Department of Computer Science and Engineering

Vision of the Department

To craft professionally skilled engineers with research orientation, innovative insights and a passion for life-long learning to meet the needs of Industry and Society.

Mission of the Department

M1: To offer need based curriculum in collaboration with industry.

M2: To inculcate professional skills with innovative thinking to address societal problems of multidisciplinary nature.

M3: To provide a congenial environment to learn and exhibit soft skills.

M4: To promote research culture and the need for life-long learning.

Program Educational Objectives (PEOs) - PG

PEO1: To apply advanced principles of computer science and engineering to solve real world research and development problems in industry and academia

PEO2: To inculcate lifelong learning skills in graduates prepare them to work in changing environments and multi-disciplinary teams globally.

PEO3: To instill leadership qualities in graduates with a sense of confidence professionalism and ethical attitude to produce professional leaders for serving the society

Program Outcomes (POs) – PG

Post Graduates will be able to:

PO1: Independently carry out research/ investigation and development work to solve practical problems.

PO2: Write and present a substantial technical report / document

PO3: Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

1st SEMESTER M.Tech.

SI No	Course Code		Course Title	Teaching Dept.	L	T	P	Credits	CIE Marks	SEE Marks	Total Marks	Exam Hrs.
1	PC	24CSE11	**Advances in Algorithm and Applications**	CSE	4	-	-	**4**	50	50	100	3
2	PC	24CSE12	**Advanced Computer Network**	CSE	4	-	-	**4**	50	50	100	3
3	PC	24CSE13	**Data Science with R**	CSE	4	-	-	**4**	50	50	100	3
4	PC	24CSE14	**Research Methodology**	CSE	3	-	-	**3**	50	50	100	3
5	PE	24CSE15x	**Professional Elective - I**	CSE	3	-	-	**3**	50	50	100	3
6	PE	24CSE16x	**Professional Elective - II**	CSE	3	-	-	**3**	50	50	100	3
7	PC	24CSETS1	**Technical Seminar -I**	CSE	-		3	**1.5**	50	-	50	-
8	PC	24CSELB1	**Advanced Algorithm and Data Science Lab**	CSE	-	-	3	**1.5**	50	-	50	-
L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination				**Total**	21	-	6	**24**	**400**	**300**	**700**	-

Professional Elective-I		Professional Elective-II	
Course Code	**Course Title**	**Course Code**	**Course Title**
24CSE151	Artificial Intelligence and Expert Systems	24CSE161	Machine Learning
24CSE152	Block chain Technology	24CSE162	Internet of Things and Applications
24CSE153	Applied Cryptography	24CSE163	Virtualization & Cloud Computing

2nd SEMESTER M.Tech.

SI No	Course Code		Course Title	Teaching Dept.	L	T	P	Credits	CIE Marks	SEE Marks	Total Marks	Exam Hrs.
1	PC	24CSE21	Big Data Analytics	CSE	4	-	-	4	50	50	100	3
2	PC	24CSE22	Computer Vision	CSE	4	-	-	4	50	50	100	3
3	PC	24CSE23	Advanced Operating System	CSE	4	-	-	4	50	50	100	3
4	PC	24CSE24	Cyber Security and Digital Forensics	CSE	3	-	-	3	50	50	100	3
5	PE	24CSE25x	Professional elective - I	CSE	3	-	-	3	50	50	100	3
6	PE	24CSE26x	Professional elective - II	CSE	3	-	-	3	50	50	100	3
7	PC	24CSETS2	Technical Seminar - II	CSE	-	-	3	1.5	50	-	50	-
8	PC	24CSELB2	Cyber Security and Digital Forensics Lab	CSE	-	-	3	1.5	50	-	50	-
L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination				Total	21	-	6	24	400	300	700	-

		Professional Elective-IV	
Course Code	Course Title	Course Code	Course Title
24CSE251	Pattern Recognition	24CSE261	Business Intelligence and Data Mining
24CSE252	High performance Computing	24CSE262	Advanced Storage Area Networks
24CSE253	Deep Learning	24CSE263	Advanced Mobile Computing

3rd SEMESTER M.Tech.

SI No	Course Code		Course Title	Teaching Dept.	L	T	P	Credits	CIE Marks	SEE Marks	Total Marks	Exam Hrs.
1	PC	24CSEIS1	**Internship**	CSE	-	-	-	**9**	100	-	100	-
2	PC	24CSEE1	**Online Course: NPTEL/MOOC/SWAYAM**	CSE				**3**	50	50	100	
3	PC	24CSEPW1	**Project Phase-I**	CSE	-	-	-	**08**	50	-	50	-
L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination				**Total**	-	-	-	**20**	**150**	**50**	**150**	-

4th SEMESTER M.Tech.

SI No	Course Code		Course Title	Teaching Dept.	L	T	P	Credits	CIE Marks	SEE Marks	Total Marks	Exam Hrs.
1	PC	24CSEPW2	**Professional Work Phase- II**	**CSE**	-	-	-	**20**	100	200	300	-
2 Paper Publications is compulsory (Conference/Journal)												
L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination				**Total**	-	-	-	20	**100**	**200**	300	-
Credits Distribution: 1st Sem=24, 2nd Sem =24, 3rd Sem=20, 4th Sem=20, Total Credits=24+24+20+20=88 Credits												

Department: Computer Science & Engineering **Semester: I**

Subject: Advances in Algorithm and Applications

Subject Code: 24CSE11 **L – T – P - C: 4 – 0 – 0 – 4**

Sl. No	Course Objectives
1	To Learn the concepts of advances in algorithms to use in applications.
2	To disseminate knowledge on how to create strategies for dealing with real world problems
3	To develop efficient algorithms for use in a variety of engineering design settings.
4	To provide analytical framework for the design and analysis of algorithms.

Unit	Description	Hrs
I	**Divide and Conquer:** Strassen's algorithm for matrix multiplication, The recursion-tree method for solving recurrences, A randomized version of quicksort. **Greedy Algorithms:** An activity-selection problem, Huffman codes	**10**
II	**Dynamic Programming:** Matrix Chain Multiplication, Longest Common Sub sequence. **Amortized Analysis:** Stack operation and Incrementing Binary counter -The aggregate method, the accounting method, the potential method, and Dynamic tables.	**10**
III	**String Matching:** Naïve String-matching Algorithms, KMP algorithm, Rabin-Karp Algorithm, String matching with Finite Automata.	**10**
IV	**Network Flow Algorithms**: Bellman - Ford Algorithm, Single source shortest paths in a directed acyclic graph, Johnson's Algorithm for sparse graphs, Flow Networks, Ford-Fulkerson method, Maximum bipartite matching.	**10**
V	**Number -Theoretic Algorithms:** Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primarily testing.	**10**

Course Outcomes:

Course outcome	Descriptions
CO1	Devise recurrence relations and amortized cost of various operations.
CO2	Apply various algorithm paradigms to solve scientific and real-life problems.
CO3	Demonstrate the string matching and network flow algorithms relating to real-life problems.
CO4	Understand and apply Number -Theoretic Algorithms.

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Introduction to algorithms.	Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein	MIT press, 2022 ISBN 9780262046305

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Algorithms	Kenneth A. Berman, Jerome L. Paul	Cengage Learning, 2002.
2	Algorithm Design,	Jon Kleinberg and EvaTardos	Pearson Education, 1“Edition, 2014.
3	Fundamentals of Computer Algorithms	Ellis Horowitz, SartajSahni, S.Rajasekharan	2nd Edition, Universities press, 2007

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Department: Computer Science & Engineering **Semester: I**

Subject: Advanced Computer Network
Subject Code: 24CSE12 **L – T – P - C: 4–0–0–4**

Sl. No	Course Objectives
1	To understand the functionalities of network layer, transport layer and application layer protocols
2	To acquire knowledge on congestion control, flow control and error control mechanisms
3	To describe the parameters used to measure the QoS in a network
4	To understand the working of different protocols in respective applications

Unit	Description	Hrs
I	**SIMPLE INTERNETWORKING (IP):** What Is an Internetwork?**,** Service Model, Global Addresses**,** Datagram Forwarding in IP Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP)**,** Virtual Networks and Tunnels, **Routing** Network as a Graph , Distance Vector (RIP), Link State (OSPF), Metrics, Routing for Mobile hosts, Router implementation, Global Internet Subnetting Classless Routing (CIDR) Interdomain Routing (BGP) Routing Areas IP Version 6 (IPv6). Multicast: Multicast addresses, Multicast Routing, Multicast Label Switching: Destination Based Forwarding, Explicit Routing, Virtual private Network and Tunnels.	**10**
II	**INTRODUCTION TO THE TRANSPORT LAYER: Transport-Layer Services** Process-to-Process Communication, Addressing Port Numbers, Encapsulation and Decapsulation, Multiplexing and Demultiplexing, Flow Control, Error Control, Combination of Flow and Error Control, Congestion Control, Connectionless and Connection-Oriented Services, **Transport-Layer Protocols** Simple Protocol, Stop- and-Wait Protocol, Go-Back-N Protocol, Selective-Repeat Protocol, Bidirectional Protocols: Piggybacking **User Datagram Protocol (UDP): Introduction, User Datagram, UDP Services** Process-to-Process Communication, Connectionless Services, Flow Control, Error Control, Congestion Control, Encapsulation and Decapsulation, Queuing, Multiplexing and Demultiplexing, Comparison between UDP and	**10**

	Generic Simple Protocol, **UDP Applications** UDP Features, Typical Applications, **UDP Package** Control-Block Tabl e, Input Queues, Control-Block Module, Input Module, Output Module, Examples.	
III	**TRANSMISSION CONTROL PROTOCOL (TCP): TCP Services** Process-to-Process Communication Stream Delivery Service, Full-Duplex Communication, Multiplexing and Demultiplexing, Connection-Oriented Service, Reliable Service, **TCP Features** Numbering System, Flow Control, Error Control, Congestion Control, **Segment** Format, Encapsulation, **A TCP Connection:** Connection Establishment, Data Transfer, Connection Termination. Connection Reset **State Transition Diagram:** Scenarios, **Windows In TCP** Send Window, Receive Window, **Flow Control** Opening and Closing Windows, Shrinking of Windows, Silly Window Syndrome, **Error Control:** Checksum, Acknowledgment Retransmission, Out-of-Order Segments, FSMs for Data Transfer in TCP, Some Scenarios, **Congestion Control:** Congestion Window, Congestion policy.	**10**
IV	**Stream Control Transmission Protocol (SCTP) INTRODUCTION, SCTP SERVICES** Process-to-Process Communication Multiple Streams Multihoming Full-Duplex Communication Connection-Oriented Service Reliable Service **SCTP FEATURES** Transmission Sequence Number (TSN) Stream Identifier (SI) Stream Sequence Number (SSN) Packets Acknowledgment Number, Flow Control, Error Control Congestion Control PACKET FORMAT General Header, Chunk **AN SCTP ASSOCIATION**: Association Establishment, Data Transfer, Association Termination, Association Abortion **STATE TRANSITION DIAGRAM** Scenarios **FLOW CONTROL** Receiver Site Sender Site A Scenario **ERROR CONTROL** Receiver Site Sender Site Sending Data Chunks Generating SACK Chunks **CONGESTIONCONTROL** Congestion Control and Multihoming Explicit Congestion Notification.	**10**
V	Quality of Service, Application Requirements, Integrated Services (RSVP), Differentiated Services (EF, AF) Equation-Based Congestion Control. **Applications: Traditional Applications** Electronic Mail (SMTP, MIME, IMAP) World Wide Web (HTTP), Name services (DNS), Network Management	**10**

	(SNMP), **Web Services** , Custom Application protocols (WSDL,SOAP) , A generic Application protocol (REST)	

Course Outcomes:

Course outcome	Descriptions
CO1	Interpret the functionalities of network layer protocols
CO2	Design solutions for network related problems and analyze the performance
CO3	Demonstrate the working of different congestion control mechanisms
CO4	Analyze the performance of transport layer and application layer protocols

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Computer Networks- A System Approach	Larry. L. Peterson and Bruce. S Davie	4th Edition, Elsevier, 2007
2	TCP/IP Protocol Suite	Behrouz A. Forouzan	4th Edition, McGrawHill

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Data Communications and Networking	Behrouz A. Forouzan	4th Edition, McGrawHill
2	Data and Computer Communication	William Stallings	8th Edition, Pearson Education
3	Communication Networks- Fundamental Concepts and Key Architectures	Alberto Leon Garcia and Widjaja	2nd Edition, McGrawHill

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Department: Computer Science and Engineering **Semester: I**

Subject: Data Science with R
Subject Code: 24CSE13 **L – T – P - C: 4–0–0–4**

Sl. No	Course Objectives
1	Students will develop relevant programming abilities.
2	Students will demonstrate proficiency with statistical analysis of data.
3	Students will develop the ability to build and assess data-based models.
4	Students will execute statistical analyses with professional statistical software.

Unit	Description	Hrs
I	**Introduction**:What Is Data Science ?, Why R ?,**Overview of the R Programming Language:** Installing R, Development Tools, R Programming Language, Packages, Running R Code. **Getting Data into R:**Reading Data, Cleaning Up Data.	**10**
II	**Data Visualization:** Introduction, Basic Visualizations, Layered Visualizations Using ggplot2, Interactive Visualizations Using Shiny. **Exploratory Data Analysis:** Summary Statistics, Getting a Sense of Data Distribution, Putting It All Together: Outlier Detection, Introduction : Tableau/PowerBi	**10**
III	**Regression:** Introduction**,** Parametric Regression Models, Nonparametric Regression Models,	**10**
IV	**Classification:** Introduction, Parametric Classification Models, Nonparametric Classification Models	**10**
V	**Text Mining:**Introduction, Dataset, Reading Text Input Data, Common Text Pre processing Tasks, Term Document Matrix, Text Mining Applications.	**10**

Course Outcomes:

Course outcome	Descriptions
CO1	Understand the semantics, data handling and control statements in R.
CO2	Analyze the libraries for data manipulation and conduct hypothesis tests for statistical inference.
CO3	Synthesize data to fit linear and nonlinear models
CO4	Implement clustering, Text Mining optimization and data visualization using R.

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Beginning Data Science with R	Manas A. Pathak	I, Springer, 2014, ISBN 978-3-319-12065-2

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Algorithms for Data Science	Brian Steele, John Chandler, Swarna Reddy	1, Springer, 2016, 978-3-319-45795-6
2	Practical data science with R	Nina Zumel, John Mount	2, Manning, 2020, 9781617295874

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Department: Computer Science & Engineering **Semester: I**

Subject: Research Methodology

Subject Code: 24CSE14 **L – T – P - C: 3–0– 0– 3**

Sl. No	Course Objectives
1	To introduce the fundamentals of research methodology.
2	To learn data collection and analysis.
3	To design and testing of research work.
4	To gain knowledge about intellectual property rights.

Unit	Description	Hrs
I	**Introduction:** Objective of Research; Definition and Motivation; Types of Research; Research Approaches; Steps in Research Process; Criteria of Good Research; Ethics in Research. **Research Formulation and Literature Review:** Problem Definition and Formulation; Literature Review; Characteristics of Good Research Question; Literature Review Process.	8
II	**Data Collection:** Primary and Secondary Data; Primary and Secondary Data Sources; Data Collection Methods; Data Processing; Classification of Data. **Data Analysis:** Statistical Analysis; Multivariate Analysis; Correlation Analysis; Regression Analysis; Principle Component Analysis.	8
III	**Research Design:** Need for Research Design; Features of a Good Design; Types of Research Designs; Induction and Deduction. **Hypothesis Formulation and Testing:** Hypothesis; Important Terms; Types of Research Hypothesis; Hypothesis Testing; Z-Test; t-Test; f-Test; Making a Decision; Types of Errors; ROC Graphics.	8

IV	**Test Procedures-Parametric and Non Parametric Tests:** ANOVA; Mann- Whitney Test; Kruskal-Wallis Test;Chi-Square Test; Multi-Variate Analysis.Presentation of the Research Work-Business Report; Technical Report; Research Report; General Tips for Writing Report; **Presentation of Data**: Oral Presentation; Bibliography and References; Intellectual Property Rights; Open-Access Initiatives; Plagiarism.	8
V	**Law of Patents, Patent Searches, Ownership, Transfer Patentability Design Patents-** Double Patenting – Patent Searching, Patent Application Process, Prosecuting the Application, Post-issuance Actions, Term and Maintenance of Patents. Ownership Rights, Sole and Joint Inventors, Inventions Made by Employees and Independent Contractors, Assignment of Patent Rights, Licensing of Patent Rights, Invention Developers and Promoters. Patent Infringement,New Developments and International Patent Law, Direct Infringement, Inducement to Infringe, Contributory Infringement, First Sale Doctrine, Claims Interpretation, Defenses to Infringement, Remedies for Infringement, Resolving an Infringement Dispute, Patent Infringement Litigation. New Developments in Patent Law	8

Course Outcomes:

Course outcome	Descriptions
CO1	Gain the sound of knowledge of distinguish research methods
CO2	Understand to analysis and writing a technical research paper.
CO3	Capable of testing, publishing, review research papers effectively.
CO4	Achieving knowledge about IPR and patent filing.

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Research Methodology. Methods & Technique	Kothari. C.R.	2nd Edition, New Age International Publishers.
2	Practical Research: planning and Design	Paul D. Leedy, Jeanne E, Ormrod	8th Edition, Pearson College Div; (January 1, 2005)

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Research methodology	S.S. Vinod Chandra, S. Anand Hareendran	Fifth Edition, 2017.
2	Tests, Measurements and Research methods in Behavioural	A.K. Singh.	Bharti Bhawan; Sixth edition (1 January 2019); Bharti Bhawan
3	Intellectual Property – Copyrights, Trademarks, and Patents	Richard Stim,	Cengage; 2nd edition (1 November 2012)

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Department: Computer Science & Engineering **Semester: I**

Subject: Artificial intelligence and expert systems

Subject Code: 24CSE151 **L – T – P - 3–0 –0 –3**
C:

Sl. No	Course Objectives
1	Study the concepts of Artificial Intelligence.
2	Learn the methods of solving problems using Artificial Intelligence
3	Learn the knowledge representation techniques, reasoning techniques and planning
4	Introduce the concepts of Expert Systems and Statistical Reasoning

Unit	Description	Hrs
I	**Introduction and Problems, Problem Spaces and Search**: What is AI? Intelligent agents: agents and environment; rationality; the nature of environment; the structure of agents. Problem-solving; problem-solving agents; example problems; searching for solution; uninformed search strategies. Defining the problem as a state space search; production systems; problem characteristics; production system characteristics; issues in the design of search programs.	**08**
II	**Heuristic search techniques:** Generate-and-test; hill climbing; best-first search; problem reduction; constraint satisfaction.	**08**
III	**Knowledge representation and predicate logic: Representations** and mappings; approaches to knowledge representation; issues in knowledge representation; the frame problem. Representing simple facts in logic; representing instance and isa relationships; computable functions and predicates; resolution.	**08**
IV	**Logical Agents**: Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Reasoning Patterns in Propositional Logic , Reasoning Patterns in Propositional Logic Resolution, Effective propositional inference, Agents Based on Propositional Logic, First-Order Logic, Representative Revisited, Syntax and semantics of First-Order Logic, Using First-order Logic, Knowledge Engineering in First-Oder Logic.	**08**
V	**Statistical Reasoning and Expert Systems** : Probability and Bayes Theorem; Certainty Factors and Rule-Based Systems; Bayesian Networks; Dempster-Shafer Theory; Fuzzy Logic. Representing and Using Domain Knowledge; Expert System Shells; Explanation; Knowledge Acquisition.	**08**

Course Outcomes:

Course outcome	Descriptions
CO1	Demonstrate awareness of informed search and exploration methods.
CO2	Explain about AI techniques for knowledge representation, planning and uncertainty Management.
CO3	Develop knowledge of decision making and learning methods.
CO4	Explain the concept of expert systems and statical reasoning.

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Artificial Intelligence	Elaine Rich, Kevin Knight	3rd Edition, Tata McGraw Hill, 2009
2	Artificial Intelligence A Modern Approach	Stuart Russel, Peter Norvig	1. 2nd Edition, Pearson Education, 2003

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Principles of Artificial Intelligence	Nils J. Nilsson	Elsevier, 1980

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Department: Computer Science & Engineering **Semester: I**

Subject: Block Chain Technology
Subject Code: 24CSE152 **L – T – P - C: 3– 0 – 0– 3**

Sl. No	Course Objectives
1	Understand the fundamentals of blockchain technology
2	Describe the working principle of consensus model and forking
3	Explore different blockchain platforms
4	Understand the applications of Blockchain technology

Unit	Description	Hrs
I	Introduction, Purpose and Scope, Results of the Public Comment Period, Document Structure, Blockchain Categorization, Permissionless, Permissioned, Blockchain Components, Cryptographic Nonce, Transactions, Asymmetric-Key Cryptography, Ledgers, Blocks, Chaining Blocks, Consensus Models, Forking	**8**
II	Smart Contracts, Blockchain Limitations and Misconceptions, Application Considerations, Additional Blockchain Considerations Introduction to Cryptography & Cryptocurrencies, Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency	**8**
III	How Bitcoin Achieves Decentralization, Centralization vs. Decentralization, Distributed consensus, Consensus without identity using a block chain, Incentives and proof of work, Mechanics of Bitcoin, Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network, Limitations and improvements	**8**
IV	Alternative Coins: Introducing altcoins, Theoretical foundations, Difficulty adjustment and retargeting algorithms, Bitcoin limitations, Extended protocols on top of Bitcoin, Development of altcoins, Initial Coin Offerings (ICOs), Ethereum 101: An overview, The Ethereum Network, Components of the Ethereum ecosystem, The Ethereum Virtual Machine (EVM)	**8**
V	Block chain -Outside of Currencies: Internet of Things, Government, Health, Finance, Media, Scalability and Other challenges	**8**

Course Outcomes:

Course outcome	Descriptions
CO1	Analyze the fundamental elements of block chain technology
CO2	Demonstrate the use of smart contracts and consensus models in implementing blockchains
CO3	Analyze the design principles of different distributed ledger platforms including Ethereum, Bitcoin
CO4	Examine the applications of blockchain beyond cryptocurrencies

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Blockchain Technology Overview	Dylan Yaga, Peter Mell, Nik Roby, Karen Scarfone	NIST Report 8202, US Department of Commerce, Oct 2018.
2	Block chain, Blueprint for A New Economy	Melanie Swan	O'Reilly
3	Mastering Blockchain	Imran Bashir	Packt Publishing Ltd, Third Edition, August 2020

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Block chain Expert, BlockChain E-Book	Sainul Abideen	Cybrosys Technologies. https://www.blockchainexpert.uk/book/blockchain-book.pdf

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Department: Computer Science & Engineering **Semester: I**

Subject: Applied cryptography
Subject Code: 24CSE153 **L – T – P - C: 3 –0 –0 –3**

Sl. No	Course Objectives
1	Student learns the basic concepts of symmetric cryptography and simple encryption methods.
2	Deploy encryption techniques to secure data in transit across data networks
3	Distinguish key distribution and management schemes.
4	Explain standard algorithms used to provide confidentiality, integrity and authenticity.

Unit	Description	Hrs
I	**Overview of Cryptography:** Introduction, Information security and cryptography: Background on functions: Functions (1-1, one-way, trapdoor one-way), Permutations, and Involutions. Basic terminology and concepts, Symmetric-key encryption: Overview of block ciphers and stream ciphers, Substitution ciphers and transposition ciphers, Composition of ciphers, Stream ciphers, The key space. Classes of attacks and security models: Attacks on encryption schemes, Attacks on protocols, Models for evaluating security, Perspective for computational security.	**08**
II	**Symmetric & Asymmetric Cryptography:** Classical encryption techniques, Block cipher design principles and modes of operation, Data encryption standard, Evaluation criteria for AES, AES cipher, Principles of public key cryptosystems, The RSA algorithm, Key management – Diffie Hellman Key exchange, Elliptic curve arithmetic-Elliptic curve cryptography.	**08**
III	**Mathematical Background:** Probability theory, Information theory, Complexity theory, Number theory, Abstract algebra, Finite fields, The integer factorization problem, The RSA problem, The Diffie-Hellman problem,	**08**

	Composite moduli. Number Theory: Introduction to number theory, Overview of modular arithmetic, discrete logarithms, and primality/factoring, Euclid's algorithm, Finite fields, Prime numbers, Fermat's and Euler's theorem- Testing for primality, A quick introduction to groups, rings, integral domain and fields.	
IV	**Block Ciphers:** Introduction and overview, Background and general concepts: Introduction to block ciphers, Modes of operation, Exhaustive key search and multiple encryptions**.** **Classical ciphers and historical development:** Transposition ciphers (background), Substitution ciphers (background), Poly alphabetic substitutions and Vigenere ciphers (historical). Poly alphabetic cipher machines and rotors (historical), Cryptanalysis of classical ciphers (historical).	**08**
V	**Quantum Cryptography and Quantum Teleportation:** Heisenberg uncertainty principle, polarization states of photons, quantum cryptography using polarized photons, local vs. nonlocal interactions, entanglements, EPR paradox, Bell's theorem, Bell basis, teleportation of a single qubit theory and experiments.	**08**

Course Outcomes:

Course outcome	Descriptions
CO1	Apply the OSI security architecture and classical encryption techniques for simple applications..
CO2	Compare various cryptographic techniques.
CO3	Analyze the vulnerabilities in any computing system.
CO4	Evaluate security mechanisms using rigorous approaches, including theoretical.

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Handbook of Applied Cryptography	Alfred J. Menezes, Paul C. van Oorschot, Scott A. Vanstone, CRC Press, Taylor and Francis Group,	ISBN-13: 978-0-84-938523-0.

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Applied Cryptography: Protocols, Algorithms, and Source Code in C	Bruce Schneier,	2nd Edition, ISBN:0-471-22357-3.
2	Cryptography and Network Security,	William Stallings,	6 th Edition, ISBN-13: 978-0-13-335469-0.'Far

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Department: Computer Science & Engineering **Semester: I**

Subject: Machine learning

Subject Code: 24CSE161 **L – T – P - C: 3 - 0 - 0 - 3**

Sl. No	Course Objectives
1	To introduce the fundamentalsof research methodology.
2	To learn data collection and analysis.
3	To design and testing of research work.
4	To gain knowledge about intellectual property rights.

Unit	Description	Hrs
I	**Introduction**: if data had mass, the earth would be a black hole: learning, machine learning, types of machine learning, supervised learning, regression, classification, the machine learning process. **Concept learning and decision trees**:Learning Problems, Designing Learning systems, Perspectives and Issues, Concept Learning Version Spaces and Candidate Elimination Algorithm, Inductive bias, Decision Tree learning, Representation, Algorithm, Heuristic Space Search	8
II	**Neural networks and genetic algorithms:** Neural Network Representation, Problems, Perceptrons, Multilayer Networks and Back Propagation Algorithms, Advanced Topics, Genetic Algorithms, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning.	8
III	**Bayesian and computational learning:** Bayes Theorem, Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier, Bayesian Belief Network, EM Algorithm, Probably Learning, Sample Complexity for Finite and Infinite Hypothesis Spaces, Mistake Bound Model.	8

IV	**Instant based learning and learning set of rules**: K- Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Sequential Covering Algorithms, Learning Rule Sets, Learning First Order Rules, Learning Sets of First Order Rules, Induction as Inverted Deduction, Inverting Resolution	8
V	**Analytical learning and reinforced learning**: Perfect Domain Theories, Explanation Based Learning, Inductive-Analytical Approaches, FOCL Algorithm, Reinforcement Learning, Task Q-Learning, Temporal Difference Learning	8

Course Outcomes:

Course outcome	Descriptions
CO1	Cable to identify and differentiate the machine learning problems.
CO2	Ability to investigate on model evolution learning.
CO3	Knowledge about theory of probability and statistics related to machine learning
CO4	Adequate to understand the concepts of computational intelligence.

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Machine Learning	Tom M. Mitchell	McGraw-Hill Education, 2013
2	Machine Learning An Algorithm Perspective	Stephen Marsland	CRC Press, Taylor and Francis Group, 2nd edition, ,2015

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Introduction to Machine Learning	Ethem Alpaydin	PHI Learning Pvt. Ltd, 2 nd Ed., 2013
2	The Elements of Statistical Learning	T. Hastie, R. Tibshirani, J. H	Springer, 1st edition, 2001

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Department: Computer Science & Engineering **Semester: I**

Subject: Internet of things and application

Subject Code: 24CSE162 **L – T – P - C: 3- 0- 0-3**

Sl. No	Course Objectives
1	To study the fundamentals and Access technologies.
2	To study the design methodology and different IoT hardware platforms
3	To study the basics of IoT Data Analytics and supporting services.
4	To study about various IoT case studies and industrial applications.

Unit	Description	Hrs
I	**Fundamentals of iot:** Evolution of Internet of Things, Enabling Technologies, M2M Communication, IoT World Forum (IoTWF) standardized architecture, Simplified IoT Architecture, Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.	**08**
II	**Iot protocols:** IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks,6LoWPAN, Application Transport Methods: SCADA, Application Layer Protocols: CoAP and MQTT.	**08**
III	**Design and development:** Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, Arduino Board details	**08**
IV	**Data analytics and supporting services:** Data Analytics: Introduction, Structured Versus Unstructured Data, Data in Motion versus Data at Rest, IoT Data Analytics Challenges, Data Acquiring, Organizing in IoT/M2M, Supporting Services: Computing Using a Cloud Platform for IoT/M2M Applications/Services, Everything as a service and Cloud Service Models.	**08**
V	**Case studies/industrial applications:** IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipment's, Industry 4.0 concepts.	**08**

Course Outcomes:

Course outcome	Descriptions
CO1	Understand the basics of IoT.
CO2	Implement the state of the Architecture of an IoT.
CO3	Understand design methodology and hardware platforms involved in IoT.
CO4	Understand how to analyze and organize the data.
CO5	Compare IOT Applications in Industrial & realworld.

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry	Cisco Press 2017
2	Internet of Things – A hands-on approach	Arshdeep Bahga, Vijay Madisetti	Universities Press, 2015
3	Internet of Things: Architecture, Design Principles And Applications	Rajkamal	McGraw Hill HigherEducation

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	The Internet of Things – Key applications and Protocols.	Olivier Hersent, David Boswarthick	2012
2	From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence.	Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle	Elsevier 2014.
3	Architecting the Internet of Things.	Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds).	Springer,2011.

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Department: Computer Science & Engineering **Semester: I**

Subject: Virtualization and Cloud computing
Subject Code: 24CSE163 **L – T – P - C: 3–0–0–3**

Sl. No	Course Objectives
1	Provide comprehensive view to different aspects of cloud computing like, service models, development models and challenges.
2	Introduce to cloud virtualization, with different type of virtualization and capacity planning metrics to clouds.
3	Know the concrete concepts of map reduce and extensions.
4	Contrast how Cloud Service providers is helpful in Cloud Computing.

Unit	Description	Hrs
I	**Introduction:**Grid computing, Essentials, Benefits, Why Cloud?, Business and IT Perspective, Cloud and Virtualization, Cloud Services Requirements, Cloud and Dynamic Infrastructure, Cloud Computing Characteristics, Cloud Adoption, Cloud rudiments, (Book 1) Clustering, Difference between Grid and Cluster computing, Characteristics of Cluster and Grid Computing, On demand computing	**08**
II	**Cloud Deployment and Service Models: Deployment Models:** Introduction, Cloud Characteristics, Measured Service, Cloud Models, Security in a Public Cloud, Public versus Private Clouds, Cloud Infrastructure Self Service. Service Models: Introduction, Gamut of Cloud Solutions, Principal Technologies, Cloud Strategy, Cloud Design and Implementation using SOA, Conceptual Cloud Model, Cloud Service defined.	**08**
III	**Virtualization:** Introduction, Characteristics of Virtualized environments, Taxonomy of Virtualization techniques, Virtualization and Cloud computing, Pros and Cons of Virtualization, Technology Examples: Vmware: Full Virtualization (Chapter 3 from book 2), Virtualization for x86 Architecture, Hypervisor Management Software, Virtual Infrastructure Requirements	**08**
IV	**Cloud Service Providers:** Heavy duty and Batch processing, Amazon cloud services, Google cloud platform, IBM smart cloud services, Microsoft Windows Azure, What is Hadoop?, Four phases of a Cloud application, other providers	**08**
V	**Map Reduce and Extensions Parallel computing**, The Map Reduce model, Applications of Map Reduce, Parallel efficiency of Map Reduce, Relational Operations using Map Reduce, Enterprise Batch processing using Map Reduce	08

Course Outcomes:

Course outcome	Descriptions
CO1	Define Cloud Computing and characteristics and various types of cloud services.
CO2	Describe importance of virtualization in Cloud Computing.
CO3	Explain various types of virtualizations, service providers and map reduce extensions.
CO4	Discuss Cloud Development and Service Models and various issues.

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	**Cloud Computing: Insights into New-Era Infrastructure**	Dr. Kumar Saurabh	Wiley India publications, 2012
2	Mastering Cloud Computing"	RajkumarBuyya,Christian Vecchiola,S.ThamaraiSelvi	
3	Cloud computing	Dr.U.S.Pandey, Dr.KavitaChoudhary	S.Chand Publications
4	Cloud computing: A practitioner's guide	Aravind Doss, Rajeev Nanda	McGraw hill Education PvtLtd

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Cloud computing – A practical approach	Anthony T Velte, Toby J. Velte, Ph.D., Robert Elsenpeter	McGraw Hill.
2	Cloud Computing	Michael Miller	Pearson Education, New Delhi, 2009.

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Department: Computer Science &Engineering **Semester: I**

Subject: Advanced Algorithm and Data Science Lab

Subject Code: 24CSELB1 **L–T –P- C: 0–0–3– 1.5**

Laboratory Work:

	Experiment Description
PART A	Implement the Algorithms which are discussed in the course CSE101

	Experiment Description
PART B	Solve the given data science problems by applying the concepts discussed in the course 24 CSE13.

Course Outcomes:

Course outcome	**Descriptions**
CO1	Analyze and design efficient algorithms for moderately difficult computational problems.
CO2	Apply the algorithms related to real-life problems.
CO3	Understand the semantics, data handling and control statements in R.
CO4	Implement clustering, optimization and data visualization using R, Tableau/PowerBi.

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Department: Computer Science & Engineering **Semester: II**

Subject: Big data analytics

Subject Code: 24CSE21 **L – T – P - C: 4–0–0–4**

Sl. No	Course Objectives
1	Understand the Big Data Platform and its Use cases.
2	Introduce students the concept and challenge of big data.
3	Provide HDFS Concepts and Interfacing with HDFS.
4	Teach students in applying skills and tools to manage and analyze the big data.

nit	Description	Hrs
I	**Understanding Hadoop Ecosystem:** Introducing Hadoop, Cloud Computing and Big Data:Cloud Delivery Models, Cloud Services for Big Data, Cloud Providers in Big Data Market Hadoop Ecosystem, Hadoop Distributed File System: HDFS Architecture, Concept of Blocks in HDFS in HDFS Architecture, NameNodes and DataNodes, HDFS commands, Features of HDFS, MapReduce, Hadoop YARN.	**10**
II	**Introducing HBase:** HBase Architecture, Regions, Storing Big Data with Hbase, Interacting with Hadoop Ecosystem, Hbase in Operation – Programming with HBase, Combining HBase and HDFS: REST and Thrift, Data Integrity in HDFS, Features of HBase, Role of HBase in Big dataProcessing : Characteristics of HBase. **Understanding MapReduce Fundamentals** The MapReduce Framework: Exploring the Features of MapReduce, working of MapReduce, Techniques to Optimize MapReduce Jobs ,Uses of MapReduce,.	**10**
III	**Understanding Big Data Technology Foundations:** Exploring the Big Data stack: Stack of layers in Big Data Architecture, Virtualization and Big Data, Virtualization approaches: server Virtualization, Application Virtualization, Network Virtualization, Processor and Memory Virtualization, Data and Storage Virtualization, Managing Virtualization with Hypervisor, Implementing Virtualization to work with Big Data.	**10**
IV	**Understanding Analytics and Big Data:** Comparing reporting and Analysis, Types of Analytics, Points to consider during Analysis, Developing an Analytic Team, Understanding Text Analytics. Analytical Approaches, History of Analytical Tools, Introducing Popular Analytical Tools.	**10**
V	**Social Media Analytics and Text Mining:** Introducing Social Media, Introducing key elements of Social Media, Introducing Text mining, Understanding Text mining Process, Sentiment Analysis, Performing Social media analytics and opinion mining on Tweets, **Mobile Analytics:** Introducing	**10**

	Mobile Analytics, Introducing Mobile Analytics Tools, Performing Mobile Analytics, Challenges of Mobile Analytics.	

Course Outcomes:

Course outcome	Descriptions
CO1	Identify the characteristics of datasets and compare the trivial data and big data for various applications.
CO2	Understand the concept of open source software frame work and its core components
CO3	Compare and Contrast different Hadoop supporting tools with traditional tool
CO4	How Big Data can be analyzed to extract knowledge and apply tools for big data analytics

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Big Data: Black Book	Dt Editorial Services, Dreamtech Press	Edition 2016.ISBN -13: 978-9351197577

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Big Data and Analytics	SeemaAcharya, SubhashiniChellappan, Infosys Limited	Publication:Wiley India Private Limited,1st Edition 2015. ISBN:978- 81-265-5478-2

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Department: Computer Science & Engineering **Semester: II**

Subject: Computer Vision

Subject Code: 24CSE22 **L – T – P - C: 4–0–0–4**

Sl. No	Course Objectives
1	To review image processing techniques for computer vision
2	To understand shape and region analysis.
3	To understand three-dimensional image analysis techniques.
4	To study some applications of computer vision algorithms.

Unit	Description	Hrs
I	**Introduction and Fundamentals** Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation, Impact of the course on societal and ethical issues and career perspective Introduction: Origins of Digital Image Processing, examples, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Digital Image Fundamentals: A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Basic relationship between pixels, Zooming and Shrinking. Image Processing Prototyping Tool: Overview, Image processing toolbox, working environment and editor, Reading, loading and displaying images, Saving Image and simple image manipulations.	**10**
II	**Image Enhancement**: Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods. Image Enhancement in the Frequency Domain: Background, Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform and the Frequency, Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering	**10**
III	**Image Segmentation:** Detection of Discontinuities, line and spot detection, Edge detection, gradient operators, compass operators, Laplace operator, stochastic gradients. **Edge Linking and Boundary Detection:** Thresholding- local and adaptive, Region-Based Segmentation, Region Growing and Linking, Splitting and Merging. **Hough Transform: Principle**, Line detection and Linking, Peak Detection, Circle detection.	**10**

IV	**Shapes And Regions:** N-Ary shape analysis – connectedness – object labelling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.	**10**
V	**3D Vision And Motion :** Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion. **Recap/Summary**: Application of various image processing Techniques	**10**

Course Outcomes:

Course outcome	Descriptions
CO1	Explain the fundamentals of image processing.
CO2	Apply 3D vision techniques.
CO3	Write programs on motion related techniques.
CO4	Develop applications using computer vision techniques.

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Digital Image Processing	. Rafael C G	3rd edition, 2008.

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Mastering OpenCV with Practical Computer Vision Projects	D. L. Baggio	Packt Publishing, 2012
2	Computer & Machine Vision	E. R. Davies,	Fourth Edition, Academic Press, 2012.B

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Department: Computer Science & Engineering **Semester: II**

Subject: Advanced Operating System

Subject Code: 24CSE23 **L – T – P - C: 4–0–0–4**

Sl. No	Course Objectives
1	To gain knowledge on Operating system fundamentals
2	To acquire knowledge on process execution
3	To understand synchronization and concurrency
4	To understand managing memory in Uniprocessor systems

Unit	Description	Hrs
I	Operating System Overview Operating System objectives and functions, Evolution of Operating Systems, Major Achievements, Modern Operating Systems, Virtual Machines, OS design considerations for multiprocessors and multicore, Microsoft Windows overview, Linux, Linux Virtual Machine Architecture.	**08**
II	Processes Process Description and Control - Process States, description and control, execution of OS, Security issues. Threads –Processes and threads, types of threads, Multicore and Multithreading, Windows Threads and SMP Management, Linux Process and Thread Management	**08**
III	Distributed Deadlock Detection Introduction, preliminaries, deadlock handling strategies in distributed systems, issues in deadlock detection and resolution, centralized deadlock detection algorithms, distributed deadlock detection algorithms, hierarchical deadlock detection algorithms	**08**
IV	Distributed Resource Management Distributed file systems: Introduction, architecture, mechanisms for building distributed file systems, design issues, Log-structured file systems. Distributed shared memory: introduction, architecture and motivation, algorithms for implementing DSM, memory coherence, coherence protocols, design issues	**08**

V	Multiprocessor Operating Systems Introduction, structures of multiprocessor operating systems, operating system design issues, threads, process synchronization, process scheduling, memory management, reliability/fault tolerance * Case study: PintOS: Threads and Virtual memory	**08**

Course Outcomes:

Course outcome	Descriptions
CO1	Understand fundamental aspects of modern operating systems.
CO2	Analyze algorithms for deadlocks, resource management, and multiprocessor systems.
CO3	Design schemes for memory coherence and deadlock resolution using multi-processes and multithreading.
CO4	Implement mechanisms for process concurrency, distributed file systems, and shared memory across diverse operating systems.

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Operating Systems: Internals and Design Principles	William Stallings	Pearson Education Inc, 20012
2	Operating Systems,	Gary Nutt:	3rd Edition, Pearson, 2004

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Operating Systems,	Gary Nutt:	3rd Edition, Pearson, 2004

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Department: Computer Science and Engineering **Semester: II**

Subject: Cyber Security and Digital Forensics

Subject Code: 24CSE24 **L – T – P - C: 3–0–0–3**

Sl. No	Course Objectives
1	Gain the knowledge of cyber security that helps to understand the implications of cybercrime
2	Understand different types of Cyber-attacks with an overview on social engineering
3	Learn about password cracking, trojan horses, backdoors, types of phishing and its related techniques
4	Appreciate the concepts of cyber forensics and digital evidence

Unit	Description	Hrs
I	**Introduction to Cybercrime**: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, who are Cybercriminals? Classifications of Cybercrimes, Cybercrimes: An Indian Perspective, Hacking and the Indian Laws, A Global Perspective on Cybercrimes.	**08**
II	**Cyber offenses**: How Criminals Plan Them: Introduction, How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes. **Botnets:** The Fuel for Cybercrime.	**08**
III	**Tools and Methods Used in Cybercrime**: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDOS Attacks	**08**
IV	**Understanding Computer Forensics**: Introduction, Historical Background of Cyberforensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Digital Forensics Life cycle.	**08**
V	**Forensics of Handheld Devices:** Introduction, Understanding Cellphone Working Characteristics, Hand-Held Devices and Digital Forensics, Toolkits for Hand-Held Device Forensics, Forensics for iPods and Digital Music Devices, An illustration on Real Life Use of Forensics, Techno-Legal Challenges With Evidence from Hand-Held Devices, Organizational Guidelines on Cellphone Forensics	**08**

Course outcome:

Course outcome	Descriptions
CO1	Describe various cybercrimes and cyber laws
CO2	Explain different types of Cyber-attacks, Criminal plans and fuel for cybercrime.
CO3	Illustrate Tools and Methods used in Cybercrime.
CO4	Justify the Need of Computer Forensics.

Text Book:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Cyber Security: Understanding Cyber Crimes, Computer Forensicsand Legal Perspectives	Sunit Belapure,Nina Godbole	Ist Edition (Reprinted 2018), Wiley India Pvt Ltd,ISBN: 978-81- 265-21791

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Cybersecurity: Managing Systems, Conducting Testing, and Investigations	Thomas J. Mowbray	John Wiley & Sons, ISBN: 978-1-118-69711-5, 2014

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Department: Computer Science & Engineering **Semester: II**

Subject: Pattern Recognition

Subject Code: 24CSE251 **L – T – P - C:3–0–0–3**

Sl. No	Course Objectives
1	The design and construction and a pattern recognition system
2	The major approaches in statistical and pattern syntactic recognition. The student should also have somse exposure to the theoretical issues involved in pattern recognition system
3	Introduce basic concepts and major techniques in statistical pattern recognition.

Unit	Description	Hrs
I	Introduction: Definition of Pattern Recognition, Applications, Datasets for Pattern Recognition, Different paradigms for Pattern Recognition, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems.	**08**
II	Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation.	**08**
III	Nearest Neighbor based classifiers & Bayes classifier: Nearest neighbor algorithm, variants of algorithms, use of for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Bayesian belief network.	**08**
IV	Naive Bayes classifier, Bayesian belief network, Decision Trees: Introduction, DT for PR, Construction of DT, splitting at the nodes, over fitting & Pruning, Examples, Hidden Markov models: Markov models for classification, Hidden Markov models and classification using HMM.	**08**
V	Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, k-means,Isodata),clustering large datasets, examples, An application: Handwritten Digit recognition.	**08**

Course Outcomes:

Course outcome	Descriptions
CO1	Identify the different paradigms and statistical foundations of Pattern Recognition
CO2	Analyze the data structures and data abstraction techniques for Pattern Recognition
CO3	Review the hierarchical and partitioned clustering techniques and its application in Pattern Recognition
CO4	. Evaluate the use of Bayesian belief networks, decision trees and hidden Markov models for classification tasks

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Pattern Recognition	V Susheela Devi, M Narasimha Murthy	Universities Press, 2011.
2	Pattern Recognition and Image Analysis,	Earl Gose, Richard Johnsonbaugh, Steve Jost	PHI, 1996.

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Pattern Classification	Duda R. O., P.E. Hart, D.G. Stork,	John Wiley and sons,2000

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Department: Computer Science and Engineering **Semester: II**

Subject: High Performance Computing
Subject Code: 24CSE252 **L – T – P - C: 3–0-0–3**

Sl. No	Course Objectives
1	Study the architecture of computing technology.
2	Understand Parallel execution models and parallel programming
3	Learn computer intensive applications on HPC platform
4	Understands basics of CUDA architecture.

Unit	Description	Hrs
I	**Fundamentals of computer design** Introduction; Classes computers; Defining computer architecture; Trends in Technology; Trends in power in Integrated Circuits; Trends in cost; Dependability, Measuring, reporting and summarizing Performance attributes; Quantitative Principles of computer design	**08**
II	**Introduction to Parallel Programming** Motivation, Scope of Parallel Computing, Principles of Parallel Algorithm design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for containing Interaction Overheads, Parallel Algorithms Models	**08**
III	**Programming Using the Message Passing Paradigm** Principles of Message Passing Programming, Building Blocks, MPI, Topologies and Embedding, Overlapping Communication with computation, Collective Communication and computation operations, Groups and Communicators.	**08**
IV	**Overview of Open MP** Introduction, the idea of Open MP, the feature set, Open MP Language Features, Parallel Construct, Sharing the work among threads in an Open MP program, Clauses to control parallel and Work-Sharing Constructs, Open MP Synchronization Constructs.	**08**
V	GPU Architectures Introduction to Graphics Processing Units, Detecting and Enhancing Loop- Level Parallelism, Mobile versus Server GPUs and Tesla versus Core i7, GPU programming using CUDA	**08**

Course Outcomes:

Course outcome	Descriptions
CO1	Explore the fundamental concepts of parallel computer architecture
CO2	Analyze the performance of parallel programming
CO3	Design parallel computing constructs for solving complex problems.
CO4	Demonstrate parallel computing concepts for suitable applications

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1.	Computer Architecture: A Quantitative Approach,	John L Hennessy, David A Patterson	Elsevier, 5th Edition; 2011, ISBN: 9780123838728.
2.	Introduction to Parallel Computing	Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar	2nd edition, Pearson Education, 2007
3.	Parallel Programming with Open ACC,	Rob Farber	1st edition, 2016, ISBN :9780124103979
4.	Using Open MP Portable Shared Memory Parallel Programming	Barbara Chapman, Gabriele Jost, Ruud van der Pas	2008, The MIT Press, ISBN: 978-0-262-53302-7.

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	HighPerfornmance Cluster Computing:Architectures and systems	Rajkumar	Vol 1,Pearson Education
2	Advanced Computer Architecture:Parallelism,Scalability,Programmability	Kai Hwang	McGraw Hill International Editions

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Department: Computer Science & Engineering **Semester: II**

Subject: Deep Learning
Subject Code: 24CSE253 **L – T – P - C: 3–0–0–3**

Sl. No	Course Objectives
1	To understand the theoretical foundations, algorithms and methodologies of Neural Network.
2	To design and develop an application using specific deep learning models
3	To provide the practical knowledge in handling and analyzing real world applications
4	Develop and Train Deep Neural Networks.

Unit	Description	Hrs
I	**Deep learning concepts**: Fundamentals about Deep Learning. Perception Learning Algorithms. Probabilistic modeling. Early Neural Networks. How Deep Learning different from Machine Learning. Scalars, Vectors, Matrixes, Higher Dimensional Tensors. Manipulating Tensors. Vector Data. Time Series Data. Image Data. Video Data.	**8**
II	**Deep learning architectures:** Machine Learning and Deep Learning, Representation Learning, Width and Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders, Deep Learning Applications	**8**
III	**Neural networks:** About Neural Network. Building Blocks of Neural Network. Optimizers. Activation Functions. Loss Functions. Data Pre-processing for neural networks, Feature Engineering. Over fitting and Under fitting. Hyper parameters.	**8**
IV	**Transfer learning and deep generative models:** Deep Belief networks, Boltzmann Machines, Deep Boltzmann Machine, Generative Adversial Networks, Variants of CNN: DenseNet, PixelNet.	**8**
V	**Deep reinforcement & unsupervised learning:** About Deep Reinforcement Learning. Q-Learning. Deep Q-Network (DQN). Policy Gradient Methods. Actor- Critic Algorithm. About Auto encoding. Convolution Auto Encoding. Variational Tentative Auto Encoding, Auto encoders for Feature Extraction. Auto Encoders for Classification.	**8**

Course Outcomes:

Course outcome	Descriptions
CO1	Recognize the characteristics of deep learning models that are useful to solve real-world problems.
CO2	Understand different methodologies to create application using deep nets.
CO3	Identify and apply appropriate deep learning algorithms for analyzing the data for variety of problems.
CO4	Implement different deep learning algorithms.

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Deep Learning	IanGoodfellow, YoshuaBengio and Aaron Courville,	MIT Press, 2017
2	Deep Learning: A Practitioner's Approach	Josh Patterson, Adam Gibson	O'Reilly Media, 2017

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Machine Learning: A Probabilistic Perspective	Kevin P. Murphy	The MIT Press, 2012.
2	Introduction to Machine Learning	EthemAlpaydin	MIT Press, Prentice Hall of India, Third Edition 2014
3	Learn Keras for Deep Neural Networks	,Jojo Moolayil,	Apress,2018

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Department: Computer Science and Engineering **Semester: II**

Subject: Business Intelligence and Data Mining
Subject Code: 24CSE261 **L – T – P - C: 3– 0–0–3**

Sl. No	Course Objectives
1	Understand the basics of business intelligence.
2	To acquire the knowledge on Data warehousing techniques
3	Learn about data patterns and association rules
4	To know the basic concepts of classification and clustering

Unit	Description	Hrs
I	Introduction to Business Intelligence :Introduction to Data Information and knowledge, Data Decision Challenge, Operational vs Information Data, Introduction to Decision Support System, Introduction to Business Intelligence, Business Intelligent System Components, Business Models, Introduction to Data Warehouse, A Business analysis framework for DW.	**8**
II	Data Warehouse Introduction, Data warehouse modeling, Data warehouse design, Data warehouse technology, Distributed Data warehouse, index techniques, and materialized view.	**8**
III	Data Preprocessing and Cube Technology Introduction to Data Preprocessing, Data Cleaning, Data integration, data reduction, transformation and Data Discretization. Introduction to OLAP, Data Cube : A multidimensional model, data cube computation, data cube computation methods : multidimensional data analysis.	**8**
IV	Mining Frequent Patterns and Association Rule: Introduction to association rule, market basket analysis, frequent item set, apriori algorithm, parameter, a pattern growth approach, mining closed and max patterns, pattern evaluation, pattern mining in multilevel, multidimensional data space, pattern exploration and application.	**8**
V	Classification Basic concepts, decision tree, rule based classification, Bayesian belief networks, classification by back propagation, support vector machines, lazy learners – k-NN classifier, case based reasoning , model evaluation and selection , techniques to improve classification accuracy, multiclass classification, semi-supervised classification, ensemble methods. Clustering Analysis Cluster analysis, Partitioning methods, hierarchical methods, density-based methods, grid-based methods, clustering graph and network data, clustering with constrains, evaluation of clustering outliers and analysis, outlier detection methods, scalable clustering algorithms.	**8**

Course Outcomes:

Course outcome	Descriptions
CO1	Apply Business Intelligence concepts
CO2	Identify various data mining problems
CO3	Choose between classification and clustering solution
CO4	Write association rules for a given data pattern.

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Data mining concepts and techniques	Jawai Han, MichellineKamber, Jiran Pie	Morgan Kaufmann Publishers, 3rd Edition.
2	Business modeling and Data Mining	Dorian Pyle	Elsevier Publication

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Introduction to Data Mining	Vipin Kumar	Pang-Ning Tan , Pearson
2	Building the Data Warehouse,	William H Inmon,	Wiley Publication 4th Edition
3	Introduction to Business Intelligence & Data Warehousing	IBM, PHI	
4	Database Systems	Thomas Connolly, Carolyn Begg	Pearson 4th Edition.

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Department: Computer Science and Engineering **Semester: II**

Subject: Advanced Storage Area Networks

Subject Code: 24CSE262 **L – T – P - C: 3–0–0–3**

Sl. No	Course Objectives
1	Understand Storage Area Networks characteristics and components.
2	To have exposure on different input output techniques and file system
3	To acquire the knowledge on storage virtualization
4	To know about SAN Architecture and its software components.

Unit	Description	Hrs
I	**Introduction:** Server Centric IT Architecture and its Limitations, Storage – Centric IT Architecture and its advantages, Case study: Replacing a server with Storage Networks **Intelligent Disk Subsystems:** Architecture of Intelligent Disk Subsystems, Hard disks and Internal I/O Channels, JBOD, Storage virtualization using RAID and different RAID levels, Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.	**8**
II	**I/O Techniques:** The physical i/o path from the cpu to the storage system, SCSI: basics, storage networks, Fibre channel protocol stack: Links, ports and Topologies, FC0, FC1, FC2, FC3, Link and Fabric services, FC4 and ULPs, Fibre channel SAN: Point-to-point, Fabric and Arbitrated loop topology. Hardware components for Fibre channel SAN, InterSANs, and Interoperability of FC SAN.	**8**
III	IP Storage, File system and NAS IP Storage Standards: iSCSI, iFCP, mFCP, FCIP, and iSNS, TCP/IP and Ethernet as an I/O technology, Migration from SCSI and FC to IP storage. Local file systems: File systems and Databases, Journaling, Snapshots, Volume manager, Network file systems and file servers, Shared disk file systems, Comparison: NAS, FC SAN and iSCSI SAN.	**8**
IV	Storage Virtualization and Application of Storage Networks Definition of Storage virtualization, Implementation considerations, Storage virtualization on block or file level, Storage virtualization on various levels of the storage network, Symmetric and asymmetric storage virtualization in the network. Definition of the term 'Storage Network', Storage sharing: Disk storage pooling, Dynamic tape library sharing, Data sharing. Availability of Data	**8**

V	SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.	**8**

Course Outcomes:

Course outcome	Descriptions
CO1	Identify the need for performance evaluation and the metrics used for it
CO2	Apply the techniques used for data maintenance.
CO3	Realize strong virtualization concepts
CO4	Analyse the architecture of SAN

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Storage Networks Explained	Ulf Troppens, Rainer Erkens and Wolfgang Muller	Wiley India,2013
2	Storage Area Network Essentials: A Complete Guide to understanding and Implementing SANs	Richard Barker and Paul Massiglia	Wiley India,2006

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Information Storage and Management	G. Somasundaram, AlokShrivastava (Editors)	EMC Education Services, Wiley- India, 2009

Signature of the course coordinator **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

Department: Computer Science & Engineering **Semester: II**

Subject: Advanced Mobile Computing

Subject Code: 24CSE263 **L – T – P - C: 3–0–0–3**

Sl. No	Course Objectives
1	To acquire the knowledge of mobile communications and systems
2	To learn the constituent elements of mobile computing
3	To understand databases, data dissemination and broadcast systems in mobile computing
4	To appreciate the concepts of Mobile IP Network Layer and Mobile Transport Layer in mobile computing

Unit	Description	Hrs
I	**Mobile Communications-Overview:** Mobile computing; Mobile computing architecture; Mobile devices; Mobile system networks; Data dissemination; Mobility management; Mobile phones, Digital Music Players, Handheld Pocket Computers, Handheld Devices, Operating Systems, Smart Systems, Limitations of Mobile Devices, Automotive Systems.	**08**
II	**GSM and Similar Architectures:** GSM – Services and System Architectures, Radio Interfaces, Protocols, Localization, Calling, Handover, General Packet Radio Service, High-speed circuit-switched data, DECT.	**08**
III	**Mobile IP Network Layer and Mobile Transport Layer:**IP and Mobile IP Network Layers Packet Delivery and Handover Management, Registration, Tunneling and Encapsulation, Route Optimization, Dynamic Host Configuration Protocol. Indirect TCP, Snooping TCP, Mobile TCP, Other Methods of TCP – layer Transmission for Mobile Networks.	**08**
IV	**Databases:** Database Hoarding Techniques, Data Caching, Client – Server Computing and Adaptation, Transactional Models, Query Processing, Data Recovery Process, Issues relating to Quality of Service	**08**
V	**Data Dissemination and Broadcasting Systems**: Communication Asymmetry, Classification of Data – Delivery Mechanisms, Data VBroadcast Models, Selective Tuning and Indexing Techniques, Digital Audio Broadcasting, Digital video Broadcasting.	**08**

Course Outcomes:

Course outcome	Descriptions
CO1	Interpret various mobile communication techniques
CO2	Justify the need of Mobile IP Network Layer and Mobile Transport Layer in mobile computing
CO3	Analyze the performance of GSM systems
CO4	Analyze Data Dissemination and Broadcasting Systems used in mobile computing

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Mobile Computing	Raj Kamal	Oxford University Press, 2007.

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Mobile Computing Technology	Asoke Talkukder, Roopa R Yavagal	Applications and Service Creation, Tata McGraw Hill, 2007
2	Mobile Computing Principles	RezaB'Far	Designing and Developing Mobile Applications with UML and XML, Cambridge Universitypress, 5th Edition, 2006.
3	Uwe Hansmann, LothatMerk, Martin S Nicklous and Thomas Stober	Principles of Mobile Computing	Springer International Edition, Second Edition, 2005.
4	Schiller	Mobile Communication	Pearson Publication, 2004.

Signature of the course coordinator **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

Department: Computer Science & Engineering **Semester: II**

Subject: Cyber Security and Digital Forensics Lab

Subject Code: 24CSELB2 **L – T – P - C: 0–0–3– 1.5**

The following exercises have to be performed using various software tools/utilities mentioned software tools:

1. **Cyber check 4.0 – Academic version**
2. **Cyber CheckSuite**
3. **Mobile check**
4. **Network Session Analyser**
5. **Win LiFT**
6. **True Imager**
7. **True Traveller**
8. **PhotoExaminer 1.1**
9. **CDRAnalyzer**

Sl.No	Experiment Description
1	**Disk Forensics** 1. **Identify digital evidences** 2. **Acquire the evidence** 3. **Authenticate the evidence** 4. **Preserve the evidence** 5. **Analyze the evidence** 6. **Report the findings**

2	**Network Forensics** 1. **Intrusion detection** 2. **Logging (the best way to track down a hacker is to keep vast records of activity on a network with the help of an intrusion detection system)** 3. **Correlating intrusion detection and logging**
3	**Device Forensics** 1. **PDA** 2. **Mobile phone** 3. **Digital Music** 4. **Printer Forensics** 5. **Scanner Forensics**

Signature of the course coordinator **Signature of the HoD** **Signature of the Dean (Academic Affairs)**