words-Lexicon Adaptation-Desirable and Undesirable Facts							
Unit – IV	**Analysis of Comparative Opinions**						**9**
Problem Definition- Identify Comparative Sentences- Identifying the Preferred Entity Set- Nonstandard Comparison- Cross-Type Comparison- Single-Entity Comparison- Sentences Involving Compare and Comparison- Entity and Aspect Extraction							
Unit – V	**Identifying intention, fake and quality of opinion**						**9**
Different Types of Spam - Supervised Fake Review Detection - Supervised Yelp Data Experiment - - Model Based Behavioral Analysis -Identifying Reviewers with Multiple User ids - Quality of Reviews: Quality Prediction as a Regression Problem - Other Methods - Some New Frontiers.							
REFERENCES:							
1.	Bing Liu "Sentiment Analysis: Mining Opinions, Sentiments and Emotions", Cambridge University Press, 2015.						
2.	Federico Pozzi, Elisabetta Fersini, Enza Messina, Bing Liu," Sentiment Analysis in Social Networks", Morgan Kaufmann, 2016.						
3.	Erik Cambria, Dipankar Das "A Practical Guide to Sentiment Analysis" Springer International Publishing AG 2017.						
4.	Aakansha Sharaff, G. R. Sinha, Surbhi Bhatia,"New Opportunities for Sentiment Analysis and Information Processing", IGI Global, 2021						

*Includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explore the underlying structure of the problem and the language constructs commonly used to express opinions, sentiments, and emotions.	Applying(K3)
CO2	apply classification of sentences for sentiment analysis.	Applying(K3)
CO3	perform aspect-oriented classification various in sentiment analysis.	Applying(K3)
CO4	infer the words and phrases that convey positive or negative sentiments to apply in sentiment analysis	Applying(K3)
CO5	identifying and apply the techniques of opinion quality, author intention and fake opinions	Applying(K3)

Mapping of COs with POs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		70	30				100
CAT2		55	45				100
CAT3		55	45				100
ESE		60	40				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

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ACADEMIC CELL
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CO: PLO - Kalaivanan

24GET13 - INNOVATION, ENTREPRENEURSHIP AND VENTURE DEVELOPMENT									
(Common to ME/MTech and MCA Programmes)									
Programme & Branch	All ME/MTech and MCA Programmes	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	1/3	PE	45	0	0	45	90	3

Preamble	This course will direct the students on how to employ their innovations towards a successful entrepreneurial venture development.	
Unit – I	**Innovation, Entrepreneurship and Design Thinking:**	9
Creativity and Innovation – Types of innovation – challenges in innovation- steps in innovation management- Meaning and concept of entrepreneurship - Role of Entrepreneurship in Economic Development - Factors affecting Entrepreneurship – Entrepreneurship vs Intrapreneurship. Design Thinking and Entrepreneurship – Design Thinking Stages: Empathize – Define – Ideate – Prototype – Test. Design thinking tools: Analogies – Brainstorming – Mind mapping.		
Unit – II	**Product Design:**	9
Techniques and tools for concept generation, concept evaluation – Product architecture –Minimum Viable Product (MVP)- Product prototyping – tools and techniques– overview of processes and materials – evaluation tools and techniques for user-product interaction.		
Unit – III	**Business Model Canvas (BMC) and Business Plan Preparation:**	9
Lean Canvas and BMC - difference and building blocks- BMC: Patterns – Design – Strategy – Process–Business model failures: Reasons and remedies. Objectives of a Business Plan - Business Planning Process and Preparation.		
Unit – IV	**IPR and Commercialization:**	9
Need for Intellectual Property- Basic concepts - Different Types of IPs: Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design– Patent Licensing - Technology Commercialization – Innovation Marketing.		
Unit – V	**Venture Planning and Means of Finance:**	9
Startup Stages - Forms of Business Ownership - Sources of Finance – Idea Grant – Seed Fund – Angel & Venture Fund – Institutional Support to Entrepreneurs – Bank and Institutional Finance to Entrepreneurs.		

REFERENCES:

1. E. Gordon & K. Natarajan., "Entrepreneurship Development", 6th Edition, Himalaya Publishing House, Mumbai, 2017.
2. Sangeeta Sharma, "Entrepreneurship Development", 1st Edition, PHI Learning Pvt. Ltd., New Delhi, 2017.
3. Charantimath Poornima M., "Entrepreneurship Development and Small Business Enterprises", 3rd Edition, Pearson Education, Noida, 2018.
4. Robert D. Hisrich, Michael P. Peters & Dean A. Shepherd, "Entrepreneurship", 10th Edition, McGraw Hill, Noida, 2018.

*includes Term Work(TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand the relationship between innovation and entrepreneurship	Understanding (K2)
CO2	understand and employ design thinking process during product design and development	Analyzing (K4)
CO3	develop suitable business models as per the requirement of the customers	Analyzing (K4)
CO4	practice the procedures for protection of their ideas IPR	Applying (K3)
CO5	understand and plan for suitable type of venture and modes of finances	Applying (K3)

Mapping of COs with POs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1				3	2	1	3	2	1	1	
CO2	1	2			3	2	1					1	
CO3	3	1	3			1						1	
CO4	1	2				3						1	
CO5	1	2				3						1	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		80	20				100
CAT2		50	50				100
CAT3		80	20				100
ESE		70	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

R. Oomyf.

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Board of Studies · Technology