SRI SHANMUGHA COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

Pullipalayam, Morur (Po.), Sankari (Tk.),
Salem (Dt.) - 637 304.

M.E.

COMPUTER SCIENCE AND ENGINEERING

CURRICULUM

CHOICE BASED CREDIT SYSTEM

REGULATIONS 2023

SRI SHANMUGHA COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Approved by AICTE, Affiliated to Anna University,
Accredited by NAAC, NBA (ECE/CSE/MECH) and ISO 9001:2015 Certified
Pullipalayam, Sankari, Salem (Dt.)

CURRICULUM & FIRST YEAR SYLLABI

CHOICE BASED CREDIT SYSTEM

M.E. COMPUTER SCIENCE AND ENGINEERING

REGULATIONS 2023

CHAIRMAN-BOARD OF STUDIES

Passed in Board of studies Meeting on 26.10.2023

Approved in Academic Council Meeting on 07.11.2023

Department of Computer Science and Engineering

Institute Vision

To be an institute of repute in all fields of education by implementing the best practices akin to global standards for fostering domain knowledge and developing research attitude among students to make them globally competent

Institute Mission

- Achieving excellence in Teaching & Learning process using state-of-the-art resources
- Extending opportunity to upgrade faculty knowledge and skills
- Implementing the best student training practices for requirements of the industrial scenario of the state
- Motivating faculty and students in research activity for real time application

Vision of the Department

To create the holistic environment for the development of Computer Science and Engineering Graduates employable at the global level and to mold them through comprehensive educational programs and quality research for developing their competency and innovation with moral values

Mission of the Department

M1 Ensuring academic growth by way of establishing centers of excellence and promoting collaborative learning.

M2 Promoting research-based projects in emerging technologies for the benefit of students and faculty.

Program Educational Outcomes (PEOs)

To enable the graduates of the M.E. Computer Science and Engineering of SSCET,

PEO1 To apply the principles and practices of Computer Science and Engineering encompassing Mathematics, Science and Basic Engineering and to employ the modern engineering tools effectively in their profession with their world class technical competence.

PEO2 To excel in the field of software industry or in higher studies endowed with the spirit of Innovation and entrepreneurship by evolving their professional knowledge on a lifelong basis.

PEO3 To practice the profession with ethics, integrity, leadership and social responsibility with a good insight of the changing societal needs for the benefit of humanity.

Program Outcomes (POs)

PO1 An ability to independently carry out research / investigation and development work to solve practical problems.

PO2 An ability to write and present a substantial technical report/document.

PO3 Able to demonstrate a degree of mastery over the area of Computer Science and Engineering.

PO4 Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms.

PO5 Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional development in computer and automation arenas.

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PO6 Model a computer-based automation system and design algorithms that explore the understanding of the tradeoffs involved in digital transformation.

Program Specific Outcomes (PSOs)

PSO1- To design, analyze, apply & develop cutting edge technological solutions for real time problems by applying the core concepts of Computer Science and Engineering.

PSO2- To apply, analyze and employ cutting edge technologies, core engineering principles and practices to create innovative research ideas for scientific and business applications of Computer Science and Engineering society and Industry

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M.E. COMPUTER SCIENCE AND ENGINEERING

REGULATIONS 2023

CHOICE BASED CREDIT SYSTEM

CURRICULUM

I SEMESTER									
Course Code	Course Title	Category	Periods / Week			C	Max Marks		
			L	T	P		CIA	ESE	Total
Theory Course(s)									
23PMA201	Applied Probability and Statistics	FC	4	0	0	4	40	60	100
23PCS101	Research Methodologies and IPR	HSC	3	0	0	3	40	60	100
23PCS301	Advanced Computer Architecture	PCC	3	0	0	3	40	60	100
23PCS302	Advanced Data Structures and Algorithms	PCC	4	0	0	4	40	60	100
23PCS303	Advanced Software Engineering	PCC	3	0	0	3	40	60	100
23PCS304	Machine Learning Techniques	PCC	3	0	0	3	40	60	100
Practical Course(s)									
23PCS305	Advanced Data Structures Laboratory	PCC	0	0	4	2	60	40	100
23PCS501	Personality Development	EEC	0	0	2	1	60	40	100
TOTAL			**20**	**0**	**6**	**23**	**360**	**440**	**800**

II SEMESTER									
Course Code	Course Title	Category	Periods / Week			C	Max Marks		
			L	T	P		CIA	ESE	Total
Theory Course(s)									
23PCS306	Big Data Analytics	PCC	3	0	0	3	40	60	100
23PCS307	Network Design and Technologies	PCC	3	0	0	3	40	60	100
23PCSXXX	Professional Elective - I	PEC	3	0	0	3	40	60	100

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23PCSXXX	Professional Elective - II	PEC	3	0	0	3	40	60	100
Theory with Practical Course(s)									
23PCS308	Advanced Database Systems	PCC	3	0	2	3	50	50	100
23PCS309	Deep Learning using Python	PCC	3	0	2	3	50	50	100
Practical Course(s)									
23PCS310	Data Analytics Laboratory	PCC	0	0	4	2	60	40	100
23PCS502	Term paper Writing and Seminar	EEC	0	0	2	1	60	40	100
Total			**18**	**0**	**10**	**23**	**380**	**420**	**800**

III SEMESTER

Course Code	Course Title	Category	Periods / Week			C	Max. Marks		
			L	T	P		CIA	ESE	Total
Theory Course(s)									
23PCSXXX	Professional Elective – III	PEC	3	0	0	3	40	60	100
23PCSXXX	Professional Elective – IV	PEC	3	0	0	3	40	60	100
23PCSXXX	Professional Elective - V	PEC	3	0	0	3	40	60	100
23PCSXXX	Open Elective	OEC	3	0	0	3	40	60	100
Practical Course(s)									
23PCS503	Project Work Phase - I	EEC	0	0	12	6	60	40	100
TOTAL			**12**	**0**	**12**	**18**	**220**	**280**	**500**

IV SEMESTER

Course Code	Course	Category	Periods / Week			C	Max. Marks		
			L	T	P		CIA	ESE	Total
Practical Course(s)									
23PCS503	Project Work Phase - II	EEC	0	0	24	12	60	40	100
Total			**0**	**0**	**24**	**12**	**60**	**40**	**100**

Total - 76 Credits

PROFESSIONAL ELECTIVES COURSES (PECs)

Semester - II

Course Code.	Course	Category	Periods / Week	C	Max. Marks

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			L	T	P		CIA	ESE	Total
23PCS401	Knowledge Engineering	PEC	3	0	0	3	40	60	100
23PCS402	Blockchain Technologies	PEC	3	0	0	3	40	60	100
23PCS403	Mobile Computing	PEC	3	0	0	3	40	60	100
23PCS404	Image Processing and Computer Vision	PEC	3	0	0	3	40	60	100
23PCS405	Cyber Security and Ethical Hacking	PEC	3	0	0	3	40	60	100
23PCS406	Natural Language Processing	PEC	3	0	0	3	40	60	100
23PCS407	Ad hoc and Wireless Sensor Networks	PEC	3	0	0	3	40	60	100
23PCS408	Internet of Things	PEC	3	0	0	3	40	60	100
23PCS409	Distributed and Cloud Computing	PEC	3	0	0	3	40	60	100
23PCS410	Ontology and Semantic Web	PEC	3	0	0	3	40	60	100
Semester III									
23PCS411	Video Analytics	PEC	3	0	0	3	40	60	100
23PCS412	Data Exploration and Visualization	PEC	3	0	0	3	40	60	100
23PCS413	Cyber Forensics	PEC	3	0	0	3	40	60	100
23PCS414	Intelligent Agent Systems	PEC	3	0	0	3	40	60	100
23PCS415	Social Network Analysis	PEC	3	0	0	3	40	60	100
23PCS416	Software Reliability Metrics and Models	PEC	3	0	0	3	40	60	100
23PCS417	High Performance Computing	PEC	3	0	0	3	40	60	100
23PCS418	Statistical Learning Theory	PEC	3	0	0	3	40	60	100
23PCS419	Intelligent Robots	PEC	3	0	0	3	40	60	100
23PCS420	UAV and Drone Technology	PEC	3	0	0	3	40	60	100
23PCS421	Queuing and Reliability Modelling	PEC	3	0	0	3	40	60	100
23PCS422	Computational Intelligence	PEC	3	0	0	3	40	60	100
23PCS423	Quantum Computing	PEC	3	0	0	3	40	60	100
23PCS424	Reinforcement Learning	PEC	3	0	0	3	40	60	100
23PCS425	Optimization Algorithms	PEC	3	0	0	3	40	60	100

OPEN ELECTIVE COURSES (For Other M.E. / M. Tech. Programmes)

Course Code	Course Title	Category	Periods / Week			C	Max. Marks		
			L	T	P		CIA	ESE	Total
23PCS601	Fundamentals of Database Systems	OEC	3	0	0	3	40	60	100
23PCS602	Android Application Development	OEC	3	0	0	3	40	60	100
23PCS603	Foundation of IoT & Its Applications	OEC	3	0	0	3	40	60	100

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SUMMARY

S. No	Semester	Category						Total Credits (SSCET)	Total Credits (Anna University)	Total Credits (AICTE)
		FC	HSC	PCC	PEC	OEC	EEC			
1.	I	4	3	15			1	23	21	18
2.	II			16	6		1	23	23	18
3.	III				9	3	6	18	19	16
4.	IV						12	12	12	16
Total Credits		4	3	31	15	3	20	76	75	68

HSC - Humanities and Social Sciences

FC - Foundation Course

PCC - Professional Core Course

PEC - Professional Elective Course

OEC - Open Elective Course

EEC - Employability Enhancement Courses

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Approved in Academic Council Meeting on 07.11.2023

SUMMARY

S. No	Semester	Category						Total Credits (BSCET)	Total Credits (Anna University)	Total Credits (AICTE)
		FC	HSC	PCC	PEC	OEC	EEC			
1.	I	4	3	16			1	23	21	16
2.	II			16	6		1	23	23	16
3.	III				9	13	6	28	19	16
4.	IV						12	12	12	16
Total Credits		4	3	32	15	13	20	76	75	64

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I SEMESTER

23PMA201	PROBABILITY AND STATISTICAL METHODS	L	T	P	C
		4	0	0	4

Course Objectives

The course is intended to make the students to

- To provide students with basic concepts of probability theory.
- To provide the most appropriate estimator of the parameter in statistical inference.
- To decide whether to accept or reject a specific value of a parameters.
- To avoid or at least to minimize, the problems of estimating the effects of the independent variable by experimental designs.
- To learn methods for analyzing time series data to extract meaningful statistical characteristic of data.

Course Outcomes

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Basic probability axioms and rules and the moments of discrete and continuous random variables.	Understand
CO 2	Least squares, correlation, regression, consistency, efficiency and unbiasedness of estimators, method of maximum likelihood estimation and Central Limit Theorem.	Understand
CO 3	Use statistical tests in testing hypotheses on data.	Apply
CO 4	List the guidelines for designing experiments and recognize the key historical figures in Design of Experiments.	Apply
CO 5	Differentiate between various time series models and application of these models appropriately to engineering problems.	Analyze

Course Contents

Unit – I	PROBABILITY AND RANDOM VARIABLES	12

Probability – Axioms of probability – Conditional probability – Baye's theorem - Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

Unit – II	ESTIMATION THEORY	12

Principle of least squares – Regression – Multiple and partial correlations – Estimation of parameters – Maximum likelihood estimates – Method of moments.

Unit – III	TESTING OF HYPOTHESIS	12

Sampling distributions – Small and large samples and problems – Tests based on Normal, t - distribution, Chi - square, Goodness of fit and F – distributions.

Unit – IV	DESIGN OF EXPERIMENTS	12

Analysis of variance – Completely randomized design – Randomized block design – Latin square design – 2^2 Factorial designs.

Unit – V	TIME SERIES	12

Characteristics and representation – Moving averages – Exponential smoothing – Auto regressive processes.

Total : 60 Hours

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Reference Books

1. Anderson, O.D, "Time Series Analysis: Theory and Practice", North - Holland, Amsterdam, 1982.
2. Devore, J. L., "Probability and Statistics for Engineering and Sciences", 9th Edition, Cengage Learning, 2016.
3. Gupta S.C. and Kapoor V.K.," Fundamentals of Mathematical Statistics",12th Edition, Sultan and Sons, New Delhi, 2020.
4. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers, 9th Edition, Pearson Education, Asia, 2016.
5. Montgomery D.C and Johnson, L.A, "Forecasting and Time Series", 6th Edition, McGraw Hill, 1990.

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Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs						PSO	
	1	2	3	4	5	6	1	2
CO 1	3	3	3	3	2	-	2	2
CO 2	3	3	3	3	2	-	2	2
CO 3	3	3	3	3	2	-	2	2
CO 4	2	2	-	2	2	-	2	2
CO 5	3	2	-	-	2	-	2	2
Average	**2**	**3**	**3**	**3**	**2**	-	**2**	**2**

3– High 2 – Medium 1 – Low '-" - No Correlation

Assessment Components	Duration	Syllabus to be covered	Max. Marks	Weightage for Internal Marks	Continuous Internal Assessment Marks	End Semester Examination Marks*
CIA I	3 hours	2.5 units	100	12	24	60
CIA II	3 hours	2.5 units	100	12		
Objective Test / Online Quiz, Assignment / Case study Seminar / Tutorial, Role Play, Poster Presentation, Group Discussions, Oral Presentation, Mini Project etc., (8 marks during CIA I and 8 marks during CIA II)					16	
				Total	**40**	**60**

23PCS101	RESEARCH METHODOLOGIES AND IPR	L	T	P	C
		3	0	0	3
Category	Humanities and Social Sciences				
Pre requisites	Nil				

Course Objectives

The course is intended to

- Understand basic concepts employed in quantitative and qualitative research methods.
- solve the research problems in a systematic approach.

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- Apply statistical methods for data collection.
- Understand the concepts of report writing.
- Introduce fundamental aspects of IPR to future developers and managers of innovative projects in industries.

Course Outcomes (COs)

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Outline the basic concepts employed in quantitative and qualitative research methods.	Understand
CO 2	Make use of research problems and design.	Apply
CO 3	Apply statistical methods to collect data and do literature surveys.	Apply
CO 4	Write a quality research paper.	Apply
CO 5	Highlight the current trends in IPR and Govt. steps in fostering IPR	Apply

Course Contents

Unit – I	**RESEARCH METHODOLOGY**	**9**

Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India. Introduction to internet, Use of Internet & www, using search engines using advanced search tools

Unit – II	**RESEARCH PROBLEM AND RESEARCH METHODOLOGY**	**9**

Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. Uses of literature review, Source of information, Organization of information on index cards.

Unit – III	**DESIGN OF SAMPLE SURVEYS AND DATA PATTERN EVALUATION**	**9**

Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Data Preprocessing – Feature Extraction – Classification – Decision Making - Case Study Method.

Unit – IV	**INTERPRETATION AND REPORT WRITING**	**9**

Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. Benchmarking – Process – Types and Examples, Working with LaTeX

Unit – V	**INTELLECTUAL PROPERTY**	**9**

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Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property - IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and international levels – Application Procedures. Case Studies on –Patents (Basmati rice, turmeric, Neem, etc.)

Total : 45 Periods

Text Books

1. C.R. Kothari, Gaurav Garg, "Research Methodology: Methods and Techniques", New Age International, 4th Edition, 2018.
2. Subbaram N.R. "Handbook of Indian Patent Law and Practice", S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.
3. Ranjit Kumar, "Research Methodology a step-by-step guide for beginners". SAGE Publications Ltd, 3rd Edition, 2011

Reference Books

1. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
2. Meredith Zozus, "The Data Book: Collection and Management of Research Data" (Chapman & Hall/CRC , 2017.
3. Wendy Olsen, "Data Collection Key Debates and Methods in Social Research", SAGE Publications Ltd, 2011.
4. Stefan Kottwitz, "LaTeX Beginner's Guide", Packt publishing, 2011.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs						PSO	
	1	2	3	4	5	6	1	2
CO 1	3	3	3	3	2	-	2	2
CO 2	3	3	3	3	2	-	2	2
CO 3	3	3	3	3	2	-	2	2
CO 4	2	2	-	2	2	-	2	2
CO 5	3	2	-	-	2	-	2	2
Average	**2**	**3**	**3**	**3**	**2**	-	**2**	**2**

3– High 2 – Medium 1 – Low '-' - No Correlation

Assessment Components	Duration	Syllabus to be covered	Max. Marks	Weightage for Internal Marks	Continuous Internal Assessment Marks	End Semester Examination Marks*
CIA I	3 hours	2.5 units	100	12	24	60
CIA II	3 hours	2.5 units	100	12		
Objective Test / Online Quiz, Assignment / Case study Seminar / Tutorial, Role Play, Poster Presentation, Group Discussions, Oral Presentation, Mini Project etc., (8 marks during CIA I and 8 marks during CIA II)					16	
				Total	**40**	**60**

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23PCS301	ADVANCED COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3
Category	Program Core				
Pre requisites	Nil				

Course Objectives

The course is intended to

- Understand and analyze performance related parameters and Instruction Level Parallelism.
- Understand the design of the memory hierarchy.
- Learn the different multiprocessor issues.
- Expose the different types of multicore architectures.
- Explain vector, SIMD and GPU architectures

Course Outcomes (COs)

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Discuss the performance related parameters and Instruction Level Parallelism.	Understand
CO 2	Discuss the memory hierarchy design and optimization techniques for cache performance	Understand
CO 3	Interpret various issues of multiprocessor.	Apply
CO 4	Point out the salient features of different multicore architectures and how they exploit parallelism.	Apply
CO 5	Make use of vector, SIMD and GPU architectures.	Apply

Course Contents

Unit – I	FUNDAMENTALS OF COMPUTER DESIGN AND ILP	9

Fundamentals of Computer Design – Measuring and Reporting Performance – Instruction Level Parallelism and its Exploitation – Concepts and Challenges –Exposing ILP - Advanced Branch Prediction- Dynamic Scheduling - Hardware-Based Speculation - Exploiting ILP - Instruction Delivery and Speculation - Limitations of ILP – Multithreading

Unit – II	MEMORY HIERARCHY DESIGN	9

Introduction – Optimizations of Cache Performance – Memory Technology and Optimizations –Protection: Virtual Memory and Virtual Machines – Design of Memory Hierarchies – Case Studies.

Unit – III	MULTIPROCESSOR ISSUES	9

Introduction- Centralized, Symmetric and Distributed Shared Memory Architectures –Cache Coherence Issues – Performance Issues – Synchronization – Models of Memory Consistency – Case Study Interconnection Networks – Buses, Crossbar and Multi-stage Interconnection Networks.

Unit – IV	MULTICORE ARCHITECTURES	9

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Homogeneous and Heterogeneous Multi-core Architectures – Intel Multicore Architectures – SUN CMP architecture – IBM Cell Architecture. Introduction to Warehouse-scale computers- Architectures Physical Infrastructure and Costs- Cloud Computing –Case Study- Google Warehouse-Scale Computer.		
Unit – V	**VECTOR, SIMD AND GPU ARCHITECTURES**	**9**
Introduction-Vector Architecture – SIMD Extensions for Multimedia – Graphics Processing Units –Case Studies – GPGPU Computing – Detecting and Enhancing Loop Level Parallelism-Case Studies		
		Total : 45 Periods

Text Books

1. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier, 6th edition, 2019.
2. Darryl Gove, "Multicore Application Programming: For Windows, Linux, and Oracle Solaris", Pearson, 2011.
3. David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors", Morgan Kauffman, 3rd Edition 2016.

Reference Books

1. David E. Culler, Jaswinder Pal Singh, "Parallel computing architecture: A hardware / software approach", Morgan Kaufmann /Elsevier Publishers, 2013.
2. Kai Hwang and Zhi.Wei Xu, "Scalable Parallel Computing", Tata McGraw Hill, New Delhi, 2003.
3. Czarnul, Pawel, Chapman & Hall, "Parallel programming for modern high performance computing systems", CRC, 2018.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs						PSO	
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**
CO 1	3	3	3	3	2	-	2	2
CO 2	3	3	3	3	2	-	2	2
CO 3	3	3	3	3	2	-	2	2
CO 4	2	2	-	2	2	-	2	2
CO 5	3	2	-	-	2	-	2	2
Average	**2**	**3**	**3**	**3**	**2**	-	**2**	**2**

3– High 2 – Medium 1 – Low '-" - No Correlation

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Assessment Components	Duration	Syllabus to be covered	Max. Marks	Weightage for Internal Marks	Continuous Internal Assessment Marks	End Semester Examination Marks*
CIA I	3 hours	2.5 units	100	12	24	60
CIA II	3 hours	2.5 units	100	12		
Objective Test / Online Quiz, Assignment / Case study Seminar / Tutorial, Role Play, Poster Presentation, Group Discussions, Oral Presentation, Mini Project etc., (8 marks during CIA I and 8 marks during CIA II)					16	
				Total	**40**	**60**

23PCS302	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		4	0	0	4
Category	Program Core				
Pre requisites	Nil				

Course Objectives

The course is intended to

- Understand the usage of algorithms in computing.
- Learn and use hierarchical data structures and its operations
- Learn the usage of graphs and its applications.
- Select and design data structures and algorithms that are appropriate for problems.
- Study about NP Completeness of problems.

Course Outcomes (COs)

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Discuss the complexity of algorithms in computing problems.	Understand
CO 2	Apply hierarchical data structures for various applications.	Apply
CO 3	Design algorithms using graph data structure to solve real-life problems.	Apply
CO 4	Apply suitable design strategy for problem solving.	Apply
CO 5	Analyze NP Complete problems	Analyze

Course Contents

Unit – I	ROLE OF ALGORITHMS IN COMPUTING	9

Algorithms – Algorithms as a Technology- Insertion Sort – Analyzing Algorithms – Designing Algorithms- Growth of Functions: Asymptotic Notation – Standard Notations and Common Functions- Recurrences: The Substitution Method – The Recursion-Tree Method.

Unit – II	HIERARCHICAL DATA STRUCTURES	9

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Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red-Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of Btrees – Basic operations on B-Trees – Deleting a key from a B-Tree- Fibonacci Heaps: structure –Mergeable-heap operations- Decreasing a key and deleting a node-Bounding the maximum degree

Unit – III	**GRAPHS**	**9**

Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components- Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra's Algorithm; AllPairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd- Warshall Algorithm

Unit – IV	**ALGORITHM DESIGN TECHNIQUES**	**9**

Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: An Activity-Selection Problem – Elements of the Greedy Strategy- Huffman Codes

Unit – V	**NP COMPLETE AND NP HARD**	**9**

NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducibility – NP-Completeness Proofs – NP-Complete Problems

Total : 45 Periods

Text Books

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, Prentice-Hall, 2011.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3. Robert Sedgewick and Kevin Wayne, "ALGORITHMS", Fourth Edition, Pearson Education, 2016.

Reference Books

1. S.Sridhar, "Design and Analysis of Algorithms", First Edition, Oxford University Press.2014.
2. Jean-Paul Tremblay and Paul Sorenson, "An Introduction to Data Structures with Application", McGraw-Hill, 2017.
3. Soltys, Michael, "An introduction to the analysis of algorithms", World Scientific, 2018.
4. Sandeep Sen, Amit Kumar, "Design and Analysis of Algorithms. A contemporary Perspective", Cambridge University Press, 2019..

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs						PSO	
	1	2	3	4	5	6	1	2
CO 1	3	3	3	3	2	-	2	2
CO 2	3	3	3	3	2	-	2	2
CO 3	3	3	3	3	2	-	2	2
CO 4	2	2	-	2	2	-	2	2
CO 5	3	2	-	-	2	-	2	2
Average	**2**	**3**	**3**	**3**	**2**		**2**	**2**

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3– High 2 – Medium 1 – Low '-" - No Correlation

Assessment Components	Duration	Syllabus to be covered	Max. Marks	Weightage for Internal Marks	Continuous Internal Assessment Marks	End Semester Examination Marks*
CIA I	3 hours	2.5 units	100	12	24	60
CIA II	3 hours	2.5 units	100	12		
Objective Test / Online Quiz, Assignment / Case study Seminar / Tutorial, Role Play, Poster Presentation, Group Discussions, Oral Presentation, Mini Project etc., (8 marks during CIA I and 8 marks during CIA II)					16	
				Total	**40**	**60**

23PCS303	ADVANCED SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3
Category	Program Core				
Pre requisites	Nil				

Course Objectives

The course is intended to

- Understand Software process models.
- Gain knowledge of the system design concepts.
- Understand software testing approaches.
- Do project management and cost estimation.
- Be familiar with DevOps practices.

Course Outcomes (COs)

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Understand the advantages of various software process models.	Understand
CO 2	Architect and design using architectural styles and design patterns.	Apply
CO 3	Apply software testing approaches.	Apply
CO 4	Gain knowledge on project management approaches as well as cost and schedule estimation strategies.	Apply
CO 5	Automate the different stages of the software delivery pipeline/workflow using DevOps.	Analyze

Course Contents

Unit – I	PROCESS MODELS AND REQUIREMENTS MODELING	9

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Prescriptive process models–Specialized process models–The unified process–personal and team process models–Product and Process–Agile development–Extreme Programming–Other Agile process models–Human aspects of Software Engineering. Understanding Requirements–Scenario based methods–Class Based Methods – Behavior, Patterns and Web/Mobile Apps.		
Unit – II	**SOFTWARE DESIGN**	**9**
The design process–Design concepts–The Design model - Architectural design – Component level Design - Object-oriented design using the UML – User Interface Design–Pattern based design–Web App design–Mobile App design.		
Unit – III	**SOFTWARE TESTING AND SOFTWARE CONFIGURATION MANAGEMENT**	**9**
Software Testing Strategies–Testing Conventional Applications–Testing Object Oriented Applications–Testing Web applications–Testing Mobile Apps–Software Configuration management – The SCM process–Configuration Management for Web and Mobile App.		
Unit – IV	**MANAGING SOFTWARE PROJECTS**	**9**
Project Management Concepts – Software and Project Metrics – Estimation of Software projects – Project Scheduling: PERT/CPM, Time-line Charts – Risk Management – Maintenance and Reengineering		
Unit – V	**IMPLEMENTATION PLATFORM**	**9**
DevOps: Motivation-Cloud as a platform-Operations- Deployment Pipeline: Overall Architecture - Building and Testing – Deployment - Case study: Migrating to Microservices.		
		Total : 45 Periods

Text Books

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", MCGraw Hill, 8th edition, 2019.
2. Ian Sommerville, "Software Engineering", 10th Edition, Pearson Education Asia, 2015.
3. Len Bass, Ingo Weber and Liming Zhu, — "DevOps: A Software Architect's Perspective", Pearson Education, 2016

Reference Books

1. Bernd Bruegge, Alan H Dutoit, "Object-Oriented Software Engineering", 3rd edition, Pearson Education, 2014.
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, "Fundamentals of Software Engineering", 2nd edition, PHI Learning Pvt. Ltd., 2010.
3. Craig Larman, "Applying UML and Patterns", 3rd edition, Pearson Education, 2005.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs						PSO	
	1	2	3	4	5	6	1	2
CO 1	3	3	3	3	2	-	2	2
CO 2	3	3	3	3	2	-	2	2
CO 3	3	3	3	3	2	-	2	2
CO 4	2	2	-	2	2	-	2	2
CO 5	3	2	-	-	2	-	2	2
Average	**2**	**3**	**3**	**3**	**2**	-	**2**	**2**

CHAIRMAN-BOARD OF STUDIES

3– High 2 – Medium 1 – Low '-" - No Correlation

Assessment Components	Duration	Syllabus to be covered	Max. Marks	Weightage for Internal Marks	Continuous Internal Assessment Marks	End Semester Examination Marks*
CIA I	3 hours	2.5 units	100	12	24	60
CIA II	3 hours	2.5 units	100	12		
Objective Test / Online Quiz, Assignment / Case study Seminar / Tutorial, Role Play, Poster Presentation, Group Discussions, Oral Presentation, Mini Project etc., (8 marks during CIA I and 8 marks during CIA II)					16	
				Total	**40**	**60**

23PCS304	MACHINE LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3
Category	Program Core				
Pre requisites	Nil				

Course Objectives

The course is intended to

- Introduce students to the basic concepts and techniques of Machine Learning.
- Understanding of the linear models.
- Study the various probability-based learning techniques.
- Understand graphical models of machine learning algorithms.
- Gain knowledge on deep learning.

Course Outcomes (COs)

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem.	Understand
CO 2	Apply the appropriate linear models for any given problem.	Apply
CO 3	Understand the foundation of probabilistic models and apply unsupervised algorithms for clustering.	Apply
CO 4	Select the appropriate graphical models of machine learning.	Apply
CO 5	Apply deep learning algorithms to improve efficiency.	Analyze

Course Contents

Unit – I	INTRODUCTION	9

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept

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Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

Unit – II	LINEAR MODELS	9

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi- layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back- Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

Unit – III	TREE AND PROBABILISTIC MODELS	9

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map.

Unit – IV	DIMENSIONALITY REDUCTION AND GRAPHICAL MODELS	9

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods

Unit – V	DEEP LEARNING	9

Introduction to Deep Learning – AI, ML and DL – Before Deep Learning : a brief history of ML –Gradient-Based Learning – Hidden Units – Architecture Design – Back-Propagation and Other- Differentiation Algorithms – Parameter Norm Penalties – Norm Penalties as Constrained Optimization - Regularization and Under-Constrained Problems – Dataset Augmentation.

Total : 45 Periods

Text Books

1. EthemAlpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning Series)", Third Edition, MIT Press, 2014.
2. Taylor Arnold, Michael Kane, Bryan W Lewis "Computational Approach to Statistical Learning", CRC Press, 2019.
3. Christoph Molnar, "Interpretable Machine Learning - A Guide for Making Black Box Models Explainable", Creative Commons License, 2020.

Reference Books

1 Jason Bell, "Machine Learning – Hands on for Developers and Technical Professionals", Second Edition, Wiley, 2020.
2. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs						PSO	
	1	2	3	4	5	6	1	2
CO 1	3	3	3	3	2	-	2	2

CHAIRMAN-BOARD OF STUDIES

CO 2	3	3	3	3	2	-	2	2
CO 3	3	3	3	3	2	-	2	2
CO 4	2	2	-	2	2	-	2	2
CO 5	3	2	-	-	2	-	2	2
Average	**2**	**3**	**3**	**3**	**2**	-	**2**	**2**

3– High 2 – Medium 1 – Low '-" - No Correlation

Assessment Components	Duration	Syllabus to be covered	Max. Marks	Weightage for Internal Marks	Continuous Internal Assessment Marks	End Semester Examination Marks*
CIA I	3 hours	2.5 units	100	12	24	60
CIA II	3 hours	2.5 units	100	12		
Objective Test / Online Quiz, Assignment / Case study Seminar / Tutorial, Role Play, Poster Presentation, Group Discussions, Oral Presentation, Mini Project etc., (8 marks during CIA I and 8 marks during CIA II)					16	
				Total	**40**	**60**

23CS305	**ADVANCED DATA STRUCTURES LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**
Category	**Program Core**				
Pre requisites	NIl				

Course Objectives

The course is intended to

- Implement and analyze the Sorting techniques.
- Acquire the knowledge of using advanced tree structures.
- Learn the usage of heap structures.
- Understand the usage of graph structures and spanning trees.
- Apply algorithmic design techniques to solve real world problems

Course Outcomes (COs)

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Design and analyze Sorting techniques.	Apply
CO 2	Design and implement advanced tree structures.	Apply
CO 3	Design and develop programs using heap structures.	Apply
CO 4	Implement algorithms of graph structures and spanning trees.	Apply
CO 5	Design and develop efficient algorithms with minimum complexity using design techniques.	Apply

CHAIRMAN-BOARD OF STUDIES

S.No	List of Exercises	CO	Bloom's Level
1.	Implementation of Merge Sort and Quick Sort-Analysis	CO 1	Apply
2.	Implementation of a Binary Search Tree	CO 2	Apply
3.	Red-Black Tree Implementation	CO 2	Apply
4.	Heap Implementation	CO 3	Apply
5.	Fibonacci Heap Implementation	CO 3	Apply
6.	Graph Traversals	CO 4	Apply
7.	Spanning Tree Implementation	CO 4	Apply
8.	Shortest Path Algorithms (Dijkstra's algorithm, Bellmann Ford Algorithm)	CO 4	Apply
9.	Implementation of Matrix Chain Multiplication	CO 4	Apply
10.	Activity Selection and Huffman Coding Implementation	CO 5	Apply
			Total : 45 Periods

Reference Books

1. Manual-prepared by SSCET

Additional / Web References

1. http://nptel.ac.in/courses/112104113/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs						PSO	
	1	2	3	4	5	6	1	2
CO 1	3	3	3	3	2	-	2	2
CO 2	3	3	3	3	2	-	2	2
CO 3	3	3	3	3	2	-	2	2
CO 4	2	2	-	2	2	-	2	2
CO 5	3	2	-	-	2	-	2	2
Average	**2**	**3**	**3**	**3**	**2**	-	**2**	**2**

3– High 2 – Medium 1 – Low '-" - No Correlation

CHAIRMAN-BOARD OF STUDIES

S. No.	Assessment Method	Max. Marks	Weightage for Internal Marks	Continuous Internal Assessment Marks	End Semester Examination Marks
1	Observation, Analysis of Experimental results & Record, Viva-voce based on rubrics.	100	75	45	40
2	Model Examination	100	25	15	
			Total	**60**	**40**

23PCS501	PERSONALITY DEVELOPMENT	L	T	P	C
		0	0	2	1
Category	**Employability Enhancement**				
Pre requisites	Nil				

Course Objectives

The course is intended to

- Understand the role of personality development.
- Understand the importance of attitude in human life.
- Understand the importance of self-esteem in personality development
- Learn body language aspects
- Gain knowledge on employability skills

Course Outcomes (COs)

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Understand the dimensions of personality development	Understand
CO 2	Understand the significance of motivation and attitude	Understand
CO 3	Analyze positive and negative self-esteem approaches.	Apply
CO 4	Perform analytics on real-time problems	Apply
CO 5	gain knowledge on human employability skills	Understand

Course Contents

Unit – I	INTRODUCTION TO PERSONALITY DEVELOPMENT	9

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

CHAIRMAN-BOARD OF STUDIES

Unit – II	ATTITUDE & MOTIVATION	9
Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude – Advantages –Negative attitude- Disadvantages - Ways to develop positive attitude - Differences between personalities having positive and negative attitude. Concept of motivation - Significance – Internal and external motives - Importance of self- motivation- Factors leading to de-motivation		
Unit – III	**SELF-ESTEEM**	**9**
Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self-esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours – Lateral thinking.		
Unit – IV	**OTHER ASPECTS OF PERSONALITY DEVELOPMENT**	**9**
Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work – Time management - Work ethics –Good manners and etiquette.		
Unit – V	**EMPLOYABILITY QUOTIENT**	**9**
Resume building- The art of participating in Group Discussion – Facing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions		
		Total : 45 Periods

Text Books

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge(2014), Organizational Behavior 16th Edition: Prentice Hall.

Reference Books

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
2. Heller, Robert.Effective leadership. Essential Manager series. Dk Publishing, 2002
3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs						PSO	
	1	2	3	4	5	6	1	2
CO 1	3	3	3	3	2	-	2	2
CO 2	3	3	3	3	2	-	2	2
CO 3	3	3	3	3	2	-	2	2
CO 4	2	2	-	2	2	-	2	2
CO 5	3	2	-	-	2	-	2	2
Average	**2**	**3**	**3**	**3**	**2**	-	**2**	**2**

3– High 2 – Medium 1 – Low '-' - No Correlation

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S. No.	Assessment Method	Max. Marks	Weightage for Internal Marks	Continuous Internal Assessment Marks	End Semester Examination Marks
1	Observation, Analysis of Experimental results & Record, Viva-voce based on rubrics.	100	75	45	40
2	Model Examination	100	25	15	
			Total	60	40

II SEMESTER

23PCS306	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3
Category	Program Core				
Pre requisites	Nil				

Course Objectives

The course is intended to

- Understand the competitive advantages of big data analytics.
- Understand the hadoop framework.
- Learn data analysis methods.
- Learn stream computing.
- Gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

Course Outcomes (COs)

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Understand how to leverage the insights from big data analytics.	Understand
CO 2	Use Hadoop framework.	Apply
CO 3	Analyze data by utilizing various statistical and data mining approaches.	Apply
CO 4	Perform analytics on real-time streaming data.	Apply
CO 5	gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data	Analyze

Course Contents

Unit – I	INTRODUCTION	9

CHAIRMAN-BOARD OF STUDIES

S. No.	Assessment Method	Max. Marks	Weightage for Internal Marks	Continuous Internal Assessment Marks	End Semester Examination Marks
1	Observation, Analysis of Experimental results & Record, Viva-voce based on rubrics.	100	75	45	40
2	Model Examination	100	25	15	
			Total	60	40

II SEMESTER

23PCS306	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3
Category	Program Core				
Pre requisites	Nil				

Course Objectives

The course is intended to

- Understand the competitive advantages of big data analytics.
- Understand the hadoop framework.
- Learn data analysis methods.
- Learn stream computing.
- Gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

Course Outcomes (COs)

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Understand how to leverage the insights from big data analytics.	Understand
CO 2	Use Hadoop framework.	Apply
CO 3	Analyze data by utilizing various statistical and data mining approaches.	Apply
CO 4	Perform analytics on real-time streaming data.	Apply
CO 5	gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data	Analyze

Course Contents

Unit – I	INTRODUCTION	9

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Big Data – Definition, Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems - Web Data – Evolution Of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis vs Reporting - Modern Data Analytic Tools

Unit – II	**HADOOP FRAMEWORK**	**9**

Distributed File Systems - Large-Scale File System Organization – HDFS concepts - MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication – Hadoop YARN.

Unit – III	**DATA ANALYSIS**	**9**

Statistical Methods: Regression modeling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods,Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data – Predictive Analytics – Exploratory Data analysis - Training a logistic regression classifier - Classification and Regression trees.

Unit – IV	**MINING DATA STREAMS**	**9**

Streams: Concepts – Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams and Mining Time-series data - Real Time Analytics Platform (RTAP) Applications – Social Media Analytics - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions, Big Data processing in cloud.

Unit – V	**BIG DATA FRAMEWORKS**	**9**

Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data Types and File Formats – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries

Total : 45 Periods

Text Books

1. Subhashini Chellappan Seema Acharya, "Big Data and Analytics", 2nd edition, Wiley Publications, 2019.
2. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley and SAS Business Series, 2012.
3. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013

Reference Books

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, Second Edition, 2007.
2. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs						PSO	
	1	2	3	4	5	6	1	2
CO 1	3	3	3	3	2	-	2	2

CHAIRMAN-BOARD OF STUDIES

CO 2	3	3	3	3	2	-	2	2
CO 3	3	3	3	3	2	-	2	2
CO 4	2	2	-	2	2	-	2	2
CO 5	3	2	-	-	2	-	2	2
Average	**2**	**3**	**3**	**3**	**2**	-	**2**	**2**

3– High 2 – Medium 1 – Low '-" - No Correlation

Assessment Components	Duration	Syllabus to be covered	Max. Marks	Weightage for Internal Marks	Continuous Internal Assessment Marks	End Semester Examination Marks*
CIA I	3 hours	2.5 units	100	12	24	60
CIA II	3 hours	2.5 units	100	12		
Objective Test / Online Quiz, Assignment / Case study Seminar / Tutorial, Role Play, Poster Presentation, Group Discussions, Oral Presentation, Mini Project etc., (8 marks during CIA I and 8 marks during CIA II)					16	
				Total	**40**	**60**

23PCS307	**NETWORK DESIGN AND TECHNOLOGIES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Category	Program Core				
Pre requisites	Nil				

Course Objectives

The course is intended to

- Understand the principles required for network design.
- Explore various technologies in the wireless domain.
- Outline various cellular networks.
- Study about 3G and 4G cellular networks.
- Understand the paradigm of Software defined networks

Course Outcomes (COs)

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Design a network at a high-level using different networking technologies.	Apply
CO 2	Analyze the various protocols of wireless networks.	Analyze
CO 3	Analyze the various protocols of cellular networks.	Analyze
CO 4	Discuss the features of 4G and 5G networks.	Apply
CO 5	Experiment with software defined networks	Analyze

Course Contents

CHAIRMAN-BOARD OF STUDIES

Unit – I	NETWORK DESIGN	9

Advanced multiplexing – Code Division Multiplexing, DWDM and OFDM – Shared media networks – Switched networks – End to end semantics – LAN cabling topologies – Ethernet Switches, Routers,Firewalls and L3 switches – Remote Access Technologies and Devices – Modems and DSLs – SLIP and PPP – Core networks, and distribution networks. Design Concepts – Design Process – Network Layout –Design Traceability – Design Metrics – Selecting Technologies and Devices for Campus and Enterprise Networks – Optimizing Network Design

Unit – II	WIRELESS NETWORKS	9

IEEE802.16 and WiMAX – Security – Advanced 802.16 Functionalities – Mobile WiMAX - 802.16e – Network Infrastructure – WLAN – Configuration – Management Operation – Security – IEEE 802.11e and WMM – QoS – Comparison of WLAN and UMTS – Bluetooth – Protocol Stack – Security –Profiles

Unit – III	CELLULAR NETWORKS	9

GSM – Mobility Management and call control – GPRS – Network Elements – Radio Resource Management – Mobility Management and Session Management – Small Screen Web Browsing over GPRS and EDGE – MMS over GPRS – UMTS – Channel Structure on the Air Interface – UTRAN –Core and Radio Network Mobility Management – UMTS Security.

Unit – IV	4G NETWORKS	9

LTE – Network Architecture and Interfaces – FDD Air Interface and Radio Networks – Scheduling –Mobility Management and Power Optimization – LTE Security Architecture – Interconnection with UMTS and GSM – LTE Advanced (3GPPP Release 10) - 4G Networks and Composite Radio Environment – Protocol Boosters – Hybrid 4G Wireless Networks Protocols – Green Wireless Networks – Physical Layer and Multiple Access – Channel Modelling for 4G – Introduction to 5G.

Unit – V	SOFTWARE DEFINED NETWORKS	9

Introduction – Centralized and Distributed Control and Data Planes – OpenFlow – SDN Controllers – General Concepts – VLANs – NVGRE – OpenFlow – Network Overlays – Types
– Virtualization – Data Plane – I/O – Design of SDN Framework

Total : 45 Periods

Text Books

1. James D. McCabe, "Network Analysis, Architecture, and Design", Morgan Kaufmann, Third Edition, 2007. (Unit 1)
2. Priscilla Oppenheimer, "Top-down Network Design: [a Systems Analysis Approach to Enterprise Network Design]", Cisco Press, 3rd Edition, 2011. (Unit 1)
3. Larry Peterson and Bruce Davie, "Computer Networks: A Systems Approach", 5th edition, Morgan.Kauffman, 2018.

Reference Books

1 Erik Dahlman, Stefan Parkvall, Johan Skold, "4G: LTE/LTE-Advanced for Mobile Broadband", Academic Press, 3rd edition 2016.
2. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", Wiley, 2015.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs						PSO	
	1	2	3	4	5	6	1	2
CO 1	3	3	3	3	2	-	2	2

CHAIRMAN-BOARD OF STUDIES

Passed in Board of Studies Meeting on 26.10.2023 *Approved in Academic Council Meeting on 07.11.2023*

CO 2	3	3	3	3	2	-	2	2
CO 3	3	3	3	3	2	-	2	2
CO 4	2	2	-	2	2	-	2	2
CO 5	3	2	-	-	2	-	2	2
Average	**2**	**3**	**3**	**3**	**2**	-	**2**	**2**

3– High 2 – Medium 1 – Low '-" - No Correlation

Assessment Components	**Duration**	**Syllabus to be covered**	**Max. Marks**	**Weightage for Internal Marks**	**Continuous Internal Assessment Marks**	**End Semester Examination Marks***
CIA I	3 hours	2.5 units	100	12	24	60
CIA II	3 hours	2.5 units	100	12		
Objective Test / Online Quiz, Assignment / Case study Seminar / Tutorial, Role Play, Poster Presentation, Group Discussions, Oral Presentation, Mini Project etc., (8 marks during CIA I and 8 marks during CIA II)					16	
				Total	**40**	**60**

23PCS308	**ADVANCED DATABASE SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Category	Program Core				
Pre requisites	Nil				

Course Objectives

The course is intended to

- Understand the basics of Database and the Query Languages.
- Learn and apply Parallel and Object-Oriented Databases in real-world applications.
- Use Distributed and XML Databases.
- Learn and understand Web Databases.
- Use advanced Indexing in emerging database applications.

Course Outcomes (COs)

On successful completion of the course, students will be able to

CO. No	**Course Outcome**	**Bloom's Level**
CO 1	Write queries to retrieve data.	Apply
CO 2	Model and represent the real world data using Object Oriented Database.	Analyze
CO 3	Represent the data using XML database for better interoperability.	Analyze
CO 4	Develop and Deploy Web databases.	Apply
CO 5	Use Advanced Indexing Techniques and apply Block Chaining Concepts	Analyze

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Course Contents		
Unit – I	**INTRODUCTION TO RDMBS AND SQL**	**9**
Significance of Databases - Database System Applications - Advantages and Disadvantages of different Database Management systems - Comparison between DBMS, RDBMS, Distributed and Centralized DB- Relational Query Languages - The SQL Query Language - Querying Multiple Relations – Creating Relations in SQL -, Destroying and Altering Relations - Adding and Deleting Tuples – Integrity Constraints (ICs) - Primary and Candidate Keys in SQL - Foreign Keys, Referential Integrity in SQL Enforcing Referential Integrity, Categories of SQL Commands - DDL - DML - TCL - DCL - Views - Embedded SQL * - Transaction Processing - Consistency and Isolation - Atomicity and Durability - Dynamic SQL		
Unit – II	**PARALLEL DATABASES AND OBJECT ORIENTED DATABASES**	**9**
Parallel Query Evaluation - Parallelizing individual operations - I/O Parallelism - Intra query Parallelism – Intra operation Parallelism - Inter operation Parallelism - Design of Parallel Systems. Object Oriented Paradigm - Introduction to OODBMS - Persistence in OODBMS - Issues in OODBMS - Advantages and Disadvantages of OODBMS - Comparison of ORDBMS and OODBMS - Object Management Group - Object Data Standard ODMG 3.0, 1999 - Object Store.		
Unit – III	**DISTRIBUTED AND XML DATABASES**	**9**
Distributed DBMSs - Concepts and Design : Introduction - Overview of Networking - Functions and Architectures of a DDBMS - Distributed Relational Database Design - Transparencies in a DDBMS - Distributed Transaction Management - Distributed Concurrency Control - Distributed Deadlock Management - Distributed Database Recovery - Distributed Query Optimization. Semi structured Data and XML: Semi structured Data - Introduction to XML - XML-Related Technologies - XML Schema -XML Query Languages - XML and Databases - XML in Oracle.		
Unit – IV	**WEB DATABASES**	**9**
Introduction - jquery – Overview of Ajax – Creating an web Application – Overview of the JSON Web Token No SQL : Azure SQL Database, Azure Cosmos DB, and MongoDB		
Unit – V	**ADVANCED INDEXING TECHNIQUES AND APPLICATION DEVELOPMENT**	**9**
Bloom Filter – Indexing of spatial Data – Hash Indices – Performance Tuning – Distributed Directory Systems – Block Chain Databases – Overview – Properties – Data Management – Performance Enhancement – Emerging Applications		
		Total : 45 Periods

Text Books

1 Henry F Korth, Abraham Silberschatz, S. Sudharshan "Database System Concepts", Seventh Edition, McGraw-Hill Education, March 2019. (Unit I, II, V)
2. Thomas Cannolly and Carolyn Begg, Database Systems, "Database Systems: a practical approach to design, implementation, and management", Sixth Edition, Pearson Education, 2015.
3. David Taniar, Clement H. C. Leung, Wenny Rahayu, Sushant Goel, "High Performance Parallel Database Processing and Grid Databases

Reference Books

1 Bipin Joshi , "Beginning Database Programming Using ASP.NET Core 3", Apress, 2019.
2.C. J. Date, A.Kannan and S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006. (Unit I)

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific

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Outcomes (PSOs)								
COs	POs						PSO	
	1	2	3	4	5	6	1	2
CO 1	3	3	3	3	2	-	2	2
CO 2	3	3	3	3	2	-	2	2
CO 3	3	3	3	3	2	-	2	2
CO 4	2	2	-	2	2	-	2	2
CO 5	3	2	-	-	2	-	2	2
Average	**2**	**3**	**3**	**3**	**2**	-	**2**	**2**

3– High 2 – Medium 1 – Low '-" - No Correlation

Assessment Components	Duration	Syllabus to be covered	Max. Marks	Weightage for Internal Marks	Continuous Internal Assessment Marks	End Semester Examination Marks*
CIA I	3 hours	2.5 units	100	12	24	60
CIA II	3 hours	2.5 units	100	12		
Objective Test / Online Quiz, Assignment / Case study Seminar / Tutorial, Role Play, Poster Presentation, Group Discussions, Oral Presentation, Mini Project etc., (8 marks during CIA I and 8 marks during CIA II)					16	
				Total	**40**	**60**

23PCS309	DEEP LEARNING USING PYTHON	L	T	P	C
		3	0	0	3
Category	Program Core				
Pre requisites	Nil				

Course Objectives

The course is intended to

- Explain the basics of deep neural networks
- Discuss advanced deep learning models
- Apply CNN and RNN architectures of deep neural networks
- Summarize the evaluation metrics for deep learning models
- Apply auto encoders and generative models for suitable applications

Course Outcomes (COs)

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Explain the basic mathematical and conceptual background of deep learning.	Understand

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CO 2	Describe the deep neural network architecture and the optimization.	Understand
CO 3	Apply CNN and RNN and its variants for suitable applications.	Apply
CO 4	Determine performance metrics and evaluate the model.	Apply
CO 5	Apply auto encoders and generative models for suitable applications	Apply

Course Contents

Unit – I	**INTRODUCTION**	**9**

Linear Algebra: Scalars - Vectors - Matrices and tensors; Probability Distributions - Gradient Based Optimization - Machine Learning Basics: Capacity - Over fitting and under fitting - Hyper parameters and validation sets - Estimators - Bias and variance - Stochastic gradient descent - Challenges motivating deep learning;

Unit – II	**DEEP NETWORKS**	**9**

Deep feed forward networks - Learning XOR - Gradient based learning - Hidden Units –Architecture Design – Back Propagation - Regularization – Optimization for Training Deep Models – pure optimization – Challenges – Basic Algorithms – Parameter initialization Strategies – Algorithms with Adaptive Learning Rates – Approximate Second-Order methods –Optimization Strategies and Meta Algorithms

Unit – III	**CONVOLUTIONAL AND RECURRENT NEURAL NETWORKS**	**9**

Convolution Operation – motivation – Pooling – Infinitely Strong prior – Variants – Structured Output – Data Types – Efficient Convolutional Algorithms – Random or Unsupervised features – Neuroscientific Basis - Deep Learning – Sequence Modelling - Computational Graphs – RNN - Bidirectional RNN – Encoder-Decoder - Sequence to Sequence RNN - Deep Recurrent Networks - Recursive Neural Networks -- Long Term Dependencies; Leaky Units – Strategies for multiple time scales – LSTM and Gated RNNs – Optimization

Unit – IV	**MODEL EVALUATION**	**9**

Performance metrics - Baseline Models - Hyperparameters: Manual Hyperparameter - Automatic Hyperparameter - Grid search - Random search - Debugging strategies.

Unit – V	**AUTOENCODERS AND GENERATIVE MODELS**	**9**

Autoencoders: Undercomplete autoencoders -- Regularized autoencoders – Power, Layer Size and Depth - Stochastic encoders and decoders -- Learning with autoencoders – contractive Autoencoders – Applications of autoencoders - Deep Generative Models – Boltzmann Machine– Restricted Boltzmann Machine – Deep Belief Networks.

Total : 45 Periods

Text Books

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ``Deep Learning", MIT Press, 2016.
2. Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, ``A Guide to Convolutional Neural Networks for Computer Vision", Synthesis Lectures on Computer Vision, Morgan & Claypool publishers, 2018.

Reference Books

1 Francois Chollet, ``Deep Learning with Python", Manning Publications Co, 2018.
2. Charu C. Aggarwal, ``Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 2018.

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3. Josh Patterson, Adam Gibson, ``Deep Learning: A Practitioner's Approach'', O'Reilly Media, 2017.

Assessment Components	Duration	Syllabus to be covered	Max. Marks	Weightage for Internal Marks	Continuous Internal Assessment Marks	End Semester Examination Marks*
CIA I	3 hours	2.5 units	100	12	24	60
CIA II	3 hours	2.5 units	100	12		
Objective Test / Online Quiz, Assignment / Case study Seminar / Tutorial, Role Play, Poster Presentation, Group Discussions, Oral Presentation, Mini Project etc., (8 marks during CIA I and 8 marks during CIA II)					16	
				Total	**40**	**60**

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs						PSO	
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**
CO 1	3	3	3	3	2	-	2	2
CO 2	3	3	3	3	2	-	2	2
CO 3	3	3	3	3	2	-	2	2
CO 4	2	2	-	2	2	-	2	2
CO 5	3	2	-	-	2	-	2	2
Average	**2**	**3**	**3**	**3**	**2**	-	**2**	**2**

3– High 2 – Medium 1 – Low '-' - No Correlation

23CS310	DATA ANALYTICS LABORATORY	L	T	P	C
		0	0	4	2
Category	**Program Core**				
Pre requisites	NIl				

Course Objectives

The course is intended to

- Implement programs using Map Reduce for processing big data
- Analyze big data using linear models
- Analyze big data using machine learning techniques such as SVM / Decision tree classification and clustering
- Learn to visualize data using various representations.
- Realize storage of big data using H base, MongoDB.

Course Outcomes (COs)

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Process big data using Hadoop framework.	Apply

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CO 2	Build and apply linear and logistic regression models.	Apply
CO 3	Perform data analysis with machine learning models.	Apply
CO 4	Perform graphical data analysis.	Apply
CO 5	Build large datasets using Hbase, MongoDB.	Apply

S.No	List of Exercises	CO	Bloom's Level
1.	Install, configure and run Hadoop and HDFS	CO 1	Apply
2.	Implement word count / frequency programs using MapReduce	CO 2	Apply
3.	Implement an MR program that processes a weather dataset	CO 2	Apply
4.	Implement Linear and logistic Regression	CO 3	Apply
5.	Implement SVM / Decision tree classification techniques	CO 3	Apply
6.	Implement clustering techniques	CO 4	Apply
7.	Visualize data using any plotting framework	CO 4	Apply
8.	Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop / R	CO 5	Apply

Total : 45 Periods

Reference Books

1. Manual-prepared by SSCET

Additional / Web References

1. http://nptel.ac.in/courses/112104113/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs						PSO	
	1	2	3	4	5	6	1	2
CO 1	3	3	3	3	2	-	2	2
CO 2	3	3	3	3	2	-	2	2
CO 3	3	3	3	3	2	-	2	2
CO 4	2	2	-	2	2	-	2	2
CO 5	3	2	-	-	2	-	2	2
Average	**2**	**3**	**3**	**3**	**2**	-	**2**	**2**

3– High 2 – Medium 1 – Low '-" - No Correlation

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S. No.	Assessment Method	Max. Marks	Weightage for Internal Marks	Continuous Internal Assessment Marks	End Semester Examination Marks
1	Observation, Analysis of Experimental results & Record, Viva-voce based on rubrics.	100	75	45	40
2	Model Examination	100	25	15	
			Total	**60**	**40**

23CS502	TERM PAPER WRITING AND SEMINAR	L	T	P	C
		0	0	2	1
Category	**Employability Enhancement**				
Pre requisites	NIl				

Course Objectives

The course is intended to

- Analyze an author's point of view by making inferences.
- Use background knowledge and understand the meaning of research articles.
- Draw general conclusions from specific details in literature.
- Write papers/articles with a clear introduction, supporting details, methodology, results and conclusion.
- Communicate and effectively present the technical research paper

Course Outcomes (COs)

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Analyze and infer the domain knowledge of the research papers.	Apply
CO 2	Find information by using reference tools, including online resources.	Apply
CO 3	Use syntactic clues to interpret the meaning of complex research articles.	Apply
CO 4	Understand technical research paper writing process.	Apply
CO 5	Effectively communicate and present the technical paper in a research forum	Apply

.No	List of Exercises	CO	Bloom's Level
1.	Selecting a subject in CSE, narrowing the subject into a topic	CO 1	Apply
2.	Stating an objective and collecting the relevant bibliography from IEEE, ACM, Elsevier,	CO 2	Apply
3.	Springer, Wiley, Taylor & Francis, Inderscience and IET Journals or IEEE/ACM conferences and Books.	CO 2	Apply

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4.	Preparing a working outline based on literature survey and Critical Review of papers	CO 3	Apply
5.	Linking the papers and preparing a draft of the papers in one area of CSE.	CO 4	Apply
6.	Preparing conclusions based on the reading of all the papers and identification of a problem	CO 4	Apply
7.	Specify the Mathematical and algorithmic requirements to solve the problem	CO 4	Apply
8.	Specify how to change architecture, analyzing existing algorithm and modify existing algorithm and propose a new work and implementation of the proposed work	CO 4	Apply
9.	Performing Plagiarism check on the Final paper	CO 5	Apply
			Total : 45 Periods

Reference Books

1. Manual-prepared by SSCET

Additional / Web References

2. http://nptel.ac.in/courses/112104113/
3. http://nptel.ac.in/courses/112108148/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs						PSO	
	1	2	3	4	5	6	1	2
CO 1	3	3	3	3	2	-	2	2
CO 2	3	3	3	3	2	-	2	2
CO 3	3	3	3	3	2	-	2	2
CO 4	2	2	-	2	2	-	2	2
CO 5	3	2	-	-	2	-	2	2
Average	**2**	**3**	**3**	**3**	**2**	-	**2**	**2**

3– High 2 – Medium 1 – Low '-" - No Correlation

S. No.	Assessment Method	Max. Marks	Weightage for Internal Marks	Continuous Internal Assessment Marks	End Semester Examination Marks
1	Observation, Analysis of Experimental results & Record, Viva-voce based on rubrics	100	75	45	40
2	Model Examination	100	25	15	
			Total	**60**	**40**

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Passed in Board of Studies Meeting on 26.10.2023 *Approved in Academic Council Meeting on 07.11.2023*