MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE
Madanapalle

(UGC-AUTONOMOUS)
www.mits.ac.in

MASTER OF TECHNOLOGY
Computer Science & Engineering

COURSE STRUCTURE
&
DETAILED SYLLABI
For the students admitted to
Master of Technology in Computer Science & Engineering from the academic year 2020-21 Batches onwards

M. Tech Regular Two Year P. G. Degree Course

CURRICULUM STRUCTURE

I Year I Semester

Sl.No.	Course Code	Name of the Course	Hours Per Week				Credits
			L	T	P	Total Contact Hours	
1	20CSEP101	Modern Algorithm Design	3	0	0	3	3
2	20CSEP102	Cluster and Grid Computing	3	0	0	3	3
3	**Discipline Elective – I**		3	0	0	3	3
	20CSEP401	Advanced Automata Theory					
	20CSEP402	Cloud Computing					
	20CSEP403	Information Systems Analysis and Design					
4	**Discipline Elective – II**		3	0	0	3	3
	20CSEP404	Advanced Operating Systems					
	20CSEP405	Big Data Technologies					
	20CSEP406	Foundations of Parallel Computation					
5	20CSEP201	Modern Algorithm Design Laboratory	0	0	4	4	2
6	20CSEP202	Cluster and Grid Computing Laboratory	0	0	4	4	2
7	20ICP101	Research Methodology and IPR	2	0	0	2	2
8	**Audit Course – I**		2	0	0	2	0
	20AUP901	Disaster Management					
	20AUP902	Sanskrit for Technical Knowledge					
	20AUP903	Constitution of India					
	20AUP904	Pedagogy Studies					
		Total Credits	16	0	8	24	18

I Year II Semester

Sl.No.	Course Code	Name of the Course	Hours Per Week				Credits
			L	T	P	Total Contact Hours	
1	20CSEP103	Programming Foundations for Data Sciences	3	0	0	3	3
2	20CSEP104	Mobile and Pervasive Computing	3	0	0	3	3
3	**Discipline Elective – III**		3	0	0	3	3
	20CSEP407	Speech and Natural Language Processing					
	20CSEP408	Information Retrieval					
	20CSEP409	Algorithms for Bioinformatics					
4	**Discipline Elective – IV**		3	0	0	3	3
	20CSEP410	Artificial Intelligence					
	20CSEP411	Computational Complexity					
	20CSEP412	Ubiquitous Computing					
5	20CSEP203	Data Sciences Laboratory	0	0	4	4	2
6	20CSEP204	Mobile and Pervasive Computing Laboratory	0	0	4	4	2
7	20CSEP701	Mini Project	0	0	4	4	2
8	**Audit Course – II**		2	0	0	2	0
	20AUP905	English for Research Paper Writing					
	20AUP906	Value Education					
	20AUP907	Stress Management by Yoga					
	20AUP908	Personality Development through Life Enlightenment Skills					
		Total Credits	14	0	12	26	18

II Year I Semester

Sl.No.	Course Code	Name of the Course	Hours Per Week				Credits
			L	T	P	Total Contact Hours	
1	**Discipline Elective – V**		3	0	0	3	3
	20CSEP413	Machine Learning: Theory and Methods					
	20CSEP414	Advanced Digital Image Processing and Computing Vision					
	20CSEP415	Network Security					
2	**Open Elective – I**		3	0	0	3	3
	20OEP301	Business Analytics					
	20OEP302	Industrial Safety					
	20OEP303	Operations Research					
	20OEP304	Cost Management of Engineering Projects					
	20OEP305	Composite Materials					
	20OEP306	Waste to Energy					
3	20CSEP702	Dissertation Phase I	0	0	20	20	10
		Total Credits	6	0	20	26	16

II Year II Semester

Sl.No.	Course Code	Name of the Course	Hours Per Week				Credits
			L	T	P	Total Contact Hours	
3	20CSEP703	Dissertation Phase II	0	0	32	32	16
		Total Credits	0	0	32	32	16

M. Tech I Year I Semester

20CSEP101 MODERN ALGORITHM DESIGN

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description: An algorithm is just a set of instructions for solving a problem. This course will provide a rigorous and hands-on introduction to the cent
ral ideas and algorithms that constitute the core of the modern algorithms. It also emphasis on understanding the high-level theoretical intuitions and principles for a concrete understanding of when and how to implement it in various scenarios. The Algorithm's coming-of-age as the new language of science promises to be the most disruptive scientific development in information technology.

Course Objectives:

1. To provide an in-depth and comprehensive knowledge of designing modern algorithms.
2. To expose modern image processing algorithms.
3. To motivate students to analyze cluster computing algorithms.
4. To encourage the students on data storage issues and need for modern algorithms.
5. To approach real world problems by machine learning algorithms.

UNIT I INTRODUCTION TO MODERN ALGORITHMS

Consistent Hashing and Random Trees: Distributed Caching Protocols, Similarity Search, Nearest Neighbour, Dimension Reduction, **Linear-Algebraic Techniques:** Understanding Principal Component Analysis (PCA), Singular Value Decomposition (SVD), Tensor methods, Jenrich's algorithm. (**9)**

UNIT II MODERN ALGORITHMS FOR IMAGE PROCESSING

Digital Image Fundamentals: Image Transforms, Enhancement, Restoration, Compression, Segmentation. **Recognition and Interpretation:** connected components in binary images, processing of gray-level images, color images, restoration of degraded images, Image compression. (**9)**

UNIT III MODERN ALGORITHMS FOR CLUSTER ANALYSIS

Cluster Analysis: Relational Methods, Graph Methods, Density-Based Methods, Grid-Based Clustering Algorithms, Model-Based Clustering, Cluster Ensembles. **Combinatorial Cluster Analysis:** Evolutionary Clustering, Streaming Clustering, Incremental Clustering, K-means, fuzzy K-means. (**9)**

UNIT IV MODERN ALGORITHMS FOR DATA STORAGE SYSTEMS

Software-Defined Storage: Automation, Enhanced Security and Reliability, Long structured merge trees (LSM). **Optimized Information Retrieval:** Automated Cars, Parallel File Systems, neural-storage. (**9)**

UNIT V MODERN ALGORITHMS FOR MACHINE LEARNING

Machine Learning Algorithm Design: Regression, Classification, Clustering, Feature Selection, Feature Extraction. **Nature Inspired Machine Learning Algorithm:** Ant colony, Artificial Bee Colony, Identifying Social behavior of premier survivor. **(9)**

Total: 45 Periods

Course Outcomes

Upon completion of this course, the student should be able to

1. Pin point the inevitability of modern algorithms essentiality for solving real world problems.
2. Image processing algorithms applicability in resolving issues in various fields like agro, space research, health care, etc.,.
3. Cluster analysis for solving problems related to any network by enhancing contribution of each and every individual as a team.
4. Provide appropriate algorithm for accessing and retrieving information form big data storage systems.
5. Machine learning based algorithm for approaching complex issues to improve the efficiency of automated systems.

Text Books:

1. Modern Algorithms for Image Processing: Computer Imagery by Example Using C#, Vladimir Kovalevsky, Apress.
2. Modern Algorithms of Cluster Analysis, Wierzchon, Slawomir, Klopotek, Mieczyslaw , 1st ed. 2018 Edition, Springer.

Reference Books:

1. Introduction to algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Second Edition, The MIT Press.
2. Essential Algorithms: A Practical Approach to Computer Algorithms Using Python and C#, Rod Stephens, Wiley.
3. First Course in Algorithms through Puzzles, Ryuhei Uehara, Springer.
4. The Algorithm Design Manual, Steven S. Skiena, Springer.
5. Problems on algorithms, Ian Parberry, Prentice Hall.
6. Algorithms Unlocked, Thomas H. Cormen, The MIT Press.
7. Foundations of Machine Learning, MohriMehryar, AfshinRostamizadeh, and Ameet Talwalkar, The MIT Press

Mode of Evaluation: Assignments, Internal Mid Examinations, End Semester Examination.

M. Tech I Year I Semester

	L	T	P	C
20CSEP102 CLUSTER AND GRID COMPUTING	**3**	**0**	**0**	**3**

Course Prerequisite: NIL

Course Description:

The Grid consists of a hardware and software infrastructure which will connect multiple regional and national computational grids of clusters and supercomputers, creating a universal source of pervasive and dependable computing power that supports dramatically new classes of applications.

Course Objectives:

Students are able to,

1. To investigate cluster and grid as computing platform for distributed computing.
2. To make students aware of distinguishing characteristics of cluster and grid computing.
3. Introducing software tools used in both cluster and grid computing.

UNIT I CLUSTER COMPUTING

Basic concepts in Distributed Systems, Notion of time, Introduction to Cluster Computing, Scalable Parallel Computer Architectures, Cluster Computer and its Architecture, Categories of clusters, Cluster Components, Cluster Middleware and Single System Image. **(9)**

UNIT II CLUSTER ENVIRONMENT

Programming Environments and Tools, Networking Protocols and I/O for clusters, Load Sharing, Load Balancing, Resource Management System, Process Scheduling, Performance measures and metrics, Detecting and Masking Faults, Recovering from Faults, Case Study : Beowulf and PARAM. **(9)**

UNIT III COMMUNICATION

Introduction to Message Passing Interface (MPI), Programming using message-passing -send and receive operations, Message passing interface, Introduction to MPI routines - send, receive, broadcast, gather, scatter, barrier, reduction, prefix, all-to-all communication. Demonstration of programs using MPI routines - matrix-matrix multiplication, quick sort, etc. Introducing Open MP programming. **(9)**

UNIT IV GRID COMPUTING

Introduction to Grid Computing, Difference between Cluster and Grid computing, Grid Architecture and its key components, Computational, Data, Enterprise, and, Desktop grids, Overview of applications of Grid Computing, Grid Infrastructure. **(9)**

UNIT V WEB SERVICES

Web Services and Service Oriented Architecture (SAO), Open Grid Services Architecture (OGSA), OGSA Platform Components, Open Grid Services Infrastructure (OGSI), OGSA Basic Services, Web Services Resource Framework (WSRF), List of Globally available Middleware, Introducing Grid Computing. **(9)**

Total: 45 Periods

Course Outcomes:

Upon completion of the course, the students will be able to:

1. Be acquainted with various tools and techniques used in the arena of Cluster and Grid Computing.
2. Able to justify the choice or selection of distributed computing platform for a specific application
3. Able to design programs in Open MP and MPI.

Text Books:

1. C.S.R.Prabhu – "Grid and Cluster Computing"-PHI(2008).
2. High Performance Cluster Computing: Architectures and systems by RajkumarBuyya

References:

1. Jankiram, "Grid Computing Models : A Research Monograph", TMH (2005)
2. Cluster Computing by Rajkumar Buyya, Clemens Szyperski.
3. Ahmar Abbas, "Grid Computing: Practical Guide to Technology and Applications", Delmar Thomson Learning, USA, 2004.
4. Joshy Joseph, Craig Fallenstein, "Grid Computing", Pearson Education, New Delhi, 2004.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech I Year I Semester

20CSEP401 ADVANCED AUTOMATA THEORY

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description:

This course aims to introduce the graduate students to develop understanding of the theoretical foundation of computation and to impart an understanding of computability theory, decidability, reducibility.

Course Objectives:

1. To understand the basic concepts of automata theory to design the computation model.
2. To understand languages and computational problems.
3. To learn Context Free Grammar (CFG), and Context Free Languages (CFL's)
4. To learn Turing Machine (TM), conversion of regular expression to TM and TM languages and undecidable problems of TM's
5. To learn about advanced automata theory concepts rabin automata and games played on finite graphs.

UNIT I INTRODUCTION

Alphabets, Strings, Languages, Problems, Grammar formalism, Chomsky Hierarchy. Finite Automata: An Informal picture of Finite Automata, Deterministic Finite Automata (DFA), Non Deterministic Finite Automata (NFA), Finite Automata with output, Myhill-Nerode Theorem, Pumping Lemma, Decidability. **(9)**

UNIT II REGULAR LANGUAGES AND CONTEXT FREE LANGUAGES

Regular Expressions (RE), Finite Automata and Regular Expressions, basic closure properties, The Arden's Theorem, Using Arden's theorem to construct RE from FA, Pumping Lemma for RLs, Applications of Pumping Lemma, Equivalence of Two FAs, Equivalence of Two REs, Decision problem's of RL. **Context Free Languages -** Derivations and Parse trees, Ambiguity in CFGs, Removing ambiguity, Left recursion and Left factoring, Normal Forms, Linear grammars, Closure properties for CFLs, Pumping Lemma for CFLs, Decision problems for CFLs. **(9)**

UNIT III PUSH DOWN AUTOMATA AND TURING MACHINE

The Formal Definition, Graphical notation, The Languages of a PDA, Deterministic Push Down Automata, Two Stack PDA. Turing Machines And Undecidability -Basics of Turing Machine (TM), Transitional Representation of TMs, Non Deterministic TM, Linear Bounded Automata, TM Languages, Reducibility, Undecidable problems about TMs. **(9)**

UNIT IV GAMES PLAYED ON FINITE GRAPHS

Introduction, Finite Games - Informal Description, Definition of Finite Games, Finding The Winners. Infinite Games -Informal Description, Formal Definition of Games, Strategies. Update Games and Update Networks- Update Games and Examples, Deciding Update Networks. Solving Games- Forgetful Strategies, Constructing Forgetful Strategies, No-Memory Forcing Strategies, Finding Winning Forgetful Strategies. **(9)**

UNIT V RABIN AUTOMATA

Rabin Automata - Union, Intersection, and Projection. Special Automata - Basic Properties of Special Automata, Example to Complementation. Game Automata – Definition, Strategies. Equivalence of Rabin and Game Automata. Terminology - Arenas, Games, and Strategies. The Notion of Rank, Open Games, Congruence Relations, Sewing Theorem. Determinacy Theorem for Games, Complementation and Decidability. (**9)**

Total: 45 Periods

Course Outcomes:

Upon completion of this course the students should be able to:

1. Understand the basics of DFA, NFA.
2. Apply regular languages and Pumping Lemma to construct FA.
3. Design Turing machine to solve undecidable problems.
4. Apply the automata theory to solve game problems.
5. Develop some special automata to solve problems.

Text Books:

1. Automata Theory and its Applications, Bakhadyr Khoussainov, AnilNerode
2. Introduction to Automata Theory, Languages, and Computation, Third Edition, John E.Hopcroft, Rajeev Motwani, Jeffery D. Ullman, Pearson.

References:

1. Introduction to Languages and the Theory of Computation, John C Martin, TMH, Third Edition.
2. Introduction to the Theory of Computation, Michel Sipser, 2nd Edition, Cengage Learning
3. Finite Automata and Formal Language A Simple Approach, A.M. Padma Reddy, Pearson
4. Introduction to the Theory of Computation, Michael Sipser,

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech I Year I Semester

20CSEP402 CLOUD COMPUTING

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description: Cloud computing is a key distributed systems paradigm that has grown popular in the last few years. Cloud technologies are pervasive, touching our daily lives any time we access the World Wide Web, use a mobile app, or make a retail purchase.

Objectives

1. To provide an in-depth and comprehensive knowledge of the Cloud Computing
2. To expose the students to the frontier areas of Cloud Computing
3. To motivate students to experiment with the various cloud computing environments
4. To shed light on the Security issues in Cloud Computing
5. To introduce about the Cloud Standards

UNIT I INTRODUCTION TO DISTRIBUTED COMPUTING

History of Centralized and Distributed Computing - Overview of Distributed Computing, Cluster computing, Grid computing. Technologies for Network based systems- System models for Distributed and cloud computing- Software environments for distributed systems and clouds. **(9)**

UNIT II CLOUD COMPUTING AND VIRTUALIZATION

Introduction to Cloud Computing- Cloud issues and challenges - Properties - Characteristics - Service models, Deployment models. Cloud resources: Network and API - Virtual and Physical computational resources - Data-storage. Virtualization concepts - Types of Virtualization- Introduction to Various Hypervisors - High Availability (HA)/Disaster Recovery (DR) using Virtualization, Moving VMs. (**9)**

UNIT III CLOUD COMPUTING SERVICE MODELS

Service models - Infrastructure as a Service (IaaS) - Resource Virtualization: Server, Storage, Network - Case studies. Platform as a Service (PaaS) - Cloud platform & Management: Computation, Storage - Case studies. Software as a Service (SaaS) - Web services - Web 2.0 - Web OS - Case studies – Anything as a service (XaaS). (**9)**

UNIT IV PROGAMMING MODEL

Cloud Programming and Software Environments – Parallel and Distributed Programming paradigms – Programming on Amazon AWS and Microsoft Azure – Programming support of Google App Engine – Emerging Cloud Software Environment. (**9)**

UNIT V CLOUD COMPUTING SECURITY

Cloud Access: authentication, authorization and accounting - Cloud Provenance and meta-data - Cloud Reliability and fault-tolerance - Cloud Security, privacy, policy and compliance- Cloud federation, interoperability and standards. (**9)**

Total: 45 Periods

Course Outcomes

Upon completion of this course, the student should be able to

1. Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
2. Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
3. Explain the core issues of cloud computing such as security, privacy, and interoperability.
4. Provide the appropriate cloud computing solutions and recommendations according to the applications used.
5. Collaboratively research and write a research paper, and present the research online.

Text Book

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier – 2012

Reference Books

1. Barrie Sosinsky, "Cloud Computing Bible" John Wiley & Sons, 2010
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance", O'Reilly 2009
3. Marinescu D C, Cloud Computing Theory and Practice, Morgan Kaufmann (2014).
4. Erl T, Mahmood Z and Martinez J W, Cloud Computing: Concepts, Technology & Architecture, Prentice Hall (2014).
5. Stallings W, Foundations of Modern Networking, Pearson (2017).
6. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
7. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation,Management, and Security", CRC Press, 2010.
8. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.
9. RajkumarBuyya, Christian Vecchiola, and ThamaraiSelvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech I Year I Semester

20CSEP403 INFORMATION SYSTEMS ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description: Learn and apply Information System consulting procedures and techniques. Utilize project management techniques to record, report, and monitor progress.

Course Objectives:

1. Create various professional analysis and design client deliverables, including a system vision document, activity diagrams, use cases, domain model class diagrams, database structure, requirements document, screen layouts and system prototype (UI).
2. Learn about Waterfall, Object Oriented and Agile systems development, with ability to utilize the best of each in appropriate settings.
3. Utilize and develop student writing skills, design activities, with requirements for iterative review and rewrite of documents.

UNIT I INTRODUCTION TO INFORMATION SYSTEMS DEVELOPMENT

System Analyst, System Analysis & Design, Categories of Information Systems, System Development Strategies, Implementation and Evaluation. Managing the application development portfolio-Information system Planning, Managing project review & Selection Information Systems & User-groups Committee Methods **(9)**

UNIT II ANALYSIS

Preliminary Investigation, Scope of Study, Conducting the investigation, Testing Project Feasibility, Handling infeasible projects. **Tools for System Requirements:** Requirement Determination, Activities, Types. **Fact-finding techniques:** Interview, Questionnaire, Record Review, Observation. **Tools for documenting Procedures and Decisions**: Decision Trees, Decision Tables, Structured English **(9)**

UNIT III STRUCTURED ANALYSIS DEVELOPMENT STRATEGY

Features, Data Flow Tools. **Tools for Structured Design:** Data Flow Diagrams, Data Dictionaries. **Application Prototypes:** Purpose, Steps, Use, Tools. Prototype Example. **(9)**

UNIT IV COMPUTER AIDED SYSTEM TOOLS

Role, Categories, CASE Tools. **Analysis to Design transition**- Objectives, Features. **Element of Design:** Output, Files, Database Interaction, Input, Control, Procedures, Program Specifications. **(9)**

UNIT V DESIGN OF COMPUTER OUTPUT

Objective, Needs, Types. Design Input and Control: Objectives Capturing input data, Input validation. Design of Online dialogues & its interface, design of files & Use of Auxiliary storage devices **Systems Engineering & Quality Assurance**: -Design Objectives, Design of Software & Documentation. **(9)**

Total: 45 Periods

Course Outcomes

Upon completion of this course, the student should be able to

1. To analyse the system functionality of existing information systems and the organizational requirements for an information system solution.
2. To Design a Computerized Information System.
3. To Construct project plans for the execution and management of appropriate information systems development methodologies.
4. To Evaluate the feasibility of launching an information systems development process. Employing effective project and operations management methods throughout the systems development process.
5. To Integrate ethical, legal, socially responsible, and security best practices with project and operations management and systems development methods, and Document the Manual System

Text Books

1. Wang, Shouhong, and Hai Wang. Information systems analysis and design. Universal-Publishers, 2012.
2. James A. Senn,Title: Analysis and Design of Information Systems, Publishers: Tata McgrawHill,Year of Publication:2004

References

1. Robert J. Thierauf, "System Analysis and Design- A Case Study Approach", CBS.
2. James Rambaugh, Grady Booch, Jacobson, "The Unified Modeling Language Reference Manual", Object Tech Series.
3. Elias M Awadh, "System Analysis & Design", Galgotia Publications
4. Haag, S., & Cummings, M. (2013). Management information systems for the information age (9th ed.). New York, NY: McGraw-Hill
5. Whitten, Bentley and Barlow, "System Analysis and Design Methods", Tata Mcgraw Hill.
6. Valacich, Joseph, Joey George, and Jeffrey Hoffer. Essentials of Systems Analysis and Design. 2nd ed.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech I Year I Semester

20CSEP404 ADVANCED OPERATING SYSTEMS

Course Prerequisite: NIL

L	T	P	C
3	0	0	3

Course Description:

This course covers general issues of design and implementation of advanced modern operating systems. The focus is on issues that are critical to the applications of distributed systems and computer networks, which include inter-process communication, distributed processing, sharing and replication of data and files.

Course objectives:

1. To study the characteristics of OS for Multiprocessor and Multicomputer.
2. To learn the issues related to designing OS.
3. To learn the latest trends in building Mobile OS.

UNIT-I MULTIPROCESSOR OPERATING SYSTEMS

System Architectures- Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation- memory management. **(9)**

UNIT-II DISTRIBUTED OPERATING SYSTEMS

System Architectures- Design issues – Communication models – clock synchronization – mutual exclusion – election algorithms- Distributed Deadlock detection **(9)**

UNIT-III FILE SYSTEM

Distributed scheduling - Distributed shared memory - Distributed File system – Multimedia file systems - File placement – Caching **(9)**

UNIT-IV DATABASE OPERATING SYSTEMS

Database Operating Systems: Requirements of Database OS – Transaction process model – Synchronization primitives - Concurrency control algorithms **(9)**

UNIT-V MOBILE OPERATING SYSTEMS

ARM and Intel architectures - Power Management - Mobile OS Architectures - Underlying OS - Kernel structure and native level programming - Runtime issues- Approaches to power management **(9)**

Total: 45 Periods

Course Outcomes:

Upon completion of this course, the student should be able to

1. Knowledge about advanced concepts in OS
2. Ability to develop OS for distributed systems
3. Ability to develop modules for mobile devices

REFERENCES:

1. A S Tanenbaum, Distributed Operating Systems, Pearson Education Asia, 2001
2. Source Wikipedia, Mobile Operating Systems, General Books LLC, 2010
3. M Singhal and NG Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw Hill Inc, 2001

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech I Year I Semester

20CSEP405 BIG DATA TECHNOLOGIES

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description:

This course introduces fundamental concepts and tools required to understand Data analytics. Discusses Big Data applications in Data Science and covers the applications and technologies needed to process the large-scale data.

Course Objectives:

1. Explore fundamental concept Big Data
2. Provide an overview of Hadoop Distributed File System
3. Understand the map reduce way of solving analytic problems
4. Understand Map Reduce Jobs
5. Provide hands on Hadoop Eco System
6. Visualize data using R

UNIT I: INTRODUCTION TO BIG DATA

Big Data and its Importance. Big Data Characteristics, Types of Data, Common Big data Customer Scenarios, BIG DATA vs. HADOOP, A Holistic View of a Big Data System, Introduction to Big Data Analytics – Big Data Analytics applications – Open Source Technology for Big Data Analytics. (**9)**

UNIT II: HADOOP DISTRIBUTED FILE SYSTEM

History of Hadoop – What is Hadoop? – Hadoop Characteristics – Hadoop Cluster Architecture 2.X - Apache Hadoop & Hadoop Ecosystem – RDBMS Vs Hadoop Distributed File System (HDFS) – The Architecture of HDFS, Features of HDFS, Hadoop File System API. (**9)**

UNIT III – MAPREDUCE

Why MapReduce? MapReduce Architecture – MapReduce Components –Anatomy of a MapReduce Work flow – Job Scheduling – Shuffle and Sort – Task Execution – MapReduce Types and Formats – MapReduce features – MapReduce Programs – Word Count Program, Maximum Temperature Program. (**9)**

UNIT IV – HADOOP ECOSYSTEM

Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.

Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.

Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. (**9)**

UNIT V – DATA ANALYTICS USING R

Introduction to Data Science - Introduction to R, Getting Started - R Console, Data types and Structures, Exploring and Visualizing Data, Programming Structures, Functions, and Data Relationships. (**9)**

Total: 45 Periods

Course Outcomes

Upon completion of this course, the student should be able to

1. Understand the Big Data platform and hadoop framework for data analytics
2. Identify the Hadoop features for the Big Data applications
3. Design map reduce algorithms for data analytics
4. Develop Big Data Solutions using Hadoop Eco System
5. Visualize large scale data using R programming

Text Books:

1. Brett Lantz, Machine Learning with R -Second Edition -Deliver Data Insights with R and Predictive Analytics 2nd Revised edition, 2015
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

References:

1. Chuck Lam , Hadoop in Action, Manning, Second Edition ,2016
2. Mark Gardener, Beginning R: The Statistical Programming Language, Wiley, 2013.
3. Jiawei Han and Micheline Kamber, Data Mining, Second Edition, Elsevier, 2007. ISBN: 81-312-0535-5.
4. Tom White, “Hadoop: The Definitive Guide”, 3rd Edition, O’reilly, 2012.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech I Year I Semester

20CSEP406 FOUNDATIONS OF PARALLEL COMPUTATION

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description:

This course covers parallel computation, multiple processors work together to solve a given problem.

Course Objective:

To learn the concepts of Parallel computing, discussing both theoretical issues such as the fundamentals of concurrent processes, models of parallel and distributed computing, and metrics for evaluating and comparing parallel algorithms

UNIT I CONCURRENT PROCESSES

Basic Concepts- Concurrency of Processes in Operating Systems- Correctness of Concurrent Programs- Selected Problems in Concurrent Programming. **(9)**

UNIT II MODELS OF PARALLEL COMPUTATION

The Shared Memory Model- The Network Model- Elementary Parallel Algorithms- Designing Parallel Algorithms- Minimizing Cost of Parallel Algorithm. **(9)**

UNIT III ARCHITECTURES OF PARALLEL COMPUTERS

Classification of Architectures- Processor Arrays- Multiprocessor Computers- Clusters- Computers of Unconventional Architectures- Interconnection Networks. **(9)**

UNIT IV MESSAGE-PASSING PROGRAMMING

Introduction- The MPI Model of Computation- Minimum Graph Bisection- Sorting- Finding Prime Numbers- Matrix–Vector Multiplication **(9)**

UNIT V SHARED-MEMORY PROGRAMMING

Introduction- The Open MP Model of Computation- Creating a Parallel Program- The Construct and Region Concepts- Parallel Construct- Loop Construct- Sections Construct- Task Construct- Clauses- Master and Synchronization Constructs **(9)**

Total: 45 Periods

Course Outcome

Upon completion of this course, the student should be able to

1. The course focuses on hardware, algorithm, and programming of parallel systems
2. To explain how large-scale parallel systems are architectured and how massive parallelism are implemented in accelerator architectures
3. To write parallel programs for large-scale parallel systems, shared address space platforms, and heterogeneous platforms
4. To design efficient parallel algorithms and applications
5. To be conversant with performance analyze and modeling of parallel programs

Text Book

1. Zbigniew J. Czech, Introduction to parallel computing, 2nd edition, Cambridge University Press,2016

Reference Books

1. "Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers" by WILKINSON6. "Python Parallel Programming Cookbook" by Giancarlo Zaccone
2. "Parallel Computers: Architecture and Programming" by V Rajaraman and C Siva Ram Murthy.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech I Year I Semester

20CSEP201 MODERN ALGORITHM DESIGN LABORATORY

L	T	P	C
0	0	4	2

Course Prerequisite: NIL

Course Description: An algorithm is just a set of instructions for solving a problem. This course will provide a rigorous and hands-on introduction to the central ideas and algorithms that constitute the core of the modern algorithms. Emphasis will be on understanding the high-level theoretical intuitions and principles underlying the algorithms we discuss, as well as developing a concrete understanding of when and how to implement and apply the algorithms. The Algorithm's coming-of-age as the new language of science promises to be the most disruptive scientific development since quantum mechanics.

Objectives

1. To provide an in-depth and comprehensive knowledge of designing modern algorithms.
2. To expose modern image processing algorithms.
3. To motivate students to analyze cluster computing algorithms.
4. To encourage the students on data storage issues and need for modern algorithms.
5. To approach real world problems by machine learning algorithms.

List of Experiments

1. Design and implement the nearest neighbour algorithm to solve a real world problem.
2. Implement the Singular Value Decomposition for multi-fascinate data processing.
3. Write a program for implementing image segmentation technique for a space image analysis.
4. Design and implement an algorithm to compress a colour image.
5. Write a program for correctly implanting a Grid based clustering approach.
6. Implement the K-Means technique for solving a combinatorial problem.
7. Write a program to implement the fuzzy K-Means algorithm for solving a real world problem.
8. Design and implement user credential system to ensure originality of data user in a storage system.
9. Write a program to implement an effective information retrieval system for a social network application.
10. Design and implement the Feature selection technique for a healthcare data set.
11. Design and develop an algorithm for correctly identifying the social behaviour of a premier survivor.

Course Outcomes

Upon completion of this course, the student should be able to

1. Pin point the inevitability of modern algorithms essentiality for solving real world problems.
2. Image processing algorithms applicability in resolving issues in various fields like agro, space research, health care, etc.,.
3. Cluster analysis for solving problems related to any network by enhancing contribution of each and every individual as a team.
4. Provide appropriate algorithm for accessing and retrieving information form big data storage systems.
5. Machine learning based algorithm for approaching complex issues to improve the efficiency of automated systems.

Text Books:

1. Modern Algorithms for Image Processing: Computer Imagery by Example Using C#, Vladimir Kovalevsky, Apress.
2. Modern Algorithms of Cluster Analysis, Wierzchon, Slawomir, Klopotek, Mieczyslaw , 1st ed. 2018 Edition, Springer.

Reference Books:

1. Introduction to algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Second Edition, The MIT Press.
2. Essential Algorithms: A Practical Approach to Computer Algorithms Using Python and C#, Rod Stephens, Wiley.
3. First Course in Algorithms through Puzzles, Ryuhei Uehara, Springer.
4. The Algorithm Design Manual, Steven S. Skiena, Springer.
5. Problems on algorithms, Ian Parberry, Prentice Hall.
6. Foundations of Machine Learning, MohriMehryar, AfshinRostamizadeh, and Ameet Talwalkar, The MIT Press

Mode of Evaluation: Continuous Evaluation of the Lab Experiments, Record, Viva-voce and External Lab Examination.

M. Tech I Year I Semester

		L	T	P	C
20CSEP202	**CLUSTER AND GRID COMPUTING LABORATORY**	**0**	**0**	**4**	**2**

Course Prerequisite: NIL

Course Description:
This course helps the students to understand cluster and grid as computing platform for distributed computing.

Course Objectives:
1. To investigate cluster and grid as computing platform for distributed computing.
2. To make students aware of distinguishing characteristics of cluster and grid computing.
3. Introducing software tools used in both cluster and grid computing.

LIST OF EXPERIMENTS

CLUSTER COMPUTING LABORATORY
1. Install PVM and MPI on a cluster.
2. Build a low-cost cluster using PC's, Linux and Ethernet.
3. Develop cluster monitoring tools.
4. Develop share-based scheduling policy and implement in systems such as PBS.
5. Develop tools for system administration.
6. Develop a load balancing algorithm.

GRID COMPUTING LABORATORY
Use Globus Toolkit or equivalent and do the following:
1. Develop a new Web Service for Calculator.
2. Develop new OGSA-compliant Web Service.
3. Using Apache Axis develop a Grid Service.
4. Develop applications using Java or C/C++ Grid APIs
5. Develop secured applications using basic security mechanisms available in Globus Toolkit.
6. Develop a Grid portal, where user can submit a job and get the result. Implement it with and without GRAM concept.

Course Outcomes:
After completing this course, the students should be able to
1. Use the grid and cluster tool kits
2. Design and implement applications on the Grid.
3. Design and Implement applications on the Clusters.

References:
1. C.S.R.Prabhu – "Grid and Cluster Computing"- PHI (2008).

Mode of Evaluation: Continuous Evaluation of the Lab Experiments, Record, Viva-voce and External Lab Examination.

M.Tech I Year I Semester

20ICP101 RESEARCH METHODOLOGY AND IPR

Course Prerequisite: NIL

L	T	P	C
2	0	0	2

UNIT-I PROBLEM FINDING

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations **(9)**

UNIT-II LITERATURE

Effective literature studies approaches, analysis Plagiarism, Research ethics **(9)**

UNIT-III 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 **(9)**

UNIT-IV IPR

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, Patentingunder PCT. **(9)**

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. **(9)**

Total: 45 Periods

Course Outcomes:

At the end of this course, students will be able to

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

REFERENCES:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

AUDIT COURSE - I

AUDIT COURSE - I

20AUP901 DISASTER MANAGEMENT

L	T	P	C
2	0	0	0

Course Objectives:

Upon the completion of subject student will be able to-

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches,
5. Planning and programming in different countries, particularly their home country or the countries they work in

UNIT-I DISASTER CLASSIFICATION

Disaster: definition, factors and significance; difference between hazard and Disaster; natural disaster: earthquakes, volcanisms, cyclones, tsunamis, floods, droughts and famines, landslides and avalanches; man-made disasters: nuclear reactor meltdown, industrial accidents, oil slicks and spills, outbreaks of disease and epidemics, war and conflicts **(6)**

UNIT-II REPERCUSSIONS OF DISASTERS

Economic damage, loss of human and animal life, destruction of ecosystem. **Disaster Prone Areas in India:** Study of seismic zones; areas prone to floods and droughts, landslides and Avalanches; areas prone to cyclonic and coastal hazards with special reference to tsunami. **(6)**

UNIT-III DISASTER PREPAREDNESS AND MANAGEMENT

Preparedness: monitoring of phenomena triggering a disaster or hazard; Evaluation of risk: application of remote sensing, data from meteorological and Other agencies, media reports: governmental and community preparedness. **(6)**

UNIT-IV RISK ASSESSMENT

Disaster risk: concept and elements, disaster risk reduction, global and national disaster risk situation. Techniques of risk assessment, global co-operation in risk assessment and warning. **(6)**

UNIT-V DISASTER MITIGATION

Meaning, concept and strategies of disaster mitigation, emerging trends in Mitigation. Structural mitigation and non-structural mitigation, programs of Disaster mitigation in India. **(6)**

Total: 30 Periods

Course outcomes:

After the completion of the subject following outcomes can be achieved-

1. Students will be able to understand disaster and its types in general.
2. They will understand the post disaster damage in terms of both like and commodity.
3. They will have clear picture of disaster-prone zones.
4. They will be able to understand the pre and post disaster preparedness needed to mitigate the disaster impact in large scale.
5. Student will also understand to quantify the risk in terms of monetary for both commodity and life.
6. Student will also learn the structural and non-structural measures for risk mitigation

REFERENCES:

1. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation
2. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
3. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi.
4. Goel S. L., Disaster Administration And Management Text and Case Studies" ,Deep&Deep Publication Pvt. Ltd., New Delhi

Mode of Evaluation: Assignments, Mid Term Tests

AUDIT COURSE – I

20AUP902 SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Prerequisite: None

L	T	P	C
2	0	0	0

Course Objectives:

Upon the completion of subject student will be able to:

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

UNIT-I

Alphabets- Vowels- Consonants - Māheśvara sutras - Combined alphabets- Verbs- Basic words **(6)**

UNIT-II

Singular/Dual/Plural – Nominative case– Accusative case - Instrumental case - Dative case - Ablative case- Genitive case - Locative case **(6)**

UNIT-III

Nouns and adjectives – Indeclinables - Present tense - Past tense - Future tense- Order and request– Prefixes - Number word - Combinations and cases **(6)**

UNIT -IV

Sanskrit literature – Harsacaritasangrah – Kumarasambhava - sabdamanjari (**6)**

UNIT -V

Technical concept of Architecture - Manasar text – logic - nyaya sutras – pramana – mathematics - sulva sutras - baudhyana theorem. **(6)**

Total: 30 Periods

Course Outcomes:

Students will be able to

1. Understanding basic alphabets and vowels
2. Understanding the cases in Sanskrit language
3. Understanding of Nouns and tense
4. Understanding of some literature
5. Analyzing the observation through pramana, application of architecture and mathematics

REFERENCES:

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

Mode of Evaluation: Assignments, Mid Term Tests

AUDIT COURSE - I

20AUP903 CONSTITUTION OF INDIA

L	T	P	C
2	0	0	0

Course Objectives:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian 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. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.
4. To get knowledge about the Indian Federal System and Center – State Relations
5. To Understand the Election Commission functions and administration system

UNIT-I: INTRODUCTION

Historical Background – Drafting Committee (Composition & Working) – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens. **(6)**

UNIT-II: STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review. **(6)**

UNIT-III: STRUCTURE AND FUNCTION OF STATE GOVERNMENT

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature –Judicial System in States – High Courts and other Subordinate Courts. **(6)**

UNIT-IV CONSTITUTION FUNCTIONS

Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments –Constitutional Functionaries - Assessment of working of the Parliamentary System in India. **(6)**

UNIT-V: ELECTION COMMISSION

Central Election Commission - Role and functioning – Chief Election Commissioner and Election Commissioners – State Election Commission – Institute and Bodies for the welfare of SC/ST/OBC and Women **(6)**

Total: 30 Periods

Course Outcomes:

Upon completion of the course, students will be able to:

1. Know about Human rights protection by Indian Constitution.
2. Understand the functions of the Indian government
3. Understand and abide the rules of the Indian constitution.
4. Role of Constitution in Socio-economic development and welfare activities of the Country.

TEXTBOOKS:

1. Durga Das Basu, “Introduction to the Constitution of India “, Prentice Hall of India, New Delhi.
2. R.C.Agarwal, (1997) “Indian Political System”, S.Chand and Company, New Delhi.

REFERENCES:

1. The Constitution of India, 1950 (Bare Act), Government Publication
2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, 1st Edition, 2015
3. M.P. Jain, Indian Constitution Law, 7thEdn., Lexis Nexis, 204
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015

Mode of Evaluation: Assignments, Mid Term Tests

AUDIT COURSE - I

20AUP904 PEDAGOGY STUDIES

L	T	P	C
2	0	0	0

Course Objectives:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

UNIT-I

Introduction and Methodology

- Aims and rationale, Policy background, Conceptual framework and terminology
- Theories of learning, Curriculum, Teacher education.
- Conceptual framework, Research questions**.**
- Overview of methodology and Searching. (**6)**

UNIT-II

- Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
- Curriculum, Teacher education. (**6)**

UNIT-III

- Evidence on the effectiveness of pedagogical practices
- Methodology for the in-depth stage: quality assessment of included studies.
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?
- Theory of change.
- Strength and nature of the body of evidence for effective pedagogical practices.
- Pedagogic theory and pedagogical approaches.
- Teachers' attitudes and beliefs and Pedagogic strategies. (**6)**

UNIT-IV

- Professional development: alignment with classroom practices and follow-up support
- Peer support
- Support from the head teacher and the community.
- Curriculum and assessment
- Barriers to learning: limited resources and large class sizes (**6)**

UNIT-V

- Research gaps and future directions
- Research design
- Contexts
- Pedagogy
- Teacher education

- Curriculum and assessment
- Dissemination and research impact. (**6)**

Total: 30 Periods

Course Outcomes:

Students will be able to understand:

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

TEXT BOOKS/ REFERENCES:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, ‘learning to read’ campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Mode of Evaluation: Assignments, Mid Term Tests

M. Tech. I Year II Semester

20CSEP103 PROGRAMMING FOUNDATIONS FOR DATA SCIENCES	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Prerequisite: NIL

Course Description:
This course helps the students to understand Data science which is an inter-disciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from many structural and unstructured data. Data science is related to data mining, machine learning and big data.

Course Objectives:

1. Gain expertise in different aspects of data science such as data collection, visualization, processing and modeling of large data sets.
2. Acquire good understanding of both the theory and application of applied statistics mathematics and computer science based existing data science models to analyse huge data sets.
3. Be able to create models using the knowledge acquired from the course to solve real-world problems requiring large scale data analysis.
4. Possess the knowledge of data science project management so as to meet the growing demand for being data scientists and engineers in industry.

UNIT I - THE FUNDAMENTALS OF MACHINE LEARNING
What Is Machine Learning? - Types of Machine Learning Systems - Main Challenges of Machine Learning - Testing and Validating - End-to-End Machine Learning Project workflow: Get the Data, Discover and Visualize the Data to Gain Insights, Prepare the Data for Machine Learning Algorithms, Select and Train a Model, Fine-Tuning Model. **(9)**

UNIT II – ELEMENTARY STATISTICS & EXPLORATORY DATA ANALYSIS
Introduction and Descriptive Statistics: Measures of Central Tendency, Skewness and Kurtosis, Relations between the Mean and the Standard Deviation, EDA: Box Plots, Scatter plots, Plotting Univariate and multivariate Distributions, Pairplots, Barplots, Histograms plots, Density plots – Probability - Random Variables: Uniform Distribution, Binomial Distribution, Poisson Distribution - Normal Distribution - Hypothesis Testing: Computing the p-Value. Data Science: Tools and Techniques - R, Octave, Scilab and Python libraries. **(9)**

UNIT III – SUPERVISED AND UNSUPERVISED LEARNING
Training a Binary Classifier - Performance Measures - Multiclass Classification – Supervised learning techniques: Decision Trees, Naïve Bayes - Multinomial NB and Gaussian NB, Support Vector Machines, Ensemble Learning and Random Forests - Dimensionality Reduction: PCA - Training Models: Linear Regression, Logistic Regression. Unsupervised Learning Techniques: Clustering. **(9)**

UNIT IV – NEURAL NETWORKS

Introduction to Artificial Neural Networks - The Perceptron, The Multilayer Perceptron, Cost function, Loss function, Error Surface - Backpropagation: overfitting and Regularization- Fine-Tuning Neural Network Hyper-parameters: Number of Hidden Layers, Number of Neurons per Hidden Layer, Learning Rate, Batch Size – Automated feature learning using Neural Networks - Applications of Artificial Neural Networks. (**9)**

UNIT IV – DEEP LEARNING

Deep learning Architectures and Libraries - Training Deep Neural Networks with Tensor Flow - Deep Computer Vision Using Convolutional Neural Networks: CNN Architectures - Natural Language Processing with RNNs. (**9)**

Total: 45 Periods

Course Outcomes:

After completion of the course the student will be able to

1. Distinguish traditional programming versus machine learning programming.
2. Find a meaningful pattern in data and graphically interpret data of various kind.
3. Analyse and implement supervised and unsupervised machine learning algorithms
4. Design complex applications using artificial neural network.
5. Use deep learning architectures and libraries to implement data science applications.

Text Books:

1. Aurelien Geron, **Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow - Concepts, Tools, and Techniques to Build Intelligent Systems**, Second Edition, O'Reilly publication, ISBN – 978-1-492-03264-9, 2019.

Reference Books:

1. Aczel, Sounderpandian **Business Statistics**, 7th Edition, McGraw-Hill/Irwin publication, ISBN−10: 0−39−050192−1, 2009.
2. Robert I. Kabacoff, **R in Action - Data analysis and graphics with R**, Manning Publications, ISBN- 9781935182399, 2011.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech. I Year II Semester

20CSEP104 MOBILE AND PERVASIVE COMPUTING

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description:

This course will give you an understanding of various wireless communication technologies and telecommunication standards such as 2G/3G/4G. The different protocols used in Network layer, Transport layer and Application layer of mobile communication model are discussed. An introduction to Pervasive computing and the various technologies used in pervasive system are also studied in this course.

Course Objectives:

1. Understand the basic concepts of wireless communication technologies
2. Be familiar with various protocols used in Network layer and Transport layer of mobile communication systems.
3. Gain knowledge to develop mobile applications
4. Understand the characteristics and principles of pervasive computing
5. Give an introduction to the technologies and services of pervasive computing

UNIT I WIRELESS TECHNOLOGIES

Wireless networks: Wireless LAN, WiFi, WiMax, HIPERLAN, Bluetooth, **GSM:** System Architecture, Radio Interface, Protocols, Localization, Handover, Security, GPRS, EDGE, UMTS, LTE, MANET. (**9)**

UNIT II MOBILE NETWORK AND TRANSPORT LAYER

Mobile IP: Goals and Assumptions, Entities and Terminology, IP packet delivery, Agent discovery and registration, tunneling and encapsulation, IPv6. DHCP. **Mobile Transport Layer**: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP. (**9)**

UNIT III MOBILE APPLICATION LAYER

Wireless application protocol (WAP): Architecture, Wireless datagram protocol, Wireless transport layer security, Wireless session protocol, Wireless application environment, **Application Development**: Wireless markup language (WML), HanDheld Markup Language(HDML), J2ME, Android Application Development (**9)**

UNIT IV PERVASIVE COMPUTING PRINCIPLES AND DEVICES

Pervasive Computing: Principles, Context-Aware Pervasive System, Context-Aware Addressing and Communication, Architecture for pervasive computing, **Pervasive Devices:** Information Access devices, Smart Identification, Embedded Controls. (**9)**

UNIT V PERVASIVE TECHNOLOGIES AND SERVICES

Technologies: WAP and Beyond, Voice Technologies, Personal Digital Assistants, Service discovery technologies, Synchronization. **Services:** Home Services, Travel and Business Services, Consumer Services, Entertainment Services. **(9)**

Total: 45 Periods

Course Outcomes:

Upon completion of this course, students should be able to:

1. Compare the architecture and features of various wireless technologies
2. Identify solution for each layer of mobile communication model
3. Choose the required network, transport and application layer protocol for given application
4. Analyze the performance of different pervasive devices
5. Design solutions with pervasive computing technologies and services

Text Books

1. Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition, 2004.
2. Hansmann, Merk, Nicklous, Stober, "Pervasive Computing", Springer, New York, 2003.

Reference Books:

1. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi, 2012.
2. Raj Kamal**, "**Mobile Computing", Oxford University Press, 2007.
3. Seng Loke, "Context-Aware Computing Pervasive Systems", Auerbach Pub., New York, 2007.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech. I Year II Semester

20CSEP407 SPEECH AND NATURAL LANGUAGE PROCESSING

	L	T	P	C
Course Prerequisite: NIL	**3**	**0**	**0**	**3**

Course Description:

This course covers speech processing and Natural Language processing which is part of Artificial Intelligence.

Course Objectives:

1. To understand the need for morphological processing and their representation
2. To know about the various techniques used for speech synthesis and recognition
3. To appreciate the syntax analysis and parsing that is essential for natural language processing
4. To learn about the various representations of semantics and discourse
5. To have knowledge about the applications of natural language processing

UNIT I MORPHOLOGY AND PART-OF-SPEECH PROCESSING

Introduction –Regular Expressions and Automata-Non-Deterministic FSAs. Transducers –English Morphology-Finite-State Morphological Parsing -Porter Stemmer -Tokenization-Detection and Correction of Spelling Errors. N-grams –Perplexity -Smoothing -Interpolation - Backoff . Part-of-Speech Tagging –English Word Classes -Tagsets -Rule-Based -HMM -Transformation-Based Tagging -Evaluation and Error Analysis. Hidden Markov and Maximum Entropy Models. (**9)**

UNIT II SPEECH PROCESSING

Phonetics –Articulatory Phonetics -Phonological Categories -Acoustic Phonetics and Signals - Speech Synthesis–Text Normalization –Phonetic and Acoustic Analysis - Diphone Waveform synthesis –Evaluation- Automatic Speech Recognition –Architecture -Hidden Markov Model to Speech -MFCC vectors -Acoustic Likelihood Computation - Evaluation. Triphones – Discriminative Training -Modeling Variation. Computational Phonology-Finite-State Phonology –Computational Optimality Theory -Syllabification -Learning Phonology andMorphology. (**9)**

UNIT III SYNTAX ANALYSIS

Finite-State and Context-Free Grammars -Dependency Grammars. Syntactic Parsing – Ambiguity – Dynamic Programming Parsing Methods – CKY- Earley and Chart Parsing-Partial Parsing-Evaluation. Statistical Parsing –Probabilistic Context-Free Grammars –Probabilistic CKY Parsing of PCFGs –Probabilistic Lexicalized CFGs –Collins Parser – Shallow parsers – Dependency parsing. (**9)**

UNIT IV SEMANTIC AND PRAGMATIC INTERPRETATION

Representation of Meaning –Desirable Properties -Computational Semantics -Word Senses - Relations Between Senses –WordNet -Event Participants-Proposition Bank -Frame Net -– Metaphor. Computational Lexical Semantics –Word Sense Disambiguation-Supervised Word Sense Disambiguation -Dictionary and Thesaurus Methods-Word Similarity -Minimally Supervised WSD -Hyponymy and Other Word Relations -Semantic Role Labeling -Unsupervised

Sense Disambiguation. Computational Discourse -Discourse Segmentation - Unsupervised Discourse -Segmentation -Text Coherence -Reference Resolution –Phenomena –Features and algorithms -Pronominal Anaphora Resolution. (**9)**

UNIT V APPLICATIONS

Information Extraction –Named Entity Recognition -Relation Detection and Classification – Temporal and Event Processing -Template-Filling -Biomedical Information Extraction. Question Answering and Summarization -Information Retrieval -Factoid Question Answering - Summarization -Single and Multi- -Focused Summarization -Evaluation. Dialog and Conversational Agents –Properties of Human Conversations -Basic Dialogue Systems. (**9)**

Total: 45 Periods

Course Outcomes:

Upon completion of this course, the student should be able to:

1. Identify the different linguistic components of natural language
2. Design a morphological analyser for a given natural language
3. Decide on the appropriate parsing techniques necessary for a given language and application
4. Design new tagset and a tagger for a given natural language
5. Design applications involving natural language

TEXT BOOKS

1. Jurafsky and Martin, "Speech and Language Processing", Pearson Prentice Hall, Second Edition, 2008.
2. Christopher D. Manning and HinrichSchütze, "Foundations of Statistical Natural Language Processing",MIT Press, 1999.

REFERENCE BOOKS

1. Stevan Bird, "Natural Language Processing with Python", Shroff, 2009.
2. James Allen, "Natural Language Understanding", Addison Wesley, Second Edition, 2007.
3. Nitin Indurkhya, Fred J. Damerau, "Handbook of Natural Language Processing", (Chapman & Hall/CRCMachine Learning & Pattern Recognition), Second Edition, 2010.
4. Alexander Clark, Chris Fox, Shalom Lappin, "The Handbook of Computational Linguistics and NaturalLanguage Processing", Wiley-Blackwell, 2012.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech. I Year II Semester

20CSEP408 INFORMATION RETRIEVAL

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description:

This course covers the basics of information retrieval with pertinence to modeling, query operations and indexing.

Course Objective:

This course will enable students to

1. To get an understanding of modeling techniques for text classification and evaluation.
2. To understand the various applications of information retrieval giving emphasis to multimedia IR, web search.
3. To understand the different classification and clustering techniques for information retrieval.
4. To understand the concepts of digital information system.

UNIT I INTRODUCTION OF INFORMATION RETRIEVAL

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval –Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics–The impact of the web on IR —IR Versus Web Search–Components of a Search Engine. (**9)**

UNIT II MODELING AND RETRIEVAL EVALUATION

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models - Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing. Retrieval Evaluation – Retrieval Metrics – Precision and Recall – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback. (**9)**

UNIT III INDEXING

Static and Dynamic Inverted Indices – Index Construction and Index Compression-Inverted Index and Multi-Dimensional Indexing. Searching - Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency. (**9)**

UNIT IV CLASSIFICATION AND CLUSTERING

Text Classification and Naïve Bayes – Vector Space Classification – Support Vector Machines (SVM),Gaussian Mixture Model (GMM) and Hidden Markov Model(HMM) and Machine learning on documents clustering. Flat Clustering – Hierarchical Clustering –Matrix decompositions and latent semantic indexing – Fusion and Meta learning. (**9)**

UNIT V SEARCHING THE WEB

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries **9**

TOTAL: 45 Periods

COURSE OUTCOMES:

Upon completion of this course, the students should be able to:

1. Build an Information Retrieval system using the available tools.
2. Identify and design the various components of an Information Retrieval system.
3. Design the various indexing methods of an Information Retrieval system.
4. Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.
5. Design an efficient search engine and analyze the Web content structure.

Text Book:

1. Christopher D. Manning, PrabhakarRaghavan, HinrichSchutze, ―Introduction to Information Retrieval‖, Cambridge University Press, First South Asian Edition, 2008.
2. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.

Reference Books:

1. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1 st Edition Addison Wesley, 2009.
2. Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech. I Year II Semester

20CSEP409 ALGORITHMS FOR BIOINFORMATICS

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description:

This course covers the basics of Bioinformatics concepts and analysis Biological Database.

Course Objective:

1. To Understand the concept of Biological Algorithm and Design techniques and Structure of DNA
2. Students will able to work with Exhaustive Searching, Sorting and Greedy Techniques.
3. To make the student understand Dynamic Programming and Pattern Matching techniques used in DNA sequences.
4. To acquaint knowledge about clustering, hidden Markov Models.

UNIT 1 INTRODUCTION AND BIOLOGICAL DATABASES

What is a Data Base? Types of Databases, Biological Databases, Pitfalls of Biological Databases, Information Retrieval from Biological Databases, Pair wise Sequence Alignment: Evolutionary Basics, Sequence homology versus similarity, Sequence similarity versus Identity, Scoring Matrices, Statistical Significance of Sequence alignment, Database similarity searching: Unique requirement of Database searching, Heuristic Database searching, Basic alignment search tool: Comparison of FASTA and BLAST. (**9)**

UNIT II ALGORITHMS AND COMPLEXITY

What is an Algorithm? Biological Algorithms versus Computer Algorithms, Change Problem, Correct versus Incorrect Algorithms, Recursive, Iterative versus Recursive Algorithms, Fast versus Slow Algorithms, Big-O Notation, Algorithm Design Techniques, Molecular Biology Primer - What is the Genetic Material, What Do Genes Do, What Molecule Codes for Genes, What Is the Structure of DNA, What Carries Information between DNA and Proteins, How Are Proteins Made, How can we Analyze DNA. (**9)**

UNIT III EXHAUSTIVESEARCHING AND GREEDY ALGORITHMS

Restriction Mapping, Impractical Restriction Mapping Algorithms, A Practical Restriction Mapping Algorithm, Regulatory Motifs in DNA Sequences, The Motif Finding Problem, Search Trees, Finding Motifs, Finding a Median String, Genome Rearrangements, Sorting by Reversals, Approximation Algorithms, Breakpoints: A Different Face of Greed, A Greedy Approach to Motif Finding. (**9)**

UNIT IVDYNAMIC PROGRAMMING AND COMBINATORIAL PATTERN MATCHING

Power of DNA Sequence Comparison, Change Problem Revisited, Manhattan Tourist Problem, Edit Distance and Alignments, Longest Common Subsequence's, Global Sequence Alignment, Scoring Alignments, Local Sequence Alignment, Alignment with Gap Penalties, Repeat Finding,

Hash Tables, Exact Pattern Matching, Keyword Trees, Suffix Trees, Heuristic Similarity Search Algorithms, Approximate Pattern Matching. (**9)**

UNIT V CLUSTERING, HIDDEN MARKOV MODELS AND RANDOMIZED ALGORITHMS

Gene Expression Analysis, Hierarchical and k-means Clustering, Clustering and Corrupted Cliques, Evolutionary Trees, Distance-Based Tree Reconstruction, CG-Islands and the "Fair Bet Casino", Fair Bet Casino and Hidden Markov Models, Decoding Algorithm, HMM Parameter Estimation, The Sorting Problem Revisited, The Sorting Problem Revisited, Gibbs Sampling, Random Projections (**9)**

Total : 45 Periods

Course Outcomes:

At the end of the course the student will be able to:

1. Understand the theoretical basis behind in bioinformatics.
2. Analyse Biological Algorithm design techniques and its complexity
3. Comprehend the Exhaustive searching, greedy Algorithm used in DNA sequence
4. Learn Dynamic Programming and Pattern Matching Techniques and apply these techniques to find the insight of the biological data.
5. Understand the Clustering, Hidden Markov models and Randomized algorithms

Textbooks:

1. Neil C. Jones and Pavel A. Pevzner. An Introduction to Bioinformatics Algorithms. 2004 (MIT Press) Massachusetts Institute of Technology, Cambridge Center, Cambridge
2. JIN Xiong, Texas A&M university "Essential Bioinformatics" cambridge university press,2006

Reference Books:

1. James Tisdall, Beginning Perl for Bioinformatics Publisher :O'Reilly
2. Arthur M**,** T.K. Attwood and Parry Smith -Introduction to Bioinformatics -University of Cambridge
3. T.K. Attwood and Parry Smith - Introduction to Bioinformatics – Oxford University Press, Third Edition copyright 2008

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech. I Year II Semester

20CSEP410 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description:

This course gives an introduction to artificial intelligence as well as current trends and characterization of knowledge-based systems. It also covers simple representation schemes, problem-solving , learning paradigms, constraint propagation, and search strategies. Applications of AI in the real world scenarios with case studies.

Course Objectives:

1. To learn the difference between optimal reasoning vs human like reasoning.
2. To understand the notions of state space representation, exhaustive search, heuristic search along with the time and space complexities.
3. To learn different knowledge representation techniques.
4. To gain knowledge of reasoning.
5. To understand the applications of Al in the real world scenarios.

UNIT-I INTRODUCTION

What is AI? Foundations of AI, History of AI, Agents and environments, The nature of the Environment, Problem solving Agents, Problem Formulation, – uninformed search strategies – heuristics – informed search strategies – constraint satisfaction. (**9)**

UNIT-II KNOWLEDGE AND REASONING

Knowledge-based Agents, Representation, Reasoning and Logic, Prepositional logic, First-order logic, Using First-order logic, Inference in First-order logic, forward and Backward Chaining. (**9)**

UNIT-III LEARNING

Learning from observations, Forms of Learning, Inductive Learning, Decision trees, rule based learning, Bayes rule, Learning in Neural and Bayesian networks, Reinforcement learning, genetic algorithms. (**9)**

UNIT-IV UNCERTAINTY

Review of basic probability, Default reasoning, Fuzzy sets and fuzzy logic, Decision making-Utility theory, utility functions, Decision theoretic expert systems, Temporal models – Hidden Markov models. (**9)**

UNIT-VAPPLICATIONS OF AI

Healthcare, Business, Education, Autonomous vehicles, Robotics and Cyborg technology, Practical Natural Language Processing, AI based programming Tools. (**9)**

Total : 45 Periods

Course Outcomes:

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

1. To choose search algorithm for a problem and characterize its time and space complexities.
2. Possess the skill for representing knowledge using the appropriate technique for any real world problem.
3. To apply Al techniques to solve problems of Game Playing, Expert Systems, Machine Learning and Natural Language Processing.
4. Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information.
5. Evaluate applications and learning methods for any real world problems.

Text Books:

1. **Stuart Russell** and Peter Norvig. Artificial Intelligence – A Modern Approach, Second Edition, Pearson Education Press, 2003.
2. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, McGraw Hill, 2008.

References:

1. George F. Luger, "AI-Structures and Strategies for Complex Problem Solving", 4/e, 2002, Pearson Education.
2. George F. Luger, Artificial Intelligence, Pearson Education, 2001.
3. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002.
4. Robert J. Schalkolf, Artificial Intelligence: An Engineering approach, McGraw Hill, 1990.
5. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson.
6. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech. I Year II Semester

20CSEP411 COMPUTATIONAL COMPLEXITY

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description:

This course gives the fundamentals of computational complexity theory.

Course Objectives:

1. To discuss basic concepts such as computational models, computational complexity measures (e.g., time and space complexity measures), complexity classes, reducibility and completeness notions.
2. To familiarize the concepts of randomized and approximation algorithms and discuss the related complexity classes.

UNIT I INTRODUCTION

Easy and hard problems. Algorithms and complexity. **Turing machines:** Models of computation. Multi-tape deterministic and non-deterministic Turing machines. Decision problems

The Halting Problem and Undecidable Languages: Counting and diagonalization. Tape reduction. Universal Turing machine. Undecidability of halting. Reductions. Rice's theorem.

Deterministic Complexity Classes: DTIME[t]. Linear Speed-up Theorem. P Time. Polynomial reducibility. Polytime algorithms: 2-satisfiability, 2-colourability. (**9)**

UNIT II NP AND NP-COMPLETENESS

Non-deterministic Turing machines. NTIME[t]. NP. Polynomial time verification. NP-completeness. Cook-Levin Theorem. Polynomial transformations: 3- satisfiability, clique, colourability, Hamilton cycle, partition problems. Pseudo-polynomial time. Strong NP-completeness. Knapsack. NP-hardness. (**9)**

UNIT III SPACE COMPLEXITY AND HIERARCHY THEOREMS

DSPACE[s]. Linear Space Compression Theorem. PSPACE, NPSPACE. PSPACE = NPSPACE. PSPACE-completeness. Quantified Boolean Formula problem is PSPACE-complete. L, NL and NL- completeness. NL=coNL. Hierarchy theorems. (**9)**

UNIT IV RANDOMIZED COMPLEXITY

The classes BPP, RP, ZPP. Interactive proof systems: IP =PSPACE. (**9)**

UNIT V OPTIMIZATION AND APPROXIMATION

Combinatorial optimization problems. Relative error. Bin-packing problem. Polynomial and fully polynomial approximation schemes. Vertex cover, traveling salesman problem, minimum partition. (**9)**

Total: 45 Periods

Course Outcomes:

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

1. Determine whether a problem is computable, and prove that some problems arenot computable
2. Categorize problems into appropriate complexity classes
3. Classify problems based on their computational complexity using reductions
4. Analyze optimization problems using the concept of interactive proofs
5. Classify optimization problems into appropriate approximation complexity classes

TEXT BOOKS:

1. Michael Sipser, Introduction to the Theory of Computation, (First edition - PWS Publishing Company, January 1997, or second edition - Thomson Course Technology, 2005).
2. Sanjeev Arora and Boaz Barak, Computational Complexity: A Modern Approach, Cambridge UniversityPress, 2009.

REFERENCE BOOKS:

1. Christos H Papadimitriou, Computational Complexity, Addison-Wesley, 1994.
2. M R Garey and D S Johnson, Computers and Intractability: A Guide to the Theory of NP-Completeness, Freeman, 1979.
3. Oded Goldreich, Computational Complexity, Cambridge University press, 2008.
4. Vijay Vazirani, Approximation Algorithms, Springer--Verlag,2001

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech. I Year II Semester

20CSEP412 UBIQUITOUS COMPUTING

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description:
This course is aimed at students who want to explore it as researchers or track its evolution. The major focus of this course is to explore the high level facilities, system architecture and protocols of the ubiquitous system and apply data analytics to facilitate next generation computing.

Course Objectives:
1. To understand the characteristics and principles of ubiquitous computing
2. To introduce to the enabling technologies of ubiquitous computing
3. To understand the basic issues and performance of ubiquitous computing
4. To study requirements of ubiquitous computing and its applications
5. To learn the trends of ubiquitous computing

UNIT I INTRODUCTION TO UBIQUITOUS COMPUTING
Definition, scope, essential elements of ubiquitous, pervasive, and mobile computing. An introduction, overview, and challenges to research topics in ubiquitous computing, including sensors, ambient displays, tangibles, middleware, mobility, and location and context awareness. (**9)**

UNIT IIARCHITECTURE AND LOCATION FOR UBIQUITOUS COMPUTING
New devices and communications, software architectures.Wireless standards & protocols for ubiquitous networks: Near field communication (NFC), Bluetooth classic, Bluetooth Low Energy (BLE), WiFi, and WiFi Direct. Location in ubiquitous computing: Personal assistants, Location aware computing, Location tracking, Architecture, Location based service and applications (Indoor Positioning Techniques). (**9)**

UNIT III INTEGRATING THE PHYSICAL AND THE VIRTUAL WORLDS
Sensing and actuation, awareness and perception. Context-aware Computing, Issues and Challenges, Developing Context-aware Applications, System Architecture. (**9)**

UNIT IV UBIQUITOUS APPLICATIONS
The appropriate design, Weiser's vision of ubiquitous computing,mixed reality and sensible design. Wearable computing, Glass and Augmented Reality, Eye-Tracking, Digital Pen and Paper Mobile social networking & crowd sensing, Event based social network. (**9)**

UNIT V APPLICATION DOMAINS FOR UBIQUITOUS COMPUTING
Illustration of some existing application domains for ubiquitous computing in such areas as gaming, workplaces, domestic spaces, museums and educational communities. Human Activity and Emotion Sensing, Health Apps Mobile peer-to-peer (p2p) computing Smart Homes and Intelligent Buildings, Mobile HCI, and Internet of Thinking IoT. (**9)**

Total: 45 Periods

Course Outcomes:

Upon completion of this course, the student should be able to

1. Express the analysis and design of an application
2. Specify functional semantics of an application
3. Evaluate software architectures
4. Select and use appropriate architectural styles
5. Explore Software design patterns

Text Book:

1. Ubiquitous Computing Fundamentals, John Krumm, Microsoft Corporation Redmond, Washington, U.S.A. CRC Press, 2010

Reference Books

1. Contributions to Ubiquitous Computing - Bernd Krämer; Wolfgang A Halang , Berlin ; London Springer, 2007.

2. Ubiquitous Computing, smart devices , Environments and interactions - Stefan Posland ,Wiley India ,Student Edition

3. Trust Worthy Ubiquitous Computing - Ismail Khalil Teddy Mantoro, Atlantis Ambient and Pervasive Intelligence book series (ATLIsmail Khalil

4. Security for Ubiquitous Computing – Frank Stajano , Wiley, Edition 2002

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech I Year II Semester

20CSEP203 DATA SCIENCES LABORATORY

L	T	P	C
0	0	4	2

Course Prerequisite: NIL

Course Description:

This course gives hands-on experience in data collection, visualization, processing modelling of large data sets.

Course Objectives:

1. Acquire knowledge on descriptive and inferential statistical tools and library.
2. Apply ML Models appropriating for solving business problems.
3. Use of deep learning architectures and libraries to model complex systems.

LIST OF EXPERIMENTS

1. Study the following,
   - Machine Learning packages in Python
   - Data set
   - Train Test split
2. Study of various characteristics of data.
   - Continuous variable (Interval, Ratio)
   - Discrete variable (Categorical, count)
   - Qualitative data and Quantitative data
   - Structured and Unstructured data
   - Big Data and Non-Big data
   - Cross sectional and time series data
   - Balanced and Imbalanced data
3. For a randomly generated 10000 numbers, compute the following.
   - Measures of Central Tendency
   - Skewness and Kurtosis
   - Relations between the Mean and the Standard Deviation
4. Data visualization practices.
   - Box Plots, Scatter plots,
   - Plotting Univariate and multivariate Distributions,
   - Pairplots, Barplots, Histograms plots,
   - Density plots
5. Understand the insights of data through Exploratory Data Analysis (EDA) on Structured Data or Excel kind of data. Perform the following steps.
   - Preview data
   - Check total number of entries and column types
   - Check any null values
   - Check duplicate entries
   - Plot distribution of numeric data (univariate and pairwise joint distribution)
   - Plot count distribution of categorical data
   - Analyse time series of numeric data by daily, monthly and yearly frequencies
6. Perform the following data pre-processing steps for cleaning and scaling the dataset

- Filling of missing values
- Normalization - min max, z-Score, Decimal scaling

7. Apply Machine Learning technique to identify customer's eligibility for loan approval. Show the performance by measuring the accuracy of the predictions.
8. Use Naïve Bayes classifier for text classification. Show the accuracy of the classification using confusion matrix.
9. Consider the dataset containing 2 attributes, Rainfall (in cms) and Temperature (in degree Celsius)
   - Observe the data and figure out whether the data is suitable for applying ML technique or not.
   - If no, identify if there is requirement of any preprocessing such as missing values.
   - If yes, apply the suitable unsupervised ML technique to cluster out the areas with similar cultivation rates, depending upon the given attributes.
10. Perform dimensionality reduction using PCA on the cleaned and preprocessed datasets. Calculate the mean absolute error for actual and predicted performance score.
11. Apply Multilayer perceptron with varying configurations
    - MLP for Hand-written digit recognition with no hidden layer with 10 output neurons
    - MLP for Hand-written digit recognition with two hidden layers
12. Loading and Preprocessing Data with TensorFlow.
13. Apply Convolutional Neural Networks using Tensorflow and Keras
    - CNNs for Hand-written digit recognition using Tensorflow
    - CNNs for Hand-written digit recognition using Keras
14. Implementing a ResNet-34 CNN Using Keras.
15. RNN for Classify movie reviews. Perform binary classification using Keras.

Course Outcomes:

After completion of the course the student will be able to

1. Exhibit the knowledge on understanding insights from various forms of data.
2. Perform data preprocessing in order to handle large scale data.
3. Demonstrate hands-on practices in solving problems using supervised and unsupervised machine learning algorithms
4. Apply artificial neural network architectures to solve complex problems.
5. Apply deep learning architectures and libraries to implement data science applications.

Text Books:

1. AurelienGeron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow - Concepts, Tools, and Techniques to Build Intelligent Systems, Second Edition, O'Reilly publication, ISBN – 978-1-492-03264-9, 2019.

Reference Books:

1. Aczel, SounderpandianBusiness Statistics, 7th Edition, McGraw-Hill/Irwin publication, ISBN−10: 0−39−050192−1, 2009.
2. Robert I. Kabacoff, R in Action - Data analysis and graphics with R, Manning Publications, ISBN- 9781935182399, 2011.

Mode of Evaluation: Continuous Evaluation of the Lab Experiments, Record, Viva-voce and External Lab Examination.

M. Tech I Year II Semester

20CSEP204 MOBILE AND PERVASIVE COMPUTING LABORATORY

Course Prerequisite: Nil

L	T	P	C
0	0	4	2

Course Description:

This course will give knowledge to develop mobile and pervasive computing applications. The software tools and programming concepts required to develop applications to solve real time problems.

Course Objectives:

1. Understand and use the programming fundamentals for mobile devices.
2. Know the components of mobile application development frameworks like Android /windows /ios
3. Apply event-driven programming to design mobile applications
4. Learn to develop pervasive computing applications

List of Experiments:

1. Develop an application that uses layout managers
2. Develop an application that uses event listeners
3. Develop an application that draws basic graphical primitives.
4. Develop an application that makes use of database
5. Develop an application that makes use of RSS Feed
6. Develop an application that implements Multithreading
7. Develop a native application that uses GPS location information
8. Implement an application that reads and writes data from/to a file.
9. Implement an application that writes data to the SD card
10. Implement an application that creates an alert upon receiving a message
11. Develop a game application
12. Develop a speech application in pervasive computing
13. Develop an application to show the interoperability between Mobile phone and other hand-held devices

Course Outcomes:

Upon completion of this course, students should be able to:

1. Understand the technology and programming concepts of mobile application development
2. Develop mobile applications that make use of Layouts, Listeners, GPS and RSS Feed.
3. Develop applications to access data from database, file and SD card.
4. Design and develop own pervasive computing applications for simple needs.

Text Books

1. Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition, 2004.

2. Hansmann, Merk, Nicklous, Stober, "Pervasive Computing", Springer, New York, 2003.

Reference Books:

1. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi, 2012.

2. Raj Kamal**, "**Mobile Computing", Oxford University Press, 2007.

3. Seng Loke, "Context-Aware Computing Pervasive Systems", Auerbach Pub., New York, 2007.

Mode of Evaluation: Continuous Evaluation of the Lab Experiments, Record, Viva-voce and External Lab Examination.

AUDIT COURSE - II

AUDIT COURSE -II

20AUP905 ENGLISH FOR RESEARCH PAPER WRITING

L	T	P	C
2	0	0	0

Course objectives:

Students will be able to:

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

UNIT I: SCIENTIFIC WRITING: AN INTRODUCTION

What is scientific writing – Language in scientific writing – Use and miss-use of English – Elements of scientific writing - Paraphrasing and Plagiarism - Hedging and Criticizing – How to identify research problem (**6)**

UNIT II: WRITING TITLE AND ABSTRACT

Strategies for writing effective title –Planning and preparing your abstract - Things to consider while writing abstract – Useful phrases for writing abstract (**6)**

UNIT III: ORGANISING THE LITERATURE; METHODS OF DATA COLLECTION AND DATA ANALYSIS

What is review of the literature - Techniques of reading and citing various studies relevant to the study – Things to consider while organising review of the literature – useful phrases while writing review of the literature. Introduction to various methods of data collection –Preparing tools and describing them - How to interpret and analyse data. (**6)**

UNIT IV: WRITING FINDINGS, DISCUSSION AND CONCLUSION

Useful vocabulary while writing findings, discussion, and conclusion –elaboration of the findings - Preparing and describing charts and graphs –how to organise your discussion section – Discussing the findings of your study with the literature available (**6)**

UNIT V: PREPARING REFERENCES, APPENDIXES AND PROOFREADING THE PAPER

Various styles of referencing and bibliography (APA, MLA, Oxford, Harvard, Chicago), – Organising and preparing Appendixes – Various strategies of proofreading (**6)**

Total: 30 Periods

Course Outcomes:

At the end of the course the learners will be able to:

1. Become aware of various components of academic writing
2. Improve and use academic vocabulary while writing a research papers
3. Plan and write quality research papers in their respective field

REFERENCES:

1. Adrian Wallwork, (2011). English for Writing Research Papers. Springer New York
2. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
3. Day, R. (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
4. Highman, N. (1998), Handbook
5. Research Papers, Springer New York Dordrecht
6. Kate L. Turabian, (2007).A Manual for Writers of Research Papers, Theses, and Dissertations, Seventh Edition: Chicago Style for Students and Researchers *[7th ed.]*Chicago Guides to Writing, Editing, and Publishing

Mode of Evaluation: Assignments, Mid Term Tests

AUDIT COURSE-II

20AUP906 VALUE EDUCATION

Course Prerequisite: NIL

L	T	P	C
2	0	0	0

Course Objectives:

Students will be able to:

1. Understand value of education
2. Understand value of self- development
3. Imbibe personality development
4. Imbibe spiritual development and to about the importance of character
5. Incorporate good emotional intelligence with self-control

UNIT-I

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements. **(6)**

UNIT-II

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline **(6)**

UNIT-III

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship.

Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature. **(6)**

UNIT-IV

Character –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. **(6)**

UNIT-V

Competence- Emotional Intelligence- Mind your Mind, Self-control, Honesty, Studying effectively **(6)**

Total: 30 Periods

Course Outcomes:

Students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the moral personality
4. Development of spiritual personality
5. Development of emotional personality for efficiency in work

Text/Reference Books:

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

Mode of Evaluation: Assignments, Mid Term Tests

AUDIT COURSE - II

20AUP907 STRESS MANAGEMENT BY YOGA

Course Prerequisite: None

	L	T	P	C
Course Objectives				
Students will be able to:	**2**	**0**	**0**	**0**

1. To know the human psyche: Yogic and modern concepts
2. To have the importance for mental health
3. To know the relationship between mind and body
4. To understand the concept of stress according to modern science and yoga
5. To achieve overall health of mind through yoga

UNIT-I SCIENTIFIC FOUNDATIONS OF STRESS

Concept of stress – Sources of stress - Types of Stress – Personality factors and Stress – Stress and the college student **(6)**

UNIT-II CONSEQUENCES OF STRESS ON HUMAN MIND

Human Psyche: Yogic and Modern concepts, behavior and consciousness – Frustration – Conflicts – Psychosomatic Disorders **(6)**

UNIT-III MENTAL HYGIENE AND YOGA

Mental health: A Yogic Perspective – Mental hygiene and role of Yoga in mental hygiene – Yogic principles for the management of stress (Prayer and meditation for mental health) **(6)**

UNIT-IV ASHTANGA YOGA INTRODUCTION

Introduction to Ashtanga Yoga – Concepts and techniques of stress management in Ashtanga yoga of Patanjali Yoga sutra (i.e. Benefits of Meditation for stress management) **(6)**

UNIT-V YOGIC MANAGEMENT OF STRESS

Specific practices for stress management: Yogasana, breath awareness, shavasana, yoganidra, pranayama and meditation **(6)**

Total: 30 Periods

Course Outcomes:

Students will be able to:

1. Understand the role of yoga in stress management
2. Understanding the role of yoga in life management
3. Understanding the role of yoga in mental hygiene
4. To Develop strong mental health
5. To Develop healthy mind and there by improve efficiency

Text/Reference Books:

1. 'Certification of yoga professionals, Official guide book for Level 1 and Level 2" Excel books private limited, Noida

2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

Mode of Evaluation: Assignments, Mid Term Tests

AUDIT COURSE - II

20AUP908 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Prerequisite: None

L	T	P	C
2	0	0	0

Course Description:

This course intends and aims to enhance the confidence of the students by exposing them to various situations and contexts they face in their career. It is imperative for students to start Preparing for the ever-growing competition in the Job market. This course focuses on the Practical aspects of soft skills relevant to the requirements of the prospective employers in view of globalization.

Course Objectives:

1. To expose the students to those soft skills which are crucial to an employee's ability to work smarter.
2. To enhance Art of Communication, Team Skills, GD handling skills and preparing resume & Interview Skills

UNIT-I VERBAL COMMUNICATION

Active listening – Non-Verbal Communication - Body Language. (**6**)

UNIT II DEVELOPING EMOTIONAL INTELLIGENCE

Importance of Team work - Leadership skills, self-realization (Identifying strengths and Weaknesses). (**6**)

UNIT III TIME MANAGEMENT

GD skills – Roles in a GD – Do's& Don'ts – Mock GD. (**6**)

UNIT IV RESUME PREPARATION

Tips in writing resume - Interview Handling Skills Interview skills – Do's & Don'ts - Goal setting. (**6**)

UNIT V TECHNIQUES

Grooming etiquette, Professional Electronic Communication-Telephone etiquette, Email Etiquette. (**6**)

Total: 30 Periods

Course Outcomes:

1. After completion of this course the students shall be able to communicate effectively and enhance their interpersonal relationship and building skills with renewed self-confidence.
2. Work together in teams and accomplish objectives in a cordial atmosphere.
3. Face Group Discussion with confidence
4. Prepare resume and face interviews.
5. Understand and develop the necessary etiquette to present oneself in a professional setting.

Text Books: "Soft Skills". Dr K Alex. S Chand Publications, New Delhi

References Books:

1. The Seven Habits Of Highly Effective People By Stephen R. Covey, Covey Leadership Center, 2005.
2. Negotiate To Close By Gary Karnass, Simon And Schuster, 1987.
3. The Greatest Miracle In The World – Ogmandino, Random House Publishing Group, 2009.
4. Working With Emotional Intelligence - Daniel Goleman, A&C Black, 2009.
5. Developing Communication Skills By Krishna Mohan And Meera Banerji; Macmillan India Ltd., Delhi, 2000.
6. Essentials Of Effective Communication, Ludlow And Panthon; Prentice Hall Of India, 1993.
7. Effective Presentation Skills (A Fifty-Minute Series Book) By Steve Mandel, Crisp Publications, 1996.
8. "Strategic Interviewing" By Richard Camp, Mary E. VielhaberAnd Jack L. Simonetti – Published By Wiley India Pvt. Ltd, 2007.
9. "Effective Group Discussion: Theory And Practice" By Gloria J. Galanes, Katherine Adams, John K. Brilhart, Tata Mcgraw-Hill, 2010.

Mode of Evaluation: Assignments, Mid Term Tests

M. Tech. II Year I Semester

20CSEP413 MACHINE LEARNING: THEORY AND METHODS

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description:
It begins with an introduction to the fundamentals of Machine Learning and discusses the various clustering techniques, which are extensively used in machine learning. It then goes on to discuss the different machine learning techniques such as Bayesian decision, multivariate and decision trees.

Course Objectives:

1. To demonstrate understanding of different types of learning algorithms
2. To discuss decision making under uncertainty and estimate probabilities
3. To analyse learning from multiple inputs and feature selection methods
4. To Evaluate learning from mixture of distributions and hierarchical data structure
5. To Understand artificial neural network structure, training algorithms and usage of Markov models to model input sequences

UNITI INTRODUCTION TO MACHINE LEARNING
Introduction to Machine Learning – Applications – Learning Associations – Classification – Regression – Unsupervised Learning – Reinforcement Learning – Supervised Learning – Vapnik-Chervonenkis (VC) Dimension – Probably Approximately Correct (PAC) Learning – Noise – Learning multiple classes – Model selection and Generalization. (**9)**

UNITII BAYESIAN DECISION THEORY AND PARAMETRIC METHODS
Bayesian Decision Theory – Classification – Losses and Risks – Discriminant Functions – Parametric methods – Maximum Likelihood estimation – Bernoulli Density – Multinomial Density – Gaussian Density – Evaluating an Estimator: Bias and Variance – Tuning Model complexity: Bias/Variance Dilemma – Model selection procedures. **(9)**

UNIT III MULTIVARIATE METHODS AND DIMENSIONALITY REDUCTION
Multivariate methods – Parameter estimation – Multivariate Normal Distribution – Tuning Complexity – Discrete Features – Multivariate regression – Dimensionality reduction – Subset selection – Principal component analysis – Factor analysis – Multidimensional scaling – Linear discriminant analysis. (**9)**

UNIT IV CLUSTERING AND DECISION TREES
Clustering – Mixture densities – k-Means clustering – Expectation-Maximization algorithm – Hierarchical clustering – Non-parametric methods – Histogram estimator – Kernel estimator – k-Nearest neighbor estimator – Decision trees – Univariate trees – Pruning – Rule extraction from trees – Learning rules from data – Multivariate trees. **(9)**

UNITV MULTILAYER PERCEPTRONS AND HIDDEN MARKOV MODELS

Introduction- The perceptron – Training a perceptron – Back propagation algorithm – Local models – Competitive learning – Radial basis functions – Mixture of experts – Hidden Markov models – Discrete Markov processes – Evaluation problem – Finding the State sequence – Learning model parameters – Model selection in HMMs. **(9)**

Total: 45 Periods

Course Outcomes:

At the end of the course, students will be able to:

1. Have an appreciation of the fundamentals of Machine Learning techniques including the topics of Bayesian decision theory, multivariate methods, clustering and markov models.
2. Be able to implement basic machine learning algorithms in PYTHON
3. Have the skill base necessary to further explore advanced topics of Machine Learning.
4. Be in a position to make a positive professional contribution in the field of Machine Learning.
5. At the end of the course the student should have a clear impression of the breadth and practical scope of machine Learning and have arrived at a level of understanding that is the foundation for most of the work currently underway in this field.

Text Books:

1. EthemAlpaydin, Introduction to Machine Learning, Third Edition, MIT Press, 2014.
2. Tom M. Mitchell, Machine Learning, McGraw Hill Education (India) Edition, 2013.

Reference Books

1. David E Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Pearson Education, 2013.
2. Jaime Guillermo C and Tom Michael Mitchell, Machine Learning, Morgan Kaufmann, 1994.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech. II Year I Semester

20CSEP414 ADVANCED DIGITAL IMAGE PROCESSING AND COMPUTING VISION

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description:

This course is concerned with the advanced digital image processing and computing vision, sensor and imaging, signal representation, non-linear image processing, feature estimation, video compression standards, object analysis and classification

Course Objectives:

1. To introduce various Sensor and Image Techniques
2. To introduce various Signal Representation and Techniques
3. To introduce various Non-Linear Image Processing Methods
4. To expose the student to a broad range of Feature Estimation and Techniques
5. To introduce various Video Compression Standards, Object Analysis and Classification

UNIT I SENSOR AND IMAGING

Sensor and Imaging: Imaging Optics, Radiometry of Imaging, Illumination sources and techniques, Camera Principles, Color Imaging, Single Sensor Color Imaging and Color Demosaicing, Range Images, 3D Imaging. **(9)**

UNIT II SIGNAL REPRESENTATION

Signal Representation: Vector Space and Unitary Transforms, Multi - Resolutional Signal Representation, Wavelet Decomposition, Scale space and diffusion, Representation of color, Retinex Processing, Markov Random Field Modeling of Images. **(9)**

UNIT III NON-LINEAR IMAGE PROCESSING

Non-linear Image Processing: Median and Order Statistics Filters, Rank-Ordered-Mean Filters and Signal Dependent Rank-Ordered-Mean Filters, Two Dimensional Teager Filters, Applications of nonlinear filters in image enhancement, edge detections, noise removal etc. **(9)**

UNIT IV FEATURE ESTIMATION

Feature Estimation: Morphological Operations, Edge Detection, Edges in multichannel images, Texture Analysis, Optical flow based motion estimation, Reflectance based shape recovery, Depth from focus, Stereo matching and depth estimation. **(9)**

UNIT V VIDEO COMPRESSION STANDARD, OBJECT ANALYSIS AND CLASSIFICATION

Video Compression Standards, Object Analysis and Classification: Lossy and lossless compression schemes: Transform Based, Sub-band Decomposition, Entropy Encoding, JPEG, JPEG2000, MPEG-1, MPEG-4, and MPEG-7. Object Analysis, Classification: Bayesian Classification, Fuzzy Classification, Neural Network Classifiers, Shape Reconstruction from volumetric data, knowledge - based interpretation of images. **(9)**

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able to:

1. Gain knowledge of Sensor and Image Techniques
2. Have understanding of Signal Representation and Techniques
3. Have understanding of Non-Linear Image Processing Methods
4. Apply and develop new techniques in the areas of Feature Estimation and Techniques
5. Gain knowledge of Video Compression Standards, Object Analysis and Classification

TEXT BOOK:

1. Mark Nixon , Alberto Aguado "Feature Extraction and Image Processing for Computer Vision",Academic Press, 4th Edition,2019.

REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson Education, Inc., 4 th Edition, 2018
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 2002.
3. Milan Sonka et al, " Image Processing, Analysis and Machine Vision", Brookes/Cole, Vikas Publishing House, 2nd Edition, 1999;
4. Marty Hall and Larry Brown, "Core Web Programming" Second Edition, Volume I and II, Pearson Education, 2001.
5. E.R.Davis, "Compute& Machine Vision", Fourth Edition, Academic Press, 2012.
6. Rick, S.Blum,Zheng Liu, " Multisensor image fusion and its Applications ",Taylor& Francis,2006.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M.Tech II Year I Semester

20CSEP415 NETWORK SECURITY

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description:
Network security consists of the policies and practices adopted to prevent and monitor unauthorized access, misuse, modification, or denial of a computer network and network-accessible resources.

Course Objectives:
1. To learn the basics of security and various types of security issues.
2. To study different cryptography techniques available and various security attacks.
3. Explore network security and how they are implemented in real world.
4. To get an insight of various issues of Web security and biometric authentication.

UNIT-I DATA SECURITY
Review of cryptography. Examples RSA, DES, ECC. (**9)**

UNIT-II INTEGRITY
Authentication, non-repudiation and message integrity. Digital signatures and certificates. Protocols using cryptography (example Kerberos). Attacks on protocols. (**9)**

UNIT-III NETWORK SECURITY
Firewalls, Proxy-Servers, Network intrusion detection. Transport security: Mechanisms of TLS, SSL, IPSec. (**9)**

UNIT-IV WEB SECURITY
SQL injection, XSS, etc. Software security and buffer overflow. Malware types and case studies. Access Control, firewalls and host/network intrusion detection. (**9)**

UNIT-V – E- SECURITY
Other topics: Biometric authentication, Secure E-Commerce (ex. SET), Smart Cards, Security in Wireless Communication. (**9)**

Course Outcomes:

After completion of course, students would be able to:
1. To have an understanding of basics of security and issues related to it.
2. Understanding of biometric techniques available and how they are used in today's world.
3. Security issues in web and how to tackle them.
4. Learn mechanisms for transport and network security

TEXT BOOK:

1. W. R. Cheswick and S. M. Bellovin. Firewalls and Internet Security. Addison Wesley, 1994.

REFERENCE BOOKS:

1. W. Stallings. Cryptography and Network Security. Prentice Hall, 1999.
2. B. Schneier. Applied Cryptography. Wiley, 1999.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

OPEN ELECTIVE - I

M. Tech II Year I Semester
Open Elective -I

20OEP301 BUSINESS ANALYTICS

L	T	P	C
3	0	0	3

Course Prerequisite: NIL

Course Description:
Course delves into commonly encountered business situations requiring optimization of business resources and provides basic solutions methods using traditional and advanced methods.

Course objectives:
1. Refresh basic statistics
2. Explain the importance of statistics in business analytics
3. Introduce predictive modeling for business decisions
4. Explain the tools for predictive modeling
5. Explain the use of simulation to make business decision
6. Explain the use of data mining techniques for making business decision

UNIT-I: INTRODUCTION TO BUSINESS ANALYTICS
Introduction to Business Analytics (BA). Evolution and Scope of Business Analytics. Data for Business Analytics. Analyzing uncertainty and model assumptions – What if analysis, Data tables, Scenario manager and Goal Seek. Regression modelling. (**9)**

UNIT-II: STATISTICS FOR BUSINESS ANALYTICS
Brief overview of descriptive statistics, graphical representation of data, and overview of hypothesis testing, Introduction to R statistical software (**9)**

UNIT-III: PREDICTIVE ANALYTICS METHODS
Forecasting techniques – Statistical forecasting techniques. Decomposition model – Estimation of trend, seasonality and cyclical components. Smoothing models for forecasting – moving average, exponential smoothing methods, time series analysis. (**9)**

UNIT-IV: SIMULATION, RISK ANALYSIS AND DATA MINING
Simulation and Risk Analysis – Monte Carlo simulation Examples of simulation models, Introduction to Data Mining – Scope of Data Mining. Data exploration and reduction. Classification – Measuring classification performance. Classification techniques – K nearest neighbor, Discriminant Analysis, factor analysis, and Logistic regression. (**9)**

UNIT-V: DECISION ANALYSIS
Decision making with uncertain information. Decision strategies for a minimize objective. Decision strategies for a maximize objective. Decision Tress. Building a decision tree. Decision trees and risk. Sensitivity analysis, Baye‘s Rule.
Case Study: Compulsory and Relevant Cases have to be discussed in each unit.
Assignment: Two relevant assignments have to be given to the students (**9)**

Total: 45 Periods

Course Outcomes:

At the end of this course students will be able to

1. Understand the need and significance of business analytics for decision making
2. Use statistical tools to extract information from raw data
3. Use regression technique to build predictive models
4. Apply simulation technique to predict business scenarios
5. Use data mining techniques to make business decisions

Text Books:

Essentials of Business Analytics, Jeffrey Camm, James Cochran, Michael Fry, Jeffrey Ohlmann, David Anderson

REFERENCES:

1. Albright C. S., Winston Wayne L. and Zappe C. J (2009). *Decision Making Using Microsoft Excel (India Edition).* Cengage Learning.
2. Evans J. R (2013). Business Analytics *Methods, Models and Decisions.* Pearson, Upper Saddle River, New Jersey.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech II Year I Semester
Open Elective - I

20OEP302 INDUSTRIAL SAFETY

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
This course facilitates the students with the aspects of Industrial safety, fundamentals of maintenance engineering, Wear and Corrosion and their prevention and Periodic and preventive maintenance.

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 firefighting, equipment and methods. **(9)**

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. **(9)**

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. **(9)**

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. **(9)**

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 **(9)**

Total: 45 Periods

REFERENCES:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M.Tech II Year I Semester
Open Elective - I

20OEP303 OPERATIONS RESEARCH

L	T	P	C
3	0	0	3

UNIT-I INTRODUCTION

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models (**9)**

UNIT-II LPP

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming (**9)**

UNIT-III NONLINEAR PROGRAMMING PROBLEM

Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT (**9)**

UNIT-IV SCHEDULING AND SEQUENCING

Single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming. (**9)**

UNIT-V COMPETITIVE MODELS

Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation (**9)**

Total: 45 Periods

Course Outcomes:

At the end of the course, the student should be able to

1. Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
2. Students should able to apply the concept of non-linear programming
3. Students should able to carry out sensitivity analysis
4. Student should able to model the real world problem and simulate it.

REFERENCES:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M.Tech II Year I Semester
Open Elective - I

20OEP304 COST MANAGEMENT OF ENGINEERING PROJECTS

L	T	P	C
3	0	0	3

UNIT I

Introduction and Overview of the Strategic Cost Management Process (**9)**

UNIT II

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. (**9)**

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 non-technical 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 (**9)**

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. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing. (**9)**

UNIT V

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory. (**9)**

REFERENCES:

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.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech II Year I Semester
Open Elective - I

20OEP305 COMPOSITE MATERIALS

L	T	P	C
3	0	0	3

UNIT–I INTRODUCTION

Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance. **(9)**

UNIT – II REINFORCEMENTS

Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions. **(9)**

UNIT – III MANUFACTURING OF METAL MATRIX COMPOSITES

Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications. **(9)**

UNIT–IV MANUFACTURING OF POLYMER MATRIX COMPOSITES

Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications. **(9)**

UNIT – V STRENGTH

Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations. **(9)**

Total: 45 Periods

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

REFERENCES:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

M. Tech II Year I Semester
Open Elective - I

20OEP306 WASTE TO ENERGY

Course Prerequisite: None

L	T	P	C
3	0	0	3

Course Description:
This course facilitates the students with the basics of how energy can be generated from waste materials.

UNIT-I INTRODUCTION

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors **(9)**

UNIT-II BIOMASS PYROLYSIS

Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods – Yields and application – Manufacture of pyrolytic oils and gases, yields and applications. **(9)**

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. **(9)**

UNIT-IV BIOMASS COMBUSTION

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. **(9)**

UNIT-V BIOGAS

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. **(9)**

Total: 45 Periods

REFERENCES:

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.