R20

M. Tech – CSE

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY::PUTTUR
(AUTONOMOUS)
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
Specialization: Computer Science and Engineering

I M. Tech. – I Semester

S.No.	Course Code	Subject	L	T	P	C
1	20CS5001	Advanced Data Structures	3	-	-	3
2	20CS5002	Python Programming	3	-	-	3
Program Elective - I						
3	20CS5012	Software Engineering and Testing	3	-	-	3
	20CS5013	Wireless Sensor Networks				
	20CS5014	Introduction to Intelligent Systems				
Program Elective - II						
4	20CS5015	Data Science	3	-	-	3
	20CS5016	Distributed Systems				
	20CS5017	Advanced Wireless and Mobile Networks				
5	20HS0823	Research Methodology and IPR	2	-	-	2
6	20CS5003	Advanced Data Structures Lab	-	-	4	2
7	20CS5004	Python Programming Lab	-	-	4	2
Audit Course – I						
8	20HS0818	English for Research Paper Writing	2	-	-	-
Contact Periods / Week			16	-	08	**18**
			Total/Week 24			

I M. Tech. – II Semester

S.No.	Course Code	Subject	L	T	P	C
1	20CS5005	Machine Learning	3	-	-	3
2	20CS5006	Soft Computing	3	-	-	3
		Program Elective – III				
3	20CS5018	Grid and Cloud Computing	3	-	-	3
	20CS5019	Cyber Security				
	20CS5020	Computer Vision				
Program Elective – IV						
4	20CS5021	Human Computer Interaction	3	-	-	3
	20CS5022	GPU Computing				
	20CS5023	Digital Forensics				
5	20CS5007	Machine Learning Lab	-	-	4	2
6	20CS5008	Soft Computing Lab	-	-	4	2
7	20CS5009	Mini Project	2	-	-	2
Audit Course - II						
8	20HS0829	Constitution of India	2	-	-	-
Contact Periods / Week			16	-	08	**18**
			Total/Week 24			

II M. Tech. – I Semester (CSE)

S. No.	Course Code	Subject	L	T	P	C
Program Elective-V						
1	20CS5024	Big Data Analytics	3	0	0	3
	20CS5025	Distributed Databases				
	20CS5026	Advanced Operating Systems				
Open Elective						
2	20HS0824	Business Analytics	3	0	0	3
	20ME3026	Industrial Safety				
	20ME3027	Advances in Operations Research				
	20CE1028	Cost Management of Engineering Projects				
	20ME3028	Composite Materials				
	20EE2128	Waste to Energy				
3	20CS5010	Dissertation Phase-I	0	0	20	10
Contact Periods / Week			06	00	20	**16**
			Total/Week 26			

II M. Tech. – II Semester (CSE)

S.No.	Course Code	Subject	L	T	P	C
1.	20CS5011	Dissertation Phase-II	0	0	32	16
Contact Periods / Week			0	0	32	**16**
			Total/Week32			

Total Number of Credits=18+18+16+16=68

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I M. Tech – I Sem.

L	T	P	C
3	-	-	3

(20CS5001) ADVANCED DATA STRUCTURES

COURSE OBJECTIVES

The objectives of this course

1. *The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.*
2. *To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.*
3. *Student should be able to come up with analysis of efficiency and proofs of correctness.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Understand the implementation of symbol table using hashing techniques.*
2. *Develop and analyze algorithms for red-black trees, B-trees and Splay trees.*
3. *Develop algorithms for text processing applications.*
4. *Understand the recent trends in Hashing Technique.*
5. *Understand how to Applying Dynamic Programming to the LCS Problem*
6. *Identify suitable data structures and develop algorithms for computational geometry Problems.*

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

Computational Geometry: One Dimensional Range Searching - Two Dimensional Range Searching - Constructing a Priority Search Tree - Searching a Priority Search Tree - Priority Range Trees - Quad trees - k-D Trees.

UNIT-V

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

TEXT BOOKS

1. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C++*, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, *Algorithm Design*, John Wiley, 2002.

REFERENCES

1. Peter Brass, *Advanced Data Structures*, Cambridge University Press, ISBN: 9781107439825, 9781107439825.
2. G A V Pai, Seymour Lipschutz, Schaums Outlines, *Data Structures*, Tata McGraw Hill, ISBN: 9780070601680, 0070601682
3. Steven S Skiena**,** *The Algorithm Design Manual*, Kindle 2nd Edition.

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L	T	P	C
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(20CS5002) PYTHON PROGRAMMING

COURSE OBJECTIVES

The objectives of this course

1. *To get familiar with Scripting Language.*
2. *To have exposure to various problem solving approaches of computer science.*
3. *To introduce function-oriented programming paradigm.*
4. *To solve the problems using object oriented concepts, exceptional handling.*
5. *To solve the problems using Files, Regular Expressions and, Standard Libraries.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Make Software easily right out of the box*
2. *Solve the problems using control structures, input and output statements*
3. *Summarize the features of lists, tuples, dictionaries, strings and files*
4. *Experience the usage of standard libraries, objects, and modules*
5. *Build the software for real needs.*
6. *Understand different types of function-oriented programming.*

UNIT- I

Introduction: Algorithms, building blocks of flow-chart design, History of Python, Python features, Applications, Programming Using the REPL(Python Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

Data Types: Data Type, Types of data types: Single-Value and Multi-valued data types.

Single-Value data types: int, float, complex & boolean.

Multi-Valued Data types: Lists, Tuples, Sets, Dictionaries and String- indexing and slicing.

UNIT- II

Indexing and slicing: With respect to group data's

Operators and Expressions: Operators, Types of operators, Expressions and order of evaluations.

Control Flow: Branching- simple if, if else, nested if, elif, looping – while and for, Jumping - break, continue, pass

UNIT-III

Functions: Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), nested functions, recursive functions, Scope of the Variables in a Function - Global and Local Variables.

Object Oriented Programming in Python: Classes-class diagram, constructor, object, self-variable, Methods, Inheritance, polymorphism, method overloading, method overriding.

UNIT-IV

Modules: Creating modules, import statement, from Import statement, name spacing

Python packages: Introduction to PIP, Installing Packages via PIP (Numpy, Pandas, MatPlotlib etc..), Using Python Packages.

Exception Handling: Introduction, try except block, try else, finally, Raising Exceptions, User Defined Exceptions

Introduction to Regular Expressions: Searching and Matching

UNIT V

Functional Programming: Iterators and Generators, Maps and Filters

Files: text files, reading and writing files, command line arguments;

Brief Tour of the Standard Library: Dates and Times, Data Compression, Python Runtime Services – Mathematics - Data Management and Object Persistence

GUI Programming - Turtle Graphics

TEXT BOOKS

1. Vamsi Kurama, *Python Programming: A Modern Approach*, Pearson.
2. Reema Thareja, *Python Programming - Using Problem Solving Approach*, First Edition, Oxford University Press; First edition (10 June 2017).

REFERENCES

1. Mark Lutz, *Learning Python*, Orielly.
2. Allen Downey, *Think Python*, Green Tea Press.
3. W.Chun, *Core Python Programming*, Pearson.
4. Kenneth A. Lambert, *Introduction to Python*, Cengage.
5. Michael T. Goodrich , Roberto Tamassia, Michael H. Goldwasser, *Data Structures and Algorithms in Python*, 1st Edition, kindle.

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I M.Tech – I Sem.

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(20CS5012) SOFTWARE ENGINEERING AND TESTING
(PROGRAM ELECTIVE – I)

COURSE OBJECTIVES

The objectives of this course

1. *To understand the software life cycle model and SRS document*
2. *Basic software debugging methods*
3. *Knowing various testing methodologies, testing of domains and paths.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Define and develop a software project from requirement gathering to implementation*
2. *Ability to code and test the software*
3. *Understand the basic testing procedures*
4. *Generating test cases and test suites*
5. *Facilitate the dichotomies and taxonomy of bugs*
6. *Implementation of different types of testing*

UNIT - I

Software Process Models : The Evolving role of Software – Software – The changing Nature of Software – Legacy software – A generic view of process– A layered Technology – A Process Framework – The Capability Maturity Model Integration (CMMI) – Process Assessment – Personal and Team Process Models – Product and Process – Process Models – The Waterfall Model – Incremental Process Models – Incremental Model – The RAD Model – Evolutionary Process Models – Prototyping – The Spiral Model – The Concurrent Development Model – Specialized Process Models – the Unified Process.

UNIT - II

Requirement Engineering : Software Engineering Practice – communication Practice – Planning practice - Modeling practice– Construction Practice –Deployment - Requirements Engineering - Requirements Engineering tasks – Initiating the requirements Engineering Process- Eliciting Requirements – Developing Use cases – Building the Analysis Models – Elements of the Analysis Model – Analysis pattern – Negotiating Requirements – Validating Requirements.

UNIT – III

Analysis Modeling: Requirements Analysis – Analysis Modeling approaches – Data Modeling Concepts – Object Oriented Analysis – Scenario based Modeling – Flow Oriented Modeling – Class based Modeling

Design &Implementation: Architectural Design – Detailed Design - Design process -Design Quality Design model - User interface Design – Implementation

UNIT IV

Introduction: Purpose of testing, Dichotomies, model for testing, Taxonomy of Bugs - consequences of bugs, taxonomy for Bugs.

Flow Graphs And Path Testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT V

Transaction Flow Testing: Transaction flows, transaction flow testing techniques.

Dataflow Testing: Basics of data flow testing, strategies in dataflow testing, application of data flow testing.

Domain Testing: Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interface testing, Domains and Testability.

TEXT BOOKS

1. Roger S. Pressman, *Software Engineering A practitioner's Approach*, Seventh Edition, 2009 McGraw Hill International Edition.
2. Boris Beizer, *Software Testing techniques*, Dreamtech Publishers, second edition.

REFERENCES

1. Ian Sommerville, *Software Engineering*, 8th Edition, Pearson Education, 2008.
2. Richard Fairley, *Software Engineering Concepts*, McGraw Hill, 2004.
3. Stephan Schach, *Software Engineering*, Tata McGraw Hill, 2007.
4. Pfleeger and Lawrence, Software *Engineering: Theory and Practice*, Pearson Education,2nd, 2001

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(20CS0513) WIRELESS SENSOR NETWORKS
(PROGRAM ELECTIVE – I)

COURSE OBJECTIVES

The objectives of this course

1. *To understand the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.*
2. *To devise appropriate data dissemination protocols and model links cost.*
3. *To design sensor networks for various application setups.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Describe and explain radio standards and communication protocols for wireless sensor networks.*
2. *Explain the function of the node architecture and use of sensors for various applications.*
3. *Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms.*
4. *Be familiar with MAC Protocol Analysis.*
5. *Describe the security system in wireless sensor networks.*
6. *Evaluate the performance of sensor networks and identify bottlenecks.*

UNIT-I

Introduction to Wireless Sensor Networks: Course Information - Introduction to Wireless Sensor Networks – Motivations – Applications - Performance metrics - History and Design factors.

Network Architecture: Traditional layered stack - Cross-Layer designs - Sensor Network Architecture.

Hardware Platforms: Motes - Hardware parameters.

UNIT-II

Introduction to NS-3: Introduction to Network Simulator 3 (NS-3) - Description of the NS - 3 core module and simulation example.

UNIT-III

Medium Access Control Protocol design: Fixed Access-Random Access -WSN protocols: Synchronized Duty-cycled

Introduction to Markov Chain: Discrete time Markov Chain definition–Properties - Classification and analysis.

MAC Protocol Analysis - Asynchronous duty-cycled - X-MAC Analysis (Markov Chain)

UNIT-IV

Security - Possible attacks – Countermeasures – SPINS - Static and Dynamic key

Routing protocols: Introduction - MANET protocols

Routing protocols for WSN: Resource-aware routing - Data-Centric–Geographic Routing - Broadcast - Multicast

UNIT-V

Opportunistic Routing Analysis: Analysis of opportunistic routing (Markov Chain) - Advanced topics in wireless sensor networks - Recent development in WSN standards - Software applications.

TEXT BOOKS

1. W.Dargie and C.Poellabauer, *Fundamentals of Wireless Sensor Networks–Theory and Practice*, Wiley Publications, 2010.
2. KazemSohraby, Daniel Minoli and TaiebZnati, *Wireless sensor networks -Technology, Protocols, and Applications*, Wiley, Inter science 2007.

REFERENCES

1. Takahiro Hara, Vladimir I.Zadorozhny, and Erik Buchmann, *Wireless Sensor Network Technologies for the Information Explosion Era*, springer 2010.
2. Ananthram Swami, Qing Zhao, Yao-Win Hang, Lang Tong, *Wireless Sensor Networks*, Hardcover Edition, 2009.
3. C.Siva Ram Murthy and B.S.Murthy, *Adhoc Wireless Networks*, Pearson Education, 2006.

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(20CS5014) INTRODUCTION TO INTELLIGENT SYSTEMS
(PROGRAM ELECTIVE - I)

COURSE OBJECTIVES

The objectives of this course

1. *To introduce to the field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach.*
2. *To explore the essential theory behind methodologies for developing systems that demonstrate intelligent behaviour including dealing with uncertainty, learning from experience and following problem solving strategies found in nature.*
3. *To study different learning and evolutionary algorithms.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Demonstrate knowledge of the fundamental principles of intelligent systems.*
2. *Analyses and compare the relative merits of a variety of AI problem solving techniques.*
3. *Understand Biological foundations to intelligent systems.*
4. *Demonstrate Knowledge of genetic algorithm.*
5. *Understand Learning Techniques on uncertainty reasoning.*
6. *Study of different learning and evolutionary algorithms.*

UNIT-I

Biological foundations to intelligent systems I - Artificial neural networks - Back-propagation networks - Radial basis function networks - Recurrent networks.

UNIT-II

Biological foundations to intelligent systems II-Fuzzy logic - Knowledge Representation and inference mechanism - Genetic algorithm - Fuzzy neural networks.

UNIT-III

Search Methods: Basic concepts of graph and tree search - Three simple search methods - Breadth-First search - Depth-first search - Iterative deepening search.

Heuristic search methods - Best-first search - Admissible evaluation functions - Hill-climbing search - Optimization and search such as Stochastic annealing and Genetic algorithm.

UNIT-IV

Knowledge representation and logical inference Issues in knowledge representation - Structured representation such as Frames – Scripts - Semantic networks and Conceptual graphs - Formal logic and Logical inference.

Knowledge based systems structures - Its basic components-Ideas of Blackboard architectures.

UNIT-V

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

TEXT BOOKS

1. Luger G.F. and Stubblefield W.A., *Artificial Intelligence*, Addison Wesley, 6th edition (2008).
2. Russell S. and Norvig P, *Artificial Intelligence: A Modern Approach* , Prentice-Hall, 3rd edition, 2009.

REFERENCES

1. Crina Grosan, Ajith Abraham, *Intelligent Systems: A Modern Approach*, Springer, 2011.
2. Danis Rothman, *Artificial Intelligence by Example*, Packt Publishing Pvt Ltd, ISBN: 9781788990547, 1788990544
3. Gabor Szederkenyi, R.Lakner, M.Gerzson, *Intelligent Control Systems: An Introduction with Examples*, Kindle Edition, 2013

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I M. Tech – I Sem.

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3	-	-	3

(20CS5015) DATA SCIENCE
(PROGRAM ELECTIVE – II)

COURSE OBJECTIVES

The objectives of this course

1. *To provide the knowledge and expertise to become a proficient data scientist.*
2. *To demonstrate an understanding of statistics and machine learning concepts that are vital for data science;*
3. *To critically evaluate data visualizations based on their design and use for communicating stories from data*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Explain how data is collected, managed and stored for data science.*
2. *Understand the key concepts in data science, including their real-world applications.*
3. *Use of different types of toolkit used by data scientists.*
4. *Implement data collection and management scripts using Mongo DB.*
5. *Understand the different type of Data visualization tools.*
6. *Understand the different application of Data Science.*

UNIT-I

Introduction to core concepts and technologies- Introduction- Terminology- Data science process-Data science toolkit- Types of data - Example applications.

UNIT-II

Data collection and management – Introduction - Sources of data - Data collection and APIs - Exploring and fixing data - Data storage and management - Using multiple data sources

UNIT–III

Data analysis - Introduction-Terminology and concepts - Introduction to statistics - Central tendencies and distributions – Variance - Distribution properties and arithmetic - Samples/CLT - Basic machine learning algorithms - Linear regression – SVM - Naive Bayes.

UNIT-IV

Data visualization: Introduction - Types of data visualization -Data for visualization: Data types - Data encodings - Retinal variables - Mapping variables to encodings - Visual encodings.

UNIT-V

Applications of Data Science - Recent trends in various data collection and analysis techniques - Various visualization techniques - Application development methods of used in data science.

TEXT BOOKS

1. Cathy O'Neil and Rachel Schutt, *Doing Data Science,* Straight Talk From The Frontline, O'Reilly.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, *Mining of Massive Datasets,* v2.1, Cambridge University Press.

REFERENCES

1. Sinan Ozdemir, *Principles of Data Science*, Packt Publishing pvt. Ltd, 2016.
2. Joel GrusO'Reilly, *Data Science from Scratch*, Second Edition, 2019
3. Sinan Ozdemir, *Principles of Data Science,* Packt Publications Pvt. Ltd, 2016.

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I M. Tech – I Sem.

L	T	P	C
3	-	-	3

(20CS5016) DISTRIBUTED SYSTEMS
(PROGRAM ELECTIVE – II)

COURSE OBJECTIVES

The objectives of this course

1. *To explain what a distributed system is, why you would design a system as a distributed system, and what the desired properties of such systems are.*
2. *To list the principles underlying the functioning of distributed systems, describe the problems and challenges associated with these principles, and evaluate the effectiveness and shortcomings of their solutions.*
3. *To recognize how the principles are applied in contemporary distributed systems, explain how they affect the software design, and be able to identify features and design decisions that may cause problems.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Demonstrate knowledge of the basic elements and concepts related to distributed system technologies;*
2. *Demonstrate knowledge of the core architectural aspects of distributed systems;*
3. *Design and implement distributed applications;*
4. *Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems);*
5. *Use and apply important methods in distributed systems to support scalability and fault tolerance;*
6. *Demonstrate experience in building large-scale distributed applications.*

UNIT- I

Characterization of Distributed Systems: Introduction - Examples - Resource Sharing and the Web - Challenges - System Models - Architectural – Fundamental - Inter process Communication - Introduction - API for Internet protocols - External data representation and marshaling - Client -server communication - Group communication - Case study-Interprocess Communication in UNIX.

UNIT- II

Distributed Objects and Remote Invocation: Introduction - Communication between distributed objects - Remote procedure calls - Events and notifications - Case study- Java RMI. Operating System Support - Introduction - OS layer - Protection - Processes and threads - Communication and invocation OS architecture.

UNIT- III

Distributed File Systems: Introduction - File service architecture - Case Study: Sun Network File System - Enhancements and further developments. Name Services - Introduction - Name Services and the Domain Name System - Directory Services - **Case Study**: Global Name Service.

UNIT- IV

Time and Global States: Introduction - Clocks, events and process states - Synchronizing physical clocks - Logical time and logical clocks - Global states - Distributed debugging. Coordination and Agreement - Introduction - Distributed mutual exclusion - Elections - Multicast communication - Consensus and related problems.

UNIT- V

Distributed Shared Memory: Introduction - Design and implementation issues – Sequential consistency and Ivy case study Release consistency and Munin case study - Other consistency models. CORBA Case Study - Introduction - CORBA RMI - CORBA services.

TEXT BOOKS

1. George Coulouris, Jean Dollimore, Tim Kindberg, *Distributed Systems: Concepts and Design*, 4th Edition, Pearson Education.
2. S.Ghosh, Chapman & Hall/CRC, Taylor & Francis Group, *Distributed Systems*,2010.

REFERENCES

1. A.S. Tanenbaum and M. V. Steen, Prentice Hall,*Distributed Systems: Principles and Paradigms,* Second Edition, 2006.
2. M.L.Liu Pearson Addison Wesley, *Distributed Computing Principles and Applications*, 2004.
3. MukeshSinghal, *Advanced Concepts In Operating Systems*, McGraw Hill Series in Computer Science, 1994.
4. Nancy A.Lynch, *Distributed Algorithms, The Morgan Kaufmann Series in Data Management System,* Morgan Kaufmann Publishers, 2000.

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I M. Tech – I Sem.

L	T	P	C
3	-	-	3

(20CS5017) ADVANCED WIRELESS AND MOBILE NETWORKS (PROGRAM ELECTIVE-II)

COURSE OBJECTIVES

The objectives of this course

1. *To get familiar with key concepts of wireless networks, standards, technologies and their basic operations*
2. *To learn how to design and analyze various medium access*
3. *To learn how to evaluate MAC and network protocols using network simulation software tools.*
4. *The students should get familiar with the wireless/mobile market and the future needs and challenges.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Demonstrate advanced knowledge of networking and wireless networking, understand various types of wireless networks, standards, operations, and use cases.*
2. *Design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.*
3. *Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.*
4. *Design wireless networks exploring trade-offs between wire line and wireless links.*
5. *Develop mobile applications to solve some of the real world problems.*
6. *Understand Security in wireless Networks.*

UNIT- I

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

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

UNIT- II

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

UNIT- III

WiMAX (Physical layer, Media access control, Mobility and Networking) - IEEE 802.22 Wireless Regional Area Networks - IEEE 802.21 Media Independent Handover Overview. **WIRELESS SENSOR NETWORKS:** Introduction–Application–Physical - MAC layer and Network Layer - Power Management - Tiny OS Overview.

UNIT- IV

WIRELESS PANs: Bluetooth AND Zigbee - Introduction to Wireless Sensors.

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

UNIT- V

ADVANCED TOPICS: IEEE 802.11x and IEEE 802.11i standards - Introduction to Vehicular Adhoc Networks.

TEXT BOOKS

1. Schiller J., *Mobile Communications* , Addison Wesley 2000
2. Stallings W, *Wireless Communications and Networks*, Pearson Education 2005

REFERENCES

1. Stojmenic Ivan, *Handbook of Wireless Networks and Mobile Computing*, John Wiley and Sons Inc, 2002
2. Yi Bing Lin and ImrichChlamtac, *Wireless and Mobile Network Architectures*, John Wiley and Sons Inc, 2000
3. Pandya Raj, *Mobile and Personal Communications Systems and Services*, PHI 2000

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I M. Tech – I Sem.

L	T	P	C
2	-	-	2

(20HS0823) RESEARCH METHODOLOGY AND IPR

COURSE OBJECTIVES

The objectives of this course

1. *Understand some basic concepts of research and its methodologies.*
2. *Identify and discuss appropriate research topics, select appropriate research design, and implement a research project.*
3. *Understand the intricacies of grant of patent, patentability, licensing and revocation at national and international level.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Explain the key concepts and issues in research and basic framework of research process.*
2. *Formulate appropriate research problem and implement suitable research design for the research problem.*
3. *Identify various sources of information for literature review and data collection.*
4. *Develop an understanding of ethics in conducting applied research and make use of components of scholarly writing in report preparation.*
5. *Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.*
6. *Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.*

UNIT - I

Research Methodology: Meaning, Objective and importance of research - Types of research - steps involved in research - Motivation in Research, Types of Research - Significance of Research - Research Methods versus Methodology - Importance of Knowing How Research is done - Research Process - Criteria of Good Research defining research problem - Errors in selecting a research problem

UNIT - II

Research Design and Data Collection: Research design - Different Research Designs - Effective literature studies - Classification of Data - Methods of Data Collection – Sampling - Sampling techniques, procedure and methods - Ethical considerations in research - Responsibility of ethics in research

UNIT - III

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

UNIT - IV

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

UNIT - V

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

TEXT BOOKS

1. Dr. C. R. Kothari, &Gaurav Garg*"Research Methodology: Methods and Techniques"*, Fourth Edition, New Age International Publisher, 2019.
2. Dr. Ramesh Shahabdakar and Dr. S SaiSatyanarayan Reddy, *"Intellectual Property Rights"* 1st Edition, Notion Press, 2019

REFERENCES

1. Ranjit Kumar, *"Research Methodology: A Step by Step Guide for beginners*", 4th Edition, SAGE Publications, 2014
2. DK Bhattacharya, *"Research Methodology",* Excel Books, 2004.
3. R. Pannerselvam, *"Research Methodology",* 2nd Edition, PHI, 2013.
4. Kalyan C. Kankanala, *"Fundamentals of Intellectual Property",* 1st Edition, Asia Law House, 2012.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, *"Intellectual Property in New Technological Age"*, Volume1 Perspectives, Trade Secrets and Patents, Claus8 Publishing, 2017.

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(20CS5003) ADVANCED DATA STRUCTURES LAB

COURSE OBJECTIVES

The objectives of this course

1. *To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.*
2. *To choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.*
3. *Student should be able to come up with analysis of efficiency and proofs of correctness.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Understand the implementation of symbol table using hashing techniques.*
2. *Develop and analyze algorithms for red-black trees, B-trees and Splay trees.*
3. *Develop algorithms for text processing applications.*
4. *Develop the recent trends in Hashing Technique.*
5. *Identify suitable data structures and develop algorithms for computational geometry Problems.*
6. *Implement various sorting, and graph traversal techniques.*

LIST OF EXPERIMENTS:

1. Write Java programs that use both recursive and non-recursive functions for implementing the following searching methods:
   a) Linear search b) Binary search
2. Write Java programs to implement the following using an array.
   a) Stack ADT b) Queue ADT
3. Write a Java program that reads an infix expression and converts the expression to postfix form. (Use stack ADT).
4. Write a Java program to implement circular queue ADT using an array.
5. Write Java programs to implement the following using a singly linked list.
   a) Stack ADT b) Queue ADT
6. Write Java programs to implement the deque (double ended queue) ADT using
   a) Array b) Singly linked list c) Doubly linked list.
7. Write a Java program to implement priority queue ADT.
8. Write a Java program to perform the following operations:
   a) Construct a binary search tree of elements.
   b) Search for a key element in the above binary search tree.
   c) Delete an element from the above binary search tree.
9. Write a Java program to implement all the functions of a dictionary (ADT) using Hashing.

10. Write a Java program to implement Dijkstra's algorithm for Single source shortest path problem.
11. Write Java programs that use recursive and non-recursive functions to traverse the given binary tree in
    a) Preorder b) Inorder c) Postorder
12. Write Java programs for the implementation of BFS and DFS for a given graph.
13. Write Java programs for implementing the following sorting methods:
    a) Bubble sort b) Merge sort c) Binary tree sort
    d) Insertion sort e) Heap sort f) Quick sort
    g) Radix sort
14. Write a Java program to perform the following operations:
    a) Insertion into a B-tree b) Searching in a B-tree.
15. Write a Java program that implements Kruskal's algorithm to generate minimum cost spanning tree.
16. Write a Java program that implements KMP algorithm for pattern matching.

TEXT BOOKS

1. S.Sahni, *Data structures, Algorithms and Applications in Java,* Universities Press.
2. Adam Drozdek, *Data structures and Algorithms in Java*,3rd edition, Cengage Learning.

REFERENCES

1. M.A.Weiss, *Data structures and Algorithm Analysis in Java*, 2nd edition, Addison.
2. Peter Brass, *Advanced Data Structures*, Cambridge University Press, ISBN: 9781107439825, 9781107439825.
3. G A V Pai, Seymour Lipschutz, Schaums Outlines, *Data Structures*, Tata McGraw. Hill, ISBN: 9720070601680, 0070601682
4. Steven S Skiena**,** *The Algorithm Design Manual*, Kindle 2nd Edition.

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(20CS5004) PYTHON PROGRAMMING LAB

COURSE OBJECTIVES

The Objectives of this course

1. *Exposure to various problem solving approaches of computer science*
2. *Learn how to carry out a range of commonly used statistical methods including analysis of variance and linear regression.*
3. *Explore data-sets to create testable hypotheses and identify appropriate statistical tests.*

COURSE OUTCOMES

On successful completion of the course students will be able to

1. *Write, Test and Debug Python Programs*
2. *Implement Conditionals and Loops for Python Programs*
3. *Use functions and represent Compound data using Lists, Tuples and Dictionaries*
4. *Read and write data from & to files in Python and develop Application using Pygame*
5. *Build software for real needs.*
6. *Ability to work on a real life Project, implementing R Analytics to create Business insights.*

LIST OF EXPERIMENTS

1. Implement the following tasks

a) Write a python program to check whether the number is positive or negative.

b) Write a python program to find whether a given number is even or odd.

c) Write a python program to find biggest number among three numbers.

2. Implement the following tasks

a) Write a python program to displaying reversal of a number.

b) Write a python program to print factorial of a number

c) Write a python program to generate prime numbers series up to N

3. Implement following problems using python script

a) Swapping of two number with and without using temporary variable.

b) If the age of Ram, Sam, and Khan are input through the keyboard, write a python program to determine the eldest and youngest of the three.

c) Arithmetic operations (Addition, Subtraction, Multiplication, and Division) on integers. Input the two integer values and operator for performing arithmetic operation through keyboard.

4. Implement the following tasks

a) Implement the python program to generate the multiplication table.

b) Implement Python program to find sum of natural numbers

c) If the first name of a student is input through the keyboard, write a program to display the vowels and consonants present in his/her name.

5. Implement the following tasks
   a) The marks obtained by a student in 5 different subjects are input through the keyboard. Find the average and print the student grade as per the SISTK examination policy.
   b) Given a number x, determine whether it is Armstrong number or not. Hint: For example, 371 is an Armstrong number since 3**3 + 7**3 + 1**3 = 371. Write a program to find all Armstrong number in the range of 0 and 999.
6. Implement the following tasks
   a) Write a Python script to
- create a list
- access elements from a list
- slice lists
- change or add elements to a list
- delete or remove elements from a list

   b) Write a Python script to read the values from a list and to display largest and smallest numbers from list.
   c) Write a Python script to compute the similarity between two lists.
7. Implement the following tasks
   a) Write a Python script to read set of values from a Tuple to perform various operations.
   b) Write a Python script to perform basic dictionary operations like insert, delete and display.
   c) Write a Python program to count the occurrence of each word in a given sentence.
8. Implement the following tasks
   a) Write a Python script to create Telephone Directory using dictionary and list to perform basic functions such as Add entry, Search, Delete entry, Update entry, View and Exit.
   b) Implement Python script to display power of given numbers using function.
   c) Implement a Python program that takes a list of words and returns the length of the longest one using function.
9. Implement the following tasks
   a) Implement Python program to perform various operations on string using string libraries.
   b) Implement Python program to remove punctuations from a given string.
   c) Write a Python program to change the case of the given string (convert the string from lower case to upper case). If the entered string is “computer”, your program should output “COMPUTER” without using library functions.
10. Implement the following tasks
    a) Implement Python program to capitalize each word in a string. For example, the entered sentence “god helps only people who work hard” to be converted as “God Helps Only People Who Work Hard”
    b) Write a Python script to display file contents.
    c) Write a Python script to copy file contents from one file to another.
11. Implement the following tasks
    a) Write a Python script to combine two text files contents and print the number of lines, sentences, words, characters and file size.

b) Write a Python commands to perform the following directory operations.

- List Directories and Files
- Making a New Directory
- Renaming a Directory or a File
- Removing Directory or File

12. Implement the following tasks

a) Create a package named Cars and build three modules in it namely, BMW, Audi and Nissan. Illustrate the modules using class. Finally we create the __init__.py file. This file will be placed inside Cars directory and can be left blank or we can put the initialization code into it.

b) Write a python script to display following shapes using turtle.

TEXT BOOKS

1. Vamsi Kurama, *Python Programming: A Modern Approach,* Pearson.
2. Reema Thareja, *Python Programming - Using Problem Solving Approach*, First Edition, Oxford University Press; First edition (10 June 2017).

REFERENCES

1. Mark Lutz, *Learning Python*, Orielly.
2. Allen Downey, *Think Python*, Green Tea Press.
3. W.Chun, *Core Python Programming*, Pearson.
4. Kenneth A. Lambert, *Introduction to Python*, Cengage.
5. Michael T. Goodrich , Roberto Tamassia, Michael H. Goldwasser, *Data Structures and Algorithms in Python*, 1st Edition , kindle.

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(20HS0818) ENGLISH FOR RESEARCH PAPER WRITING
(AUDIT COURSE – I)

COURSE OBJECTIVES

The objectives of this course:

1. *Understand that how to improve your writing skills and level of readability.*
2. *Learn about what to write in each section.*
3. *Understand the skills needed when writing a Title.*
4. *Ensure the good quality of paper at very first-time submission.*
5. *Understand critical thinking in research writing*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *To familiarize students with the key concepts of linguistics and develop awareness of the latest trends in language study*
2. *To lead to a greater understanding of the human communicative action through an objective study of language*
3. *To know and appreciate the location of literature within humanities*
4. *To gain knowledge of research methods in literary studies and advanced knowledge of literature in the English language and literary theory*
5. *To carry out an independent, limited research project under supervision, in accordance with applicable norms, ideals and conditions for literary research.*
6. *To improve common and basic scholarly requirements of logical and empirical rigor.*

UNIT-I

Planning and Preparation, Word Order, Breaking up long sentences, StructuringParagraphs and Sentences, Being Concise and Removing Redundancy, AvoidingAmbiguity and Vagueness.

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

Skills needed when writing the Methods, skills needed when writing the Results, skills needed when writing the Discussion, skills needed when writing the Conclusions.

TEXT BOOK

1. Goldbort R *Writing for Science,* Yale University Press. 2006

2. Day R *How to Write and Publish a Scientific Paper,* Cambridge University Press. 2006

REFERENCES

1. Highman N *Handbook of Writing for the Mathematical Sciences,* SIAM. Highman's Books, 1998

2. Adrian Wall work , *English for Writing Research Papers,* Springer New York Dordrecht. Heidelberg London, 2011.

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(20CS5005) MACHINE LEARNING

COURSE OBJECTIVES

The objectives of this course

1. *To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.*
2. *To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.*
3. *Explore supervised and unsupervised learning paradigms of machine learning.*
4. *To explore Deep learning technique and various feature extraction strategies*.

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Extract features that can be used for a particular machine learning approach in various IOT Applications.*
2. *Compare and contrast pros and cons of various machine learning techniques*
3. *Get an Insight of when to apply a particular machine learning approach.*
4. *Mathematically analyze various machine learning approaches and paradigms.*
5. *Understand the classification methods for IOT applications.*
6. *Understand trends in various learning techniques of machine learning*

UNIT-I

Supervised Learning (Regression/Classification): Basic methods - Distance-based methods- Nearest-Neighbours - Decision-Trees - Naive Bayes - Linear models - Linear Regression - Logistic Regression - Generalized Linear Models - Support Vector Machines - Nonlinearity and Kernel Methods - Beyond Binary Classification - Multi-class/Structured Outputs - Ranking

UNIT-II

Unsupervised Learning: Clustering - K-means/Kernel K-means - Dimensionality Reduction -PCA and kernel PCA - Matrix Factorization and Matrix Completion - Generative Models (mixture models and latent factor models)

UNIT-III

Evaluating Machine Learning algorithms and Model Selection - Introduction to Statistical Learning Theory - Ensemble Methods (Boosting, Bagging- Random Forests)

UNIT-IV

Sparse Modeling and Estimation - Modeling Sequence/Time-Series Data - Deep Learning and Feature Representation Learning Scalable Machine Learning (Online and Distributed Learning) a selection from some other advanced topics - e.g.- Semi-supervised Learning - Active Learning - Reinforcement Learning - Inference in Graphical Models - Introduction to Bayesian Learning and Inference.

UNIT-V

Recent trends in various learning techniques of machine learning and classification methods for IOT applications - Various models for IOT applications.

TEXT BOOKS

1. Kevin Murphy, *Machine Learning: A Probabilistic Perspective*, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, *The Elements of Statistical Learning*, Springer 2009 (freely available online).

REFERENCES

1. Christopher Bishop, *Pattern Recognition and Machine Learning*, Springer, 2007.
2. Tomm, Mitchell , *Machine Learning*, Tata McGraw Hill, 2017
3. ShaiShalev - Scwartz, Sai Ben David, *Understanding Machine Learning: From Theory to Algorithms*, Kindle Edition, 2015

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(20CS5006) SOFT COMPUTING

COURSE OBJECTIVES

The objectives of this course

1. *To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.*
2. *To implement soft computing based solutions for real-world problems.*
3. *To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.*
4. *To provide student an hand-on experience on MATLAB to implement various strategies.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Identify and describe soft computing techniques and their roles in building intelligent machines*
2. *Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.*
3. *Apply genetic algorithms to combinatorial optimization problems.*
4. *Evaluate and compare solutions by various soft computing approaches for a given problem*
5. *Apply Machine Learning Approach to Knowledge Acquisition*
6. *Execute various strategies using MATLAB..*

UNIT-I

INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS: Evolution of Computing: Soft Computing Constituents - From Conventional AI to Computational Intelligence: Machine Learning Basics.

UNIT-II

FUZZY LOGIC: Fuzzy Sets - Operations on Fuzzy Sets - Fuzzy Relations – Membership Functions: Fuzzy Rules and Fuzzy Reasoning - Fuzzy Inference Systems - Fuzzy Expert Systems- Fuzzy Decision Making.

UNIT-III

NEURAL NETWORKS: Machine Learning Using Neural Network - Adaptive Networks - Feed forward Networks - Supervised Learning Neural Networks - Radial Basis Function Networks: Reinforcement Learning-Unsupervised Learning Neural Networks - Adaptive Resonance architectures - Advances in Neural networks.

UNIT-IV

GENETIC ALGORITHMS: Introduction to Genetic Algorithms (GA) - Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.

UNIT-V

Mat lab/Python Lib: Introduction to Matlab/Python - Arrays and array operations -Functions and Files - Study of neural network toolbox and fuzzy logic toolbox - Simple implementation of Artificial Neural Network and Fuzzy Logic - Recent Trends in deep learning - various classifiers-neural networks and genetic algorithm - Implementation of recently proposed soft computing techniques.

TEXT BOOKS

1. Jyh:Shing Roger Jang, Chuen, Tsai Sun, EijiMizutani, *Neuro: Fuzzy and Soft Computing*, Prentice: Hall of India, 2003.
2. George J. Klir and Bo Yuan, *Fuzzy Sets and Fuzzy Logic: Theory and Applications*, Prentice Hall, 1995.

REFERENCES

1. N P Padhy, S.P.Simon, *Soft Computing with MATLAB Programming*, Oxford Publications, 2015.
2. S.N.Sivanandam, S.N.Deepa, *Principles of Soft Computing*, Wiley Publications, Second Edition, 2011.
3. *MATLAB Toolkit Manual.*

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(20CS5018) GRID AND CLOUD COMPUTING
(PROGRAM ELECTIVE-III)

COURSE OBJECTIVES

The objectives of this course

1. *To understand how Grid computing helps in solving large-scale scientific problems.*
2. *To gain knowledge on the concept of virtualization that is fundamental to cloud computing.*
3. *To learn how to program the grid and the cloud.*
4. *To understand the security issues in the grid and the cloud environment.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Understand the Cloud environment and its real time utilization.*
2. *Use the grid and cloud tool kits.*
3. *Apply the concept of virtualization.*
4. *Apply grid-computing techniques to solve large-scale scientific problems.*
5. *Analyze the security issues in the grid and the cloud environment.*
6. *Understand the Hadoop framework adaption in cloud environment.*

UNIT-I

INTRODUCTION: Evolution of Distributed computing: Scalable computing over the Internet – Technologies for network based systems – clusters of cooperative computers - Grid computing Infrastructures – cloud computing - service oriented architecture – Introduction to Grid Architecture and standards – Elements of Grid – Overview of Grid Architecture.

UNIT-II

GRID SERVICES: Introduction to Open Grid Services Architecture (OGSA) – Motivation – Functionality Requirements – Practical & Detailed view of OGSA/OGSI – Data intensive grid service models – OGSA services.

UNIT-III

VIRTUALIZATION : Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software - Pros and Cons of cloud computing – Implementation levels of virtualization – virtualization

structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation.

UNIT-IV

PROGRAMMING MODEL : Open source grid middleware packages – Globus Toolkit (GT4) Architecture , Configuration – Usage of Globus – Main components and Programming model - Introduction to Hadoop Framework - Map reduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Design of Hadoop file system, HDFS concepts, command line and java interface, dataflow of File read & File write.

UNIT-V

SECURITY: Trust models for Grid security environment – Authentication and Authorization methods – Grid security infrastructure – Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud, Key privacy issues in the cloud.

TEXT BOOK

1. Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, *Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet*, First Edition, Morgan Kaufman Publisher, an Imprint of Elsevier, 2012.

REFERENCES

1. Jason Venner, *Pro Hadoop- Build Scalable, Distributed Applications in the Cloud*, A Press, 2009
2. Tom White, *Hadoop The Definitive Guide*, First Edition, O'Reilly, 2009.
3. Bart Jacob (Editor), *Introduction to Grid Computing*, IBM Red Books, Vervante, 2005
4. Ian Foster, Carl Kesselman, The *Grid: Blueprint for a New Computing Infrastructure*, 2nd Edition, Morgan Kaufmann.

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(20CS5019) CYBER SECURITY
(PROGRAM ELECTIVE-III)

COURSE OBJECTIVES

The objectives of this course

1. *To gain knowledge about securing both clean and corrupted systems, protect personal data, and secure computer networks.*
2. *To understand principles of web security and to incorporate approaches for incident analysis and response.*
3. *Appraise the current structure of cyber security roles across the DoD enterprise, including the roles and responsibilities of the relevant organizations.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Analyze threats and risks within context of the cyber security architecture*
2. *Appraise cyber security incidents to apply appropriate response*
3. *Evaluate decision making outcomes of cyber security scenarios*
4. *Evaluate the trends and patterns that will determine the future state of cyber security*
5. *Examine secure software development practices.*
6. *Understand key terms and concepts in cyber law, intellectual property and cyber crimes, trademarks and domain theft.*

UNIT-I

Cyber Crime: Mobile and Wireless devices-Trend mobility-authentication service security-Attacks on mobile phones-mobile phone security Implications for organizations Organizational measurement for Handling mobile-Security policies and measures in mobile computing era. Cases.

UNIT-II

Tools and methods used in cyber crime-Proxy servers and Anonymizers- Phishing Password cracking-Key loggers and Spy wares-Virus and worms-Trojan Horse and Backdoors-Steganography-SQL Injection-Buffer overflow-Attacks on wireless network. Cases.

UNIT-III

Understanding computer forensic-Historical background of cyber forensic Forensic analysis of e-mail-Digital forensic life cycle-Network forensic-Setting up a computer forensic Laboratory-Relevance of the OSI 7 Layer model to computer Forensic Computer forensic from compliance perspectives. Cases.

UNIT-IV

Forensic of Hand –Held Devices-Understanding cell phone working characteristics Hand-Held devices and digital forensic- Toolkits for Hand-Held device-Forensic of i-pod and digital music devices-Techno legal Challenges with evidence from hand-held Devices. Cases.

UNIT-V

Cyber Security –Organizational implications-cost of cybercrimes and IPR issues Web threats for organizations: the evils and Perils-Social media marketing Security and privacy Implications-Protecting people privacy in the organizations Forensic best practices for organizations, Cases.

TEXT BOOK

1. Nina Godbole & SunitBelapure, *Cyber Security*, Wiley India, 2012.

REFERENCES

1. Harish Chander, *Cyber laws & IT protection*, PHI Learning Pvt.Ltd, 2012.
2. Dhiren R Patel, *Information security theory & practice*, PHI Learning Pvt.Ltd,2010

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(20CS5020) COMPUTER VISION
(PROGRAM ELECTIVE-III)

COURSE OBJECTIVES

The objectives of this course

1. *To be familiar with both the theoretical and practical aspects of computing with images.*
2. *To have described the foundation of image formation, measurement, and analysis.*
3. *To understand the geometric relationships between 2D images and the 3D world.*
4. *To grasp the principles of state-of-the-art deep neural networks.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Developed the practical skills necessary to build computer vision applications.*
2. *Have gained exposure to object and scene recognition and categorization from images.*
3. *Understand different techniques used for edge detections and corner detection.*
4. *Understand the concept of pattern analysis and data processing.*
5. *Develop and learn the classifiers and distinct models.*
6. *Implement the geometric relationships between 2D images and the 3D world.*

UNIT-I

Overview - Computer imaging systems – Lenses - Image formation and Sensing - Image analysis - Pre-processing and Binary image analysis.

UNIT-II

Edge detection - Edge detection performance - Hough transform - Corner detection.

UNIT-III

Segmentation - Morphological filtering - Fourier transforms.

UNIT-IV

Feature extraction – Shape – Histogram – Color – Spectral – Texture - Using CVIP tools - Feature analysis - Feature vectors - Distance /similarity measures - Data preprocessing.

Pattern Analysis: Clustering - K-Means - K-Medoids - Mixture of Gaussians Classification - Discriminant Function – Supervised - Un-supervised - Semi supervised

UNIT-V

Classifiers – Bayes – KNN - ANN models - Dimensionality Reduction – PCA – LDA - ICA and Non-parametric methods.

Recent trends in Activity Recognition - Computational photography - Biometrics.

TEXT BOOKS

1. Richard Szeliski, *Computer Vision: Algorithms and Applications*, HardCover Publications, 2010
2. Goodfellow, Bengio and Courville , *Deep Learning*,HardCover Publications, 2017
3. Fisher et al, *Dictionary of Computer Vision and Image Processing*, Wiley Publications

REFERENCES

1. Forsyth, *Computer Vision: A Modern Approach*, Second Edition, Ponce, 2015
2. Ahmadi Tazehkandi, Amin, *Hands-On Algorithms for Computer Vision*,packt Publications Pvt Ltd, 2018.
3. E R Davies, *Computer and Machine Vision*, AP Publications, 2012
4. Ian Good Fellow, Yoshua Bengio, Aaron Courville, Francis Bach, *Deep Learning*, Hard Cover Publications, 2017

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(20CS5021) HUMAN COMPUTER INTERACTION
(PROGRAM ELECTIVE-IV)

COURSE OBJECTIVES

The objectives of this course

1. *To learn the foundations of Human Computer Interaction*
2. *To be familiar with the design technologies for individuals and persons with disabilities*
3. *To be aware of mobile Human Computer interaction.*
4. *To learn the guidelines for user interface.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Understand the structure of models and theories of human computer interaction and vision.*
2. *Design an interactive web interface on the basis of models studied.*
3. *Understand various social Organizational issues.*
4. *Learning and understanding various frameworks and develop the mobile applications.*
5. *Understanding the web interfaced and learning the recent trends.*
6. *Design Web Interfaces.*

UNIT-I

Human: I/O channels–Memory–Reasoning and problem solving - **The computer**: Devices – Memory – Processing and Networks; Interaction: Models – Frameworks – Ergonomics – Styles – Elements – Interactivity - Paradigms.

UNIT-II

Interactive Design basics – Process – Scenarios – Navigation – Screen design – Iteration and prototyping - HCI in software process – Software life cycle – Usability engineering – Prototyping in practice – Design rationale - Design rules – Principles – Standards – Guidelines – Rules - Evaluation Techniques – Universal Design.

UNIT-III

Cognitive models – Socio - Organizational issues and Stake holder requirements – Communication and Collaboration models – Hypertext - Multimedia and WWW.

UNIT-IV

Mobile Ecosystem – Platforms - Application frameworks - Types of Mobile Applications: Widgets – Application – Games - Mobile Information Architecture - Mobile 2.0 - Mobile Design: Elements of Mobile Design - Tools.

UNIT-V

Designing Web Interfaces – Drag & Drop - Direct Selection - Contextual Tools – Overlays - Inlays and Virtual Pages - Process Flow - Case Studies.
Recent Trends - Speech Recognition and Translation - Multimodal System.

TEXT BOOKS

1. Janet Finlay, Gregory Abowd, Russell Beale, Alan Dix, *Human Computer Interaction*, 3rd Edition, Pearson Education, 2004.
2. Brian Fling, *Mobile Design and Development*, First Edition , O Reilly Media Inc., 2009
3. Bill Scott and Theresa Neil, *Designing Web Interfaces*, First Edition, OReilly, 2009.

REFERENCES

1. Ben Shneiderman, Maxine Cohen, Catherine Plaisant, Steven M. Jacobs, *Designing the User Interface*, Pearson Education.
2. Julie A Jacko, *Human Computer Interaction Handbook*, Hardcover Publications, Third edition.
3. Serendual Smith-Atakan, *Human-Computer Interaction*, Cengage Learning publications, India Edition.

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(20CS5022) GPU COMPUTING
(PROGRAM ELECTIVE -IV)

COURSE OBJECTIVES
The objectives of this course

1. *To understand GPU many-core hardware architecture, shading and GPU programming languages and APIs*
2. *To learn the approaches for massively parallel computations.*
3. *To understand the utilization of memory subsystems and caches, texture mapping.*

COURSE OUTCOMES
On successful completion of this course, the student will be able to

1. *Understand of GPU architecture and APIs (OpenGL, GLSL, CUDA) with important practical applications.*
2. *Understand of the traditional use of GPUs for rendering graphics, as well as the use of GPUs for general-purpose computations (GPGPU), or GPU Computing.*
3. *Understand of parallel computations, memory subsystems and caches, texture mapping*
4. *Handle the different types of System Issues in GPU*
5. *Understand the utilization of 3D computer graphics and mathematics related to GPU.*
6. *Implement the GPU-Specific APIs.*

UNIT-I
Basics of computer graphics: Concepts–Pipeline–Transformation - Lighting
Overview of GPUs: Architecture–Features - Programming model

UNIT-II
GPU Architecture: Types of GPU Architecture - Alternative GPU Architectures - Shading and Compute APIs - Types of GPU Texturing.

UNIT-III
Stream Computing and GPGPU - CUDA Memory Access 1,2,3 and 4 - GPU Reduction - GPU Parallel Scan / Prefix Sum.

UNIT-IV
System issues: Cache and data management - Languages and Compilers - Stream processing- GPU-CPU load balancing

UNIT-V
GPU-Specific implementation - 3D computer graphics topics - Sorting and Searching - Linear algebra - Signal processing - Differential equations - Numerical Solvers

TEXT BOOKS

1. R. Fernando and M. Kilgard, *The CG Tutorial: The Definitive Guide to Programmable Real-Time Graphics,* Addison-Wesley, 2003.
2. David Wolf, *Open GL 4 Shading Language Cook Book*, Packt Publishing Pvt. Ltd, 2013.

REFERENCES

1. David B.Kirk, Wen-mei W Hue, *Programming Massively Parallel Processors*, MK Publications, 3rd Edition
2. Peter S. Pacheco, *An Introduction to Parallel Programming*, Morgan Kaufmann Publishers 1st Edition, 2011.
3. Jason Sanders and Edward Kandrot, *CUDA by Example: An Introduction to General-Purpose GPU Programming*, Addison Wesley Professional, 1st Edition, 2011.
4. Wolfgang Engel, *GPUPro 360 Guide to Shadows*, CRC Press, 2018

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(20CS5023) DIGITAL FORENSICS
(PROGRAM ELECTIVE-IV)

COURSE OBJECTIVES

The objectives of this course

1. *Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.*
2. *Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.*
3. *Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools*
4. *E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Understand relevant legislation and codes of ethics.*
2. *Perform Computer forensics and digital detective and various processes, policies and procedures.*
3. *Perform E-discovery, guidelines and standards, E-evidence, tools and environment.*
4. *Check Email and web forensics and network forensics*
5. *Understand the awareness of legal aspects of forensics.*
6. *Implement E-evidence collection and preservation.*

UNIT-I

Digital Forensics Science: Forensics science - Computer forensics - Digital forensics. **Computer Crime:** Criminalistics as it relates to the investigative process - Analysis of cyber-Criminalistics area - Holistic approach to cyber forensics

UNIT-II

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

UNIT-III

Evidence Management & Presentation: Create and manage shared folders using operating system - Importance of the forensic mindset - Define the workload of law enforcement - Explain what the normal case would look like - Define who should be notified of a crime - Parts of gathering evidence - Define and apply probable cause.

UNIT-IV

Computer Forensics: Prepare a case - Begin an investigation - Understand computer forensics workstations and software - Conduct an investigation - Complete a case - Critique a case.

Network Forensics: Open-source security tools for network forensic analysis - Requirements for preservation of network data.

UNIT-V

Mobile Forensics: Mobile forensics techniques - Mobile forensics tools.

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

TEXT BOOKS

1. John Sammons, *The Basics of Digital Forensics*, Elsevier
2. John Vacca,*Computer Forensics: Computer Crime Scene Investigation,*Laxmi Publications

REFERENCES

1.Dr. MrsRukmani Krishnamurthy, *Introduction to Forensic Science in Criminal Investigation,* Paper back Publications, 2015
2.Dejey(Author), Murugan(Author), *Cyber Forensics* ,Oxford Publications, 2018.
3.Nilakshi Jain, Dhananjay R. Kalbande, *Digital Forensics,* Wiley Publications, For Mumbai University, 2019.

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(20CS5007) MACHINE LEARNING LAB

COURSE OBJECTIVES

The objectives of this course

1. *To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.*
2. *To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.*
3. *To explore supervised and unsupervised learning paradigms of machine learning.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Experiment the features that can be used for a particular machine learning approach in various IOT Applications.*
2. *Implement various machine learning approaches and paradigms.*
3. *Implement the classification methods for IOT applications.*
4. *Implement the trends in various learning techniques of machine learning.*
5. *Can explore Deep learning technique and various feature extraction strategies*.

LIST OF EXPERIMENTS

1. Decision Tree learning
2. Implement Logistic Regression
3. Implement classification using Multilayer perceptron
4. Implement classification using SVM
5. Implement Boosting and Bagging for Ensemble Learning
6. Implement K-means clustering to Find Natural Patterns in Data
7. Implement Principle Component Analysis for Dimensionality Reduction
8. Maximum Likelihood Estimation of Gaussian Mixtures Using the Expectation Maximization Algorithm
9. Estimate Hidden Markov Model Parameters
10. Implement Genetic algorithms
11. Implement K-nearest Neighbors

TEXT BOOKS

1. Kevin Murphy, *Machine Learning: A Probabilistic Perspective*, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, *The Elements of Statistical Learning*, Springer 2009 (freely available online).

REFERENCES

1. Christopher Bishop, *Pattern Recognition and Machine Learning*, Springer, 2007.
2. Tomm.Mitchell, *Machine Learning*, Tata McGraw Hill, 2017.
3. ShaiShalev - Scwartz, Sai Ben David, *Understanding Machine Learning: From Theory to Algorithms*, Kindle Edition, 2015.

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(20CS5008) SOFT COMPUTING LAB

COURSE OBJECTIVES

The Objectives of this course

1. *To implement soft computing based solutions for real-world problems.*
2. *To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.*
3. *To analyze various algorithms and train them.*

COURSE OUTCOMES

On successful completion of the course students will be able to

1. *Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.*
2. *Apply genetic algorithms to combinatorial optimization problems.*
3. *Evaluate and compare solutions by various soft computing approaches for a given problem*
4. *Implement soft computing based solutions for real-world problems.*
5. *Understand various functional analyses over the data sets.*
6. *Work on MATLAB Programming.*

LIST OF PROGRAMS

1. Write a Program For Implementing Linear Saturating Function.
2. Study and Analysis of Art Model.
3. Write a Program For Error Back Propagation Algorithm (Ebpa) Learning.
4. Study and Analysis of CPN
5. Study and Analysis of Genetic Algorithm Life Cycle.
6. Study and Analysis of Fuzzy vs Crisp Logic.
7. Write a Program of Perceptron Training Algorithm.
8. Write a Program to Implement Hebb's Rule
9. Write a Program to Implement Of Delta Rule
10. Write a Program for Back Propagation Algorithm
11. Write a Program to Implement Logic Gates

TEXT BOOKS

1.S.N. Shivnandam, *Principle of soft computing*, Wiley.
2.S.Rajshekaran and G.A.V. Pai, *Fuzzy logic And Genetic Algorithm, Neural Network*, PHI.

REFERENCES

1.Jack M. Zurada, *Introduction to Artificial Neural Network System*, JAico Publication.
2. Simon Haykins, *Neural Network- A Comprehensive Foudation*.
3.N P Padhy, S.P.Simon*Soft Computing with MATLAB Programming*, Oxford Publications, 2015
4.S.N.Sivanandam, S.N.Deepa, *Principles of Soft Computing*, Wiley Publications, Second Edition, 2011
5.*MATLAB Toolkit Manual*

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(20CS5009) MINI PROJECT

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(20HS0829) CONSTITUTION OF INDIA
(AUDIT COURSE-II)

COURSE OBJECTIVES

The objectives of this course:

1. *Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.*
2. *Address the growth of Indian opinion regarding modern Indian intellectuals 'constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*
3. *Address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.*
4. *Address the federal structure and its effects on administration.*
5. *Understand parliamentary form of government.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Explain the key concepts of political economy.*
2. *Analyze the significant developments in the political ideologies.*
3. *Describe the salient features of the constitution of India.*
4. *Interpret, integrate and critically.*
5. *Analyze the political economy of Indian international relations and gain knowledge in Judiciary system.*
6. *Apply their knowledge and skills acquired to write civil service examinations*

UNIT-I

Introduction to Indian Constitution.

UNIT-II

Historical Perspective of the Constitution of India, Salient features and characteristics of the Constitution of India

UNIT-III

Scheme of the fundamental rights, the scheme of the Fundamental Duties and its legislative status, The Directive Principles of State Policy – Its importance and implementation, Federal structure and distribution of legislative and financial powers between the Union and States.

UNIT-IV

Parliamentary Form of Government in India – The constitution powers and status of the President of India, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions : National Emergency, President Rule, Financial Emergency

UNIT-V

Local Self Government – Constitutional Scheme in India, Scheme of the Fundamental Right to Equality, Scheme of the Fundamental Right to certain Freedom under Article19, Scope of the Right to Life and Personal Liberty under Article21.

TEXT BOOK

1. Government of India Ministry of Law and Justice (Legislative Department) *The Constitution of India, 1950 (Bare Act)* Government Publication, 2015
2. Dr.Busi S.N *Dr.B.R.Ambedkar framing of Indian Constitution*, 1st Edition, Government Publication 2015

REFERENCES

1. Jain M. P *Indian Constitution Law* Lexis Nexis Publishers 7th Edition.2014.
2. Basu D.D *Introduction to the Constitution of India* Lexis Nexis, 8th Edition 2015
3. Bakshi P.M *Constitution of India* Universal Law Publishing.15th Edition, 2018

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(20CS5024) BIG DATA ANALYTICS
(PROGRAM ELECTIVE – V)

COURSE OBJECTIVES

The Objectives of this course

1. *To understand the competitive advantages of big data analytics*
2. *To understand the big data frameworks*
3. *To learn data analysis methods*
4. *To learn stream computing*
5. *To gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics*

COURSE OUTCOMES

On successful completion of the course students will be able to

1. *Understand how to leverage the insights from big data analytics*
2. *Analyze data by utilizing various statistical and data mining approaches*
3. *Perform analytics on real-time streaming data*
4. *Develop Real Time Analytics Platform (RTAP) Applications*
5. *Understand the various NoSql alternative database models*
6. *Able to gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics*

UNIT I

INTRODUCTION TO BIG DATA: 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:

Distributed File Systems - Large-Scale File System Organization – HDFS concepts – Map Reduce Execution, Algorithms using Map Reduce, Matrix-Vector multiplication – Hadoop YARN

UNIT III

DATA ANALYSIS

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 – Data analysis using R.

UNIT IV

MINING DATA STREAMS

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 - Case Studies – Real Time Sentiment Analysis, Stock Market Predictions.

UNIT V

BIG DATA FRAMEWORKS

Introduction to No-SQL – 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 – Hive-QL Data Definition – Hive-QL Data Manipulation – Hive-QL Queries

TEXT BOOKS

1. Bill Franks, *Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics*, Wiley and SAS Business Series, 2012.
2. David Loshin, *Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, No-SQL, and Graph*, Morgan Kaufmann,2013.

REFERENCES

1. Michael Berthold, David J. Hand, *Intelligent Data Analysis*, Springer, Second Edition, 2007.
2. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, *Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses*, Wiley, 2013.
3. P. J. Sadalage and M. Fowler, *No-SQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence*, Addison-Wesley Professional, 2012.
4. Richard Cotton, *Learning R – A Step-by-step Function Guide to Data Analysis*, O'Reilly Media, 2013.

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(20CS5025) DISTRIBUTED DATABASES
(PROGRAM ELECTIVE – V)

COURSE OBJECTIVES

The Objectives of this course

1. *To understand the Concepts of distributed database and centralized databases*
2. *To learn Transformations for Queries*
3. *To learn Distributed Concurrency Control – Distributed Deadlocks*
4. *To gain knowledge on Distributed object database management systems*

COURSE OUTCOMES

On successful completion of the course students will be able to

1. *Understand the Features of Distributed versus Centralized Databases*
2. *Gain knowledge on Equivalence Transformations for Queries*
3. *Understand Foundations of Distributed Concurrency Control and Distributed Deadlocks*
4. *Understand Distributed object database management systems and Distributed Object Storage*
5. *Understand Parallel Database Systems*
6. *Performance Evaluation over the types of database available*

UNIT - I

Features of Distributed versus Centralized Databases – Why Distributed Databases – Distributed Database Management Systems (DDBMSs)- Review of Databases – Review of Computer Networks-Levels of Distribution Transparency- Reference Architecture for Distributed Databases – Types of Data Fragmentation – Distribution Transparency for read-only Applications – Distribution transparency for Update Applications – Distributed Database Access Primitives – Integrity Constraints in Distributed Databases - A Framework for Distributed Database Design – The Design of Database Fragmentation – The Allocation of Fragments.

UNIT - II

Equivalence Transformations for Queries – Transforming Global Queries into Fragment Queries – Distributed Grouping and Aggregate Function Evaluation – Parametric Queries -Optimization of Access Strategies - A Framework for Query Optimization – Join Queries – General Queries. A Framework for Transaction Management – Supporting Atomicity of Distributed Transactions – Concurrency Control for Distributed Transactions – Architectural Aspects of Distributed Transactions

UNIT- III

Foundations of Distributed Concurrency Control – Distributed Deadlocks – Concurrency Control Based on Timestamps – Optimistic Methods for Distributed Concurrency Control - Reliability – Basic Concepts No blocking Commitment Protocols – Reliability and Concurrency Control –

Determining a Consistent View of the Network – Detection and Resolution of Inconsistency – Checkpoints and Cold Restart - Distributed Database Administration – Catalog Management in Distributed Databases – Authorization and Protection.

UNIT - IV

Distributed object database management systems – Fundamental object concepts and Models – Object – Abstract Data Types – Composition (Aggregation) – Class – Collection – Subtyping and Inheritance. – Object Distribution Design – Horizontal Class Partitioning – Vertical Class Partitioning – Path Partitioning – Class Partitioning Algorithms – Allocation – Replication – Alternative Client / Server Architectures – Cache Consistency – Object Identifier Management – Pointer Switching Object Migration – Distributed Object Storage – Object Query Processor Architectures – Query Processing Issues – Query Execution – Correctness Criteria – Transaction Models and Object Structures – Transactions Management in Object DBMSs – Transactions as Objects – Conclusion – Bibliographic Notes – Exercises.

UNIT-V

Parallel Database Systems – Database Server Approach – Database Servers and Distributed Databases – Parallel System Architectures – Objectives – Functional Aspects – Parallel Data Processing – Parallel Query Optimization – Data Placement – Query Parallelism – Parallel Execution Problems – Initialization – Interferences and Convoy Effect – Load Balancing – Parallel Execution for Hierarchical Architecture – Problem Formulation – Basic Concepts – Load Balancing Strategy – Performance Evaluation – Conclusion – Bibliographic Notes – Exercises.

TEXT BOOKS

1. Stefano Ceri, Giuseppe Pelagatti, *Distributed Databases Principles & Systems*, McGraw-Hill.
2. M.TamerOzsu, Patrick Valduriez, *Distributed database systems*, 2nd Edition, Prentice Hall of India, New Delhi.

REFERENCES

1. M.TamerOzsu, Patrick Valduriez, *Principles of Distributed Database Systems*, PearsonEducation.
2. Bell D. and Grimson J., *Distributed Database Systems*, Addison-Wesley, 1992.

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(20CS5026) ADVANCED OPERATING SYSTEMS
(PROGRAM ELECTIVE – V)

COURSE OBJECTIVES

The Objectives of this course

1. *To learn the fundamentals of Operating Systems*
2. *To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols*
3. *To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols*
4. *To know the components and management aspects of Real time, Mobile operating systems*

COURSE OUTCOMES

On successful completion of the course students will be able to

1. *Discuss the various synchronization, scheduling and memory management issues*
2. *Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system*
3. *Discuss the various resource management techniques for distributed systems*
4. *Identify the different features of real time and mobile operating systems*
5. *Install and use available open source kernel*
6. *Modify existing open source kernels in terms of functionality or features used*

UNIT-I

FUNDAMENTALS OF OPERATING SYSTEMS: Overview – Synchronization Mechanisms – Processes and Threads - Process Scheduling –Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques.

UNIT-II

DISTRIBUTED OPERATING SYSTEMS: Issues in Distributed Operating System – Architecture – Communication Primitives –Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.

UNIT III

DISTRIBUTED RESOURCE MANAGEMENT: Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Nonblocking Commit Protocol – Security and Protection.

UNIT IV

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

UNIT V

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

TEXT BOOKS

1. MukeshSinghal and Niranjan G. Shivaratri, *Advanced Concepts in Operating Systems Distributed, Database, and Multiprocessor Operating Systems*, Tata McGraw-Hill, 2001.
2. Abraham Silberschatz, Peter Baer Galvin; Greg Gagne, *Operating System Concepts*, Seventh Edition, John Wiley & Sons, 2004.

REFERENCES

1. Daniel P Bovet and Marco Cesati, *Understanding the Linux kernel*, 3rd edition, O'Reilly, 2005.
2. Rajib Mall, *Real-Time Systems: Theory and Practice*, Pearson Education India, 2006.
3. Neil Smyth, *iPhone iOS 4 Development Essentials – Xcode*, Fourth Edition, Payload media, 2011.

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(20HS0824) BUSINESS ANALYTICS
(OPEN ELECTIVE)

COURSE OBJECTIVES

The Objectives of this course

1. *Understand the concepts and methods of business analytics.*
2. *To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.*
3. *To become familiar with processes needed to develop, report, and analyze business data.*

COURSE OUTCOMES

On successful completion of the course students will be able to

1. *Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.*
2. *Design alternatives to solve business problems utilizing quantitative analysis, critical thinking and sound ethical decision making.*
3. *Summarize, process and transform data for obtaining meaningful conclusions*
4. *Interpret data using latest data analytics tools to address organizational problems*
5. *Organize and critically apply the concepts and methods of business analytics*
6. *Assess decision problems and build models for creating solutions using business analytical tools.*

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

Decision Analysis: Formulating Decision Problems - Decision Strategies with the Outcome Probabilities - Decision Trees - The Value of Information - Utility and Decision Making - Recent Trends in Embedded and collaborative business intelligence - Visual data recovery - Data Storytelling and Data journalism.

TEXT BOOKS

1. S. Christian Albright & Wayne Winston, *Business Analytics: Data analysis & Decision making,* 6th Edition, Cengage Learning, 2019
2. James Evans, *Business Analytics,* 2nd Edition, Pearson Education, 2013.

REFERENCES

1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, *Business analytics Principles, Concepts, and Applications,* 1st Edition, Pearson FT Press, 2014.
2. SeemaAcharya & RN Prasad, Fundamentals *of Business Analytics,* 2nd Edition, WILEY
3. GalitShmueli, Peter C. Bruce, Nitin R. Patel, *Data mining for business analytics: Concepts, Techniques and Applications in Microsoft Office Excel with XLMiner*, WILEY, 2008.

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(20ME3026) INDUSTRIAL SAFETY
(OPEN ELECTIVE)

COURSE OBJECTIVES*:*

1. *To learn about mechanical and electrical hazards.*
2. *To learn about Fundamentals of Maintenance Engineering.*
3. *To learn about Wear and Corrosion and their prevention.*
4. *To know about Fault Tracking*
5. *To learn about Periodic and preventive maintenance.*

COURSE OUTCOMES:

Students undergoing this course are able to

1. *Understand the points of factories act 1948 for health and safety.*
2. *Understand the cost & its relation with replacement economy.*
3. *Understand the concepts of Wear and Corrosion Prevention*
4. *Understand the concepts of sequence of fault finding activities*
5. *Understand the Program and schedule of preventive maintenance of mechanical and electrical equipment.*
6. *Understand the Periodic Maintenance of Equipments*

UNIT-I:

Industrial Safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and fire fighting, equipment and methods.

UNIT-II:

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

UNIT-III:

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

UNIT-IV:

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine

tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT-V:

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

Text Books:

1. Higgins & Morrow, *Maintenance Engineering Handbook,* Da Information Services.
2. H. P. Garg, *Maintenance Engineering*, S. Chand and Company.

Reference Books:

1. Audels, *Pump-hydraulic Compressors*, McGraw Hill Publication.
2. Winterkorn, *Foundation Engineering Handbook*, Chapman & Hall London.

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(20ME3027) ADVANCES IN OPERATIONS RESARCH
(OPEN ELECTIVE)

COURSE OBJECTIVES:

On successful Completion of this course the student will be able to

1. *Enumerate the fundamentals of Linear Programming*
2. *Learn classical optimization techniques*
3. *Develop the best strategy of Game and identifying the Queuing theory.*
4. *Understand about sequence and optimum Duration of the Project*
5. *Develop the importance of Replacement models and Inventory control*

COURSE OUTCOMES

On successful Completion of this course the student will be able to

1. *Create mathematical models of the real time situations.*
2. *Implement Transportation and Assignment problems to solve in real time industry*
3. *choose the best strategy of Game and capable of identifying the suitable queuing theory*
4. *Enumerate fundamental techniques and apply it to solve various optimization areas*
5. *Investigate, study, Apply knowledge in Replacement models and*
6. *Understand the Inventory control Models*

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UNIT-I

Introduction to OR and Linear Programming-OR definition–Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Degeneracy - Problems

UNIT-II

Transportation Problem – Formulation; Initial Basic Feasible Solution-North-West Corner Rule, Least Cost Method, Vogel‘s Approximation Method, Modified Distribution (MODI) Method, Unbalanced Transportation - Problems

Assignment Problem – Formulation, Optimal Solution -Traveling Salesman problem.

UNIT-III

Game Theory - Introduction – Minimax (Maxi mini) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy and Mixed Strategies – 2 X 2 Games – Dominance Principle.

Queuing Theory- Introduction to queuing system–Service Channel, Arrival Pattern, Size of Population, Service Pattern, Queue Discipline, Customer Behavior, Probability Distribution-Birth & Death Process, Simple Problems on Single Service channel only.

UNIT-IV

Sequencing –Terminology - Johnson’s Algorithm for n-jobs x 2 Machines and n-jobs x 3 machines models - Problems

PERT & CPM: Introduction, Difference between PERT and CPM, Terminology- Activities,

Events, Predecessor, Early Start, Early Finish, Late Start & Late Finish Times, Earliest Occurrence and Latest Occurrence of the Event, Total Float, Free Float, Independent Float; CPM- Deterministic Model; PERT- Probabilistic Model, Critical Path, Optimal Project Duration, Least Possible Project Duration- Problems.

UNIT-V

Replacement – Failure Mechanism of Items**,** Types of Replacements- Individual Replacement policy, Group Replacement policy, Replacement of items fail suddenly – problems

Inventory - Necessity for maintaining inventory, inventory costs, classification of fixed order quantity inventory models, selective inventory management techniques.

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TEXT BOOKS:

1. S D. SHARMA *Operations Research* KNRN Publications. 17th edition 2015
2. Hamdy A Taha , *Operations Research* Pearson Publications, 9th edition 2015

.**REFERENCES BOOKS**

1. Manohar Mahajan *Operations Research,* Dhanpat Rai &Co 2016
2. Er. Prem kumar Guptha & Dr.D.S.Hira *Operations Research*, Schand publications 2012.
3. R Panneerselvam *Operations Research* PHI, 2nd edition, 2012.

R20	M. Tech – CSE

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II M. Tech – I Sem.

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(20CE1028) COST MANAGEMENT OF ENGINEERINGPROJECTS
(OPEN ELECTIVE)

COURSE OBJECTIVES

The Objectives of this course

1. *To Implement CPM and PERT concepts in construction*
2. *To provide techniques to develop personal skills of practical use in the Management and implementation of Civil Engineering projects*
3. *To know the Management techniques, the development of personal, interpersonal and Project Management skills*
4. *To provide a fundamental of understanding of the social, economic, resource management within which the Construction Project takes place.*

COURSE OUTCOMES

On successful completion of the course students will be able to

1. *Implement generic and special Construction Project Management skills to a higher level*
2. *Understand the special management skills required in multidisciplinary and global Construction Industry*
3. *Integrate and apply theoretical concepts, ideas, tools and techniques to Construction practice.*
4. *Can plan, execute, monitor and control construction projects using Construction Project Management Tools such as CPM &PERT*
5. *Analyze Cost Behavior and Profit Planning according to the projects*
6. *Efficiently perform Budgetary Control.*

UNIT-I

Introduction: Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User.

UNIT -II

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT-III

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts.Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

UNIT-IV

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.

UNIT-V

Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing. Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

TEXT BOOKS

1. *Cost Accounting A Managerial Emphasis*, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, *Advanced Management Accounting.*
3. Robert S Kaplan Anthony A. Alkinson, *Management & Cost Accounting.*
4. Ashish K. Bhattacharya, *Principles & Practices of Cost Accounting,* A. H. Wheeler publisher
5. N.D. Vohra, *Quantitative Techniques in Management*, Tata McGraw Hill Book Co.Ltd.

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(20ME3028) COMPOSITE MATERIALS
(OPEN ELECTIVE)

COURSE OBJECTIVES

1. *To understand the mechanical behavior of composite materials*
2. *To get an overview of the methods of manufacturing composite materials.*
3. *To know the fundamentals of composite materials.*
4. *To understand the fabrication and process of composites.*
5. *To recognize the applications of composite materials.*

COURSE OUTCOMES

Upon completion of this course, the students will have an overview of

1. *Fundamental concept of composite materials.*
2. *Different types of composite materials.*
3. *Fabrication and processing of composite materials.*
4. *MMC & CMC*
5. *Mechanical behavior of composite materials.*
6. *Application of composite materials .*

UNIT-I:

Introduction To Composites: Fundamentals of composites – need– enhancement of properties – classifications —Introduction to Reinforcement composites–types. Applications. Fiber production techniques for glass, carbon and ceramic fibers –Resin materials-Types.

UNIT-II:

Polymer Matrix Composites: Fabrication of PMC's ,Fabrication of Fibers, Plastic Fiber Forms, Pre-pregs, Molding Compounds-Processes, Lay-Ups, Filament Winding, Pultrusion, and Recycling. Matrix – Reinforcement Interface, Wettability.

UNIT-III:

MMC&CMC : Fabrication of MMC'S, Liquid Infiltration- Casting, Solid State Processes-Diffusion Bonding &In Situ Technique. Fabrication of CMC's, Hot-Pressing, Infiltration, In Situ Chemical reaction Techniques. CVD& CVI, Sol-gel.

UNIT-IV:

Mechanics of Composites: Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria, Von -Mises Yield criterion for isotropic materials, generalized Hill's criterion for anisotropic materials, Tsai-Hill's criterion for composites, prediction of laminate failure, thermal analysis of composite laminates

UNIT-V :

Applications Of Composites: Applications of advanced composite materials. Environmental effects in Composites, Green composites, Synthesis and Properties of Nano composites. Surface Composites & Surface metal matrix composites: Need, Synthesis, Properties and applications.

TEXT BOOKS:

1. Mathews F. L. and Rawlings R. D., "*Composite Materials: Engineering and Science*", 1st Edition, Chapman and Hall, London, England, 1994.
2. Chawla K. K., "*Composite materials*", Second Edition, Springer – Verlag, 1998.

REFERENCES:

1. Clyne, T. W. and Withers, P. J., "*Introduction to Metal Matrix Composites*", Cambridge University Press, 1993.
2. Strong, A.B., "*Fundamentals of Composite Manufacturing*", SME, 1989.
3. Sharma, S.C., "*Composite materials*", Narosa Publications, 2000.

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(20EE2128) WASTE TO ENERGY
(OPEN ELECTIVE)

COURSE OBJECTIVES
The Objectives of this course

1. *To understand the importance of gaining energy from the waste*
2. *To Understand and analyze the pattern of renewable energy resources Suggest methodologies / technologies for its utilization Economics of the utilization and environmental aspects.*
3. *To undusted the need and production of for biogas.*

COURSE OUTCOMES
On successful completion of the course students will be able to

1. *Identify the new methodologies / technologies for effective utilization of renewable energy sources.*
2. *Analyze over different types of waste for energy conception.*
3. *Understand different types of Bio mass utilizations.*

UNIT-I
INTRODUCTION TO ENERGY FROM WASTE:
Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

UNIT-II
BIOMASS PYROLYSIS:
Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

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

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

UNIT-V

PROPERTIES OF BIOGAS (CALORIFIC VALUE AND COMPOSITION)

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

TEXT BOOKS

1. Desai, Ashok V., *Non-Conventional Energy*, Wiley Eastern Ltd., 1990.
2. Khandelwal, K. C. and Mahdi, S. S.,*Biogas Technology - A Practical HandBook* - Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Challal, D. S., *Food, Feed and Fuel from Biomass*, IBH Publishing Co. Pvt. Ltd., 1991.

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(20CS5010) DISSERTATION-I /PHASE-I

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(20CS5011)DISSERTATION PHASE-II

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