UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY

SCHOOL OF ENGINEERING & TECHNOLOGY

Vision

To achieve excellence in engineering education, empower students to be technically competent professionals and entrepreneurs with strong ethical values so as to significantly contribute as agents for universal development and societal transformation

Mission

To provide affordable quality education at par with global standards of academia and serve society with harmonious social diversity

To encourage new ideas and inculcate an entrepreneurial attitude amongst the students, and provide a robust research ecosystem

To practice and encourage high standards of professional ethics and accountability among students

Master of Technology in Computer Science & Engineering

Program Outcomes (POs)

PO1	**Engineering knowledge:** Acquire strong fundamental knowledge of computer science and engineering along with mathematics.
PO2	**Problem analysis:** Ability to identify, formulate & analyse requirements of a problem to provide sustainable solution which are in coherence with the local/regional/national or global needs and feasibility
PO3	**Design/development of solutions:** Design solution for complex problems, which incorporate components and processes, which are sustainable and reusable.
PO4	**Conduct investigation of complex problems:** Develop skills to synthesize research-based knowledge in the design, interpretation, analysis and synthesis of data for providing solutions to complex problems
PO5	**Modern tool usage:** Possess programming skills in different contemporary programming languages and use different development tools. Be able to select the appropriate tool/programing language/platform and understand the limitations of the same while implementing the solution.
PO6	**The Engineer and Society:** To apply skills for social causes at the local, regional, national and global level and work towards sustainable solutions. Apply reasoning informed by the contextual knowledge to access social, legal and cultural issues.
PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environment contexts
PO8	**Ethics:** To understand contemporary legal, social & ethical issues in computing.
PO9	**Individual and Teamwork:** Posses Flexibility to adapt to a team environment. To be able to work as an individual or as a member or a team leader in multidisciplinary team organizations.
PO10	**Communication:** To be able to present and communicate precisely and effectively. Be able to comprehend and write effective reports and design documents and presentations professionally and be able to perceive and give clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of engineering and management principles and apply to work in the capacity of a member/leader in the team to manage projects
PO12	**Life-long learning:** To have passion for acquiring technical advancements in the field of computer science and engineering and apply new technology for solving local/regional/national or global problems

Program Specific Outcomes (PSOs)

PSO-1	To be able to understand problem, think of best suitable approach to solve the problem, develop and evaluate effective solutions as per the local/ regional/ national/ global requirements and availability of resources/ technologies.
PSO-2	To be able excel in contemporary technologies being adopted by the industry and academia for providing sustainable solutions
PSO-3	To be able to excel in various programming/ project competitions and technological challenges laid by professional bodies

Program Educational Outcomes (PEOs)

PEO-1	To make the students ready for successful career leading to higher education/ industry and to apply expertise in solving global problems.
PEO-2	To empower students achieve personal and professional success with awareness and commitment to their ethical and social responsibilities, both as individuals and in team environments.
PEO-3	To encourage students maintain and improve their technical competence through lifelong learning.

Curricular Components

Category of courses	Credits offered
Departmental Core	**30**
Departmental Electives / MOOC	**16**
Project / Dissertation	**26**
Total	**72**

Semester-wise Course Structure

1st Year - Semester I

Sl. No.	Course Code	Course Title	L	T	P	Credits
1.	MCSE-101	Mathematical Foundation of Computer Science	3	1	0	4
2.	MCSE-102	Fundamentals of Computer Science	3	0	0	3
3.	MCSE-103	Advanced Software Engineering	3	0	0	3
4	MCSE-104	Advanced Python Programing	3	0	2	4
5	MCSE-105	MOOC course on Report writing using Latex	3	0	2	4
		Total				**18**

1st Year - Semester II

Sl. No.	Course Code	Course Title	L	T	P	Credits
	MCSE-106	Artificial Intelligence	3	0	2	4
1.	MCSE-107	Advance Data Structures and Algorithms	3	0	2	4
2.	MCSE-108	Advance Database Management System	3	0	2	4
3.	MCSE-3--	Departmental Elective-I / MOOC	3	0	0	3
4.	MCSE-3--	Departmental Elective-II / MOOC	3	0	0	3
		Total				**18**

2nd Year - Semester III

Sl. No.	Course Code	Course Title	L	T	P	Credits
1.	MCSE -201	Digital Image Processing	3	0	1	4
2.	MCSE-3--	Departmental Elective-III	3	0	0	3
3.	MCSE-204	Minor Dissertation	-	-	3	8
4.	MCSE-3--	Departmental Elective-IV	3	0	0	3
		Total				**18**

2nd Year - Semester IV

Sl. No.	Course Code	Course Title	L	T	P	Credits
1.	MCSE-DT	Dissertation /	-	-	3	18
		Total				**18**

Total Credits – 72

List of Departmental Electives

	Bucket -1	**Bucket -2**	**Bucket -3**	**Bucket -4**	**Bucket -5**
Departmental Elective-I	Machine Learning	Advance Computer Networks	Distributed Processing	Computer Vision	Distributed Databases
Departmental Elective-II	Natural Language Processing	Cryptography and Network Security	Internet Of Things	Deep Learning	Management Information System
Departmental Elective-III	Big data Analytics Or Datamining and Data Warehousing	Adhoc and Sensor Networks	Cloud Computing	Augmented Reality	Datamining and Data Warehousing
Departmental Elective-IV	Deep Learning	Cyber Security and Privacy	Multicore Computer Architecture	Remote sensing	Bioinformatics

Detailed Syllabus

Course Code: MCSE-101 **Breakup: 3 –1 – 0 – 4**
Course Name: Mathematical Foundation of Computer Science

Course Objectives: (CO): Objective of the course is:

CO1	To understand the mathematical fundamentals that is prerequisites for variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems bioinformatics, Machine learning.
CO2	To develop the understanding of the mathematical and logical basis to many modern techniques in computer science technology like machine learning, programming language design, and concurrency.
CO3	To study various sampling and classification problems.

Course Outcomes (CO): After the completion of the course, student will be able to

CO1	To apply the basic rules and theorems of probability theory such as Baye's Theorem, todetermine probabilities that help to solve engineering problems and to determine the expectation and variance of a random variable from its distribution.
CO2	Able to perform and analyze of sampling, means, proportions, variances and estimates themaximum likelihood based on population parameters.
CO3	To learn how to formulate and test hypotheses about sample means, variances and proportions and to draw conclusions based on the results of statistical tests.
CO4	Apply graph theory for real time problems like network routing problem.

Course Details:

UNIT I: Basic Probability and Random Variables: Random Experiments, Sample Spaces Events, the Concept of Probability the Axioms of Probability, Some Important Theorems on Probability Assignment of Probabilities, Conditional Probability Theorems on Conditional Probability, Independent Events, Bayes Theorem or Rule. Random Variables, Discrete Probability Distributions, Distribution Functions for Random Variables, Distribution Functions for Discrete Random Variables, Continuous Random Variables

UNIT II: Sampling and Estimation Theory: Population and Sample, Statistical Inference Sampling With and Without Replacement Random Samples, Random Numbers Population Parameters Sample Statistics Sampling Distributions, Frequency Distributions, Relative Frequency Distributions, Computation of Mean, Variance, and Moments for Grouped Data. Unbiased Estimates and Efficient Estimates Point Estimates and Interval Estimates. Reliability Confidence Interval Estimates of Population Parameters, Maximum Likelihood Estimates

UNIT III: Tests of Hypothesis and Significance: Statistical Decisions Statistical Hypotheses. Null Hypotheses Tests of Hypotheses and Significance Type I and Type II Errors Level of Significance Tests Involving the Normal Distribution One-Tailed and Two-Tailed Tests P Value Special Tests of Significance for Large Samples Special Tests of Significance for Small Samples Relationship between Estimation Theory and Hypothesis Testing Operating Characteristic Curves. Power of a Test Quality Control Charts Fitting Theoretical Distributions

to Sample Frequency Distributions, The Chi-Square Test for Goodness of Fit Contingency Tables Yates' Correction for Continuity Coefficient of Contingency.

UNIT IV: Algebraic Structures and Number Theory: Algebraic Systems, Examples, General Properties, Semi Groups and Monoids, Homomorphism of Semi Groups and Monoids, Group, Subgroup, Abelian Group, Homomorphism, Isomorphism. Properties of Integers, Division Theorem, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem)

UNIT V: Graph Theory: Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs).

Text Books:

1. Foundation Mathematics for Computer Science, John Vince, Springer.
2. Probability & Statistics, 3rd Edition, Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan, Schaum's Outline Series, Tata McGraw-Hill Publishers
3. Probability and Statistics with Reliability, K. Trivedi, Wiley.
4. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition,
5. H. Rosen, Tata McGraw Hill.

Reference Books:

1. Probability and Computing: Randomized Algorithms and Probabilistic Analysis, M. Mitzenmacher and E. Upfal.
2. Applied Combinatorics, Alan Tucker, Wiley.

Course Code: MCSE-102 **Breakup: 3-0-0-3**
Course Name: Fundamentals of Computer Science

Course Objectives (CO): Objective of course is:

CO1	How Computer Systems work & the basic principles.
CO2	To provide the knowledge Formal Grammar and language.
CO3	The current state of art of compiler Construction.

Course Outcomes(CO): After the Completion of the course, student will be able to

CO1	Student will develop the ability and confidence to use the fundamentals of digital electronics.
CO2	Student will learn the concepts of computer organization for several engineering applications.
CO3	To understand need and working of operating System.
CO4	To use basic concepts of formal languages and grammar
CO5	Student will learn the different concepts are required to implement a language processor.

UNIT I: Digital Electronics: Number Systems, Boolean Algebra, Boolean Expression Generation, Simplification of Boolean Expressions, Digital Circuit Design, Combinational Circuits, Sequential Circuits.

UNIT II: Computer Organization: Basic Functional units of Computers, Data Representation, Computer Arithmetic, Computer Arithmetic, Central Processing Unit organization, Control unit design, Memory Organization, Input –Output Organization.

UNIT III: Operating System: Operating Systems Overview, Operating Systems Structures, Process Management, Concurrency and Synchronization, Memory Management, Deadlocks, File System, Input-output System

UNIT IV: Theory of Automata: Deterministic and Non Deterministic finite Automata, Regular expression, Grammar and Languages, Push Down Automata, Turing machines.

UNIT V: Compiler Design: Introduction to Compilers, Lexical Analyzer, Parsing and Syntax Analyzer, Syntax Directed Translation, Intermediate Code Generation, Type Checking, Run Time Environments, Code Optimization and Code Generation.

Text and Reference Books

1. M. Moris Mano, "Digital Design" 5th Edition Pearson
2. William Stallings "Computer Organization and Architecture", 10th Edition, Pearson Education.
3. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), "Operating System Principles", 7th edition, Wiley India Private Limited, New Delhi.
4. Hopcroft, Ullman, "Introduction to Automata Theory,Languages and Computation", Pearson Education.
5. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman (2007), Compilers Principles, Techniques and Tools, 2nd edition, Pearson Education, New Delhi, India.

Course Code: MCSE – 103 **Breakup: 3 – 0 – 0 – 3**
Course Name: Advance Software Engineering

Course Objectives: (CO): Objective of the course is:

CO1	To elicit, analyze and specify software requirements through a productive working relationship with various stakeholders of the project.
CO2	To understand the what software life cycle is, how software projects are planned and managed, types of resources involved in software development projects, risks are identified and assessed, predictions and assessments are made.
CO3	To identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements

Course Outcomes (CO): After the completion of the course, student will be able to

CO1	Apply the Object Oriented Software-Development Process to design software
CO2	Analyze and Specify software requirements through a SRS documents.
CO3	Design and Plan software solutions to problems using an object-oriented strategy.
CO4	Model the object oriented software systems using Unified Modeling Language (UML)
CO5	Estimate the cost of constructing object oriented software.

Course Details:

UNIT I: Introduction to Software Engineering: Software, Software Crisis, Software Engineering definition, Evolution of Software Engineering Methodologies, Software Engineering Challenges. Software Processes: Software Process, Process Classification, Phased development life cycle, Software Development Process Models, Process, use, applicability and Advantages/limitations.

UNIT II: Object oriented Paradigm, Object oriented Concepts, Classes, Objects, Attributes, Methods and services, Messages, Encapsulation, Inheritance, Polymorphism, Identifying the elements of object model, management of object oriented Software projects, Object Oriented Analysis, Domain Analysis, Generic Components of OOA model, OOA Process, Object Relationship model, Object Behavior Model.

UNIT III: Object Oriented Design: Design for Object- Oriented systems, The Generic components of the OO design model, The System design process, The Object design process, Design Patterns, Object Oriented Programming.

UNIT IV: Object Oriented testing: Broadening the view of Testing, Testing of OOA and OOD models, Object-Oriented testing strategies, Test case design for OO software, testing methods applicable at the class level, Interclass test case design.

UNIT V: Technical Metrics for Object Oriented Systems: The Intent of Object Oriented metrics, The distinguishing Characteristics, Metrics for the OO Design model, Class-Oriented metrics, Operation-Oriented Metrics, Metrics foe Object Oriented testing, Metrics for Object Oriented projects. CASE Tools.

Text Books:

1. Object oriented and Classical Software Engineering, 7/e, Stephen R. Schach, TMH.
2. Object oriented and Classical Software Engineering, Timothy Lethbridge, Robert Laganiere, TMH
3. Software Engineering by Roger S Pressman, Tata McGraw Hill Edition.

Reference Books:

Component based software engineering: 7th International symposium, ivicaCrnkovic, Springer, CBSE 2004

Course Code: MCSE – 104 **Breakup: 3 – 0 – 3 – 4**
Course Name: Advance Python Programing

Course Objectives: (CO): Objective of the course is:

CO1	Learn basic programming constructs –data types, decision structures, control structures in python
CO2	Know how to use libraries for string manipulation and File handling
CO3	Learn to use in-built data structures in python – Lists, Tuples, Dictionary
CO4	Learn the fundamental principles of Object-Oriented Programming.
CO5	Solve problems through application of OO concepts and using Files/database

Course Outcomes (CO): After the completion of the course, student will be able to

CO1	Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.
CO2	Express proficiency in the handling of strings and functions
CO3	Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets
CO4	Identify the commonly used operations involving file systems and regular expressions.
CO5	Articulate the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python

Course Details:
Unit-1 Introduction: Features, Environmental setup, --Installation of Pycharm and tools required for running python
Basic Types, Variable types and operators: Assigning values to variables --Multiple Assignments Standard Data Types, Set---Map--Single line comments using #--Multi-line comments using triple quote --Data Type Conversion, Operators, Types of Operator, Conditional statement: If statement, If –else statement, Nested If statement, Nested If-else statement, For Loop, While Loop-For loop and while loop with else-Pass-Break continue

Unit-2 Number and List: Accessing values in List-Delete, update List element-Basic List operations-Indexing, Slicing and Matrixes-Built in methods and Functions for List-Accessing values in Tuple-Delete, List element-Basic Tuple operations, Indexing, Slicing and Matrixes-Built in methods and Functions for Tuple

Unit-3 Dictionary and Function: Accessing values in Dictionary-Updating Dictionary-Deleting Dictionary –elements-Properties of Dictionary keys-Built in Dictionary Functions and Methods Defining Function-Calling function- Pass by reference vs value Function Arguments-Required arguments-Keyword arguments-Default arguments-Variable-length arguments Recursion

Unit-4 Date and Time & Modules and Packages: Tick-Getting Current time-Getting Formatted Time-Getting calendar for Month-The Time Module and its functions-Calendar modules and its functions-Other modules and Functions Sum and Difference f time and date Import -From---import statement-From--- import* statement-Executing modules as script Locating Modules-PYTHONPATH variable-Dir() function-Global and Local functions-Reload function Packages in Python

Unit-5 File Input-output & Exception handling: Input function-Opening and closing files-The open Function-The File Object Attributes-The close method Reading and Writing methods-Uniform reading and writing-Random reading and writing-File Positions Renaming and Deleting files-Remove Method- Directories in python- Mkdir, chdir, rmdir- File and Directory related methods. Exception handling and assertions-Standard Exceptions-Assertions in Python-Handling and exception-Except clause with no exception-Except Clause with multiple exception-Try-Finally Clause-Argument of an Exception Raising an Exception

Text Book (s)

1. Tony Gaddis, Starting Out with Python, 3rd edition, Pearson
2. Y. Daniel Liang, Introduction to Programming Using Python, Pearson
3. Budd T A, Exploring Python , 2011, Tata McGraw Hill Education
4. Learning Python, Fourth Edition, Mark Lutz, O'Reilly publication

Reference Book (s)

1. Downey, Allen B., Think Python: How to Think Like a Computer Scientist. O'Reilly,
2. 2012. Obtain free PDF at http://www.greenteapress.com/thinkpython/

Python Programming: An Introduction to Computer Science (Second Edition) John Zelle, ISBN 978-1-59028-241-0-9, Franklin, Beedle & Associates Inc., 2004.

Course Code: MCSE – 106 **Breakup: 3 – 0 – 1 – 3**
Course Name: Artificial Intelligence

Course Objectives: (CO): Objective of the course is:

CO1	To provide a strong foundation of fundamental concepts in Artificial Intelligence
CO2	To provide a basic exposition to the goals and methods of Artificial Intelligence
CO3	To enable the student to apply these techniques in applications which involve perception, reasoning and learning
CO4	Distinguish between a conventional system and an intelligent system
CO5	Artificial Intelligent techniques in solving problems of a particular domain

Course Outcomes (CO): After the completion of the course, student will be able to

CO1	Understand different types of AI agents and knows various AI search algorithms
CO2	Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving .
CO3	Know how to build simple knowledge-based systems
CO4	Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information
CO5	Ability to apply knowledge representation, reasoning, and machine learning techniques to real-world problems

Course Details:

Overview: foundations, scope, problems, and approaches of AI.
Intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents
Problem-solving through Search: forward and backward, state-space, blind, heuristic, problem-reduction, A, A*, AO*, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications.
Knowledge Representation and Reasoning: ontologies, foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.
Planning: Planning as search, partial order planning, construction and use of planning graphs, existing expert systems like MYCIN, RI, Expert system shells.
Representing and Reasoning with Uncertain Knowledge: probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.
Decision-Making: basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications.
Machine Learning and Knowledge Acquisition: learning from memorization, examples, explanation, and exploration. Learning nearest neighbor, naive Bayes, and decision tree classifiers, Q-learning for learning action policies, applications.
Languages for AI problem solving: Introduction to PROLOG syntax and data structures, representing objects and relationships, built-in predicates. Introduction to LISP- Basic and intermediate LISP programming.
Expert Systems: Architecture of an expert system.

Course Code: MCSE-107 **Breakup: 3 –0 – 3 – 5**
Course Name: Advance Data Structures and Algorithms

Course Objectives: (CO): Objective of the course is:

CO1	Single Linked, Double Linked Lists, Stacks, Queues, Searching and Sorting techniques, Trees,Binary trees, representation, traversal, Graphs- storage, traversal.
CO2	Dictionaries, ADT for List, Stack, Queue, Hash table representation, Hash functions, Priorityqueues, Priority queues using heaps, Search trees.
CO3	AVL trees, operations of AVL trees, Red- Black trees, Splay trees, comparison of search trees.

Course Outcomes(CO): After the completion of the course, student will be able to

CO1	Ability to write and analyze algorithms for algorithm correctness and efficiency
CO2	Master a variety of advanced abstract data type (ADT) and data structures and their Implementation
CO3	Demonstrate various searching, sorting and hash techniques and be able to apply and solveproblems of real life
CO4	Design and implement variety of data structures including linked lists, binary trees, heaps,graphs and search trees
CO5	Ability to compare various search trees and find solutions for IT related problems

Course Details:
UNIT I: Introduction to Data Structures, Singly Linked Lists, Doubly Linked Lists, Circular Lists-Algorithms. Stacks and Queues: Algorithm Implementation using Linked Lists.

UNIT II: Searching-Linear and Binary, Search Methods, Sorting-Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort. Trees- Binary trees, Properties, Representation and Traversals (DFT, BFT), Expression Trees (Infix, prefix, postfix). Graphs-Basic Concepts, Storage structures and Traversals.

UNIT III: Dictionaries, ADT, The List ADT, Stack ADT, Queue ADT, Hash Table Representation, Hash Functions, Collision Resolution-Separate Chaining, Open Addressing-Linear Probing, Double Hashing.

UNIT IV: Priority queues- Definition, ADT, Realizing a Priority Queue Using Heaps, Definition, Insertion, Deletion .Search Trees- Binary Search Trees, Definition, ADT, Implementation, Operations-Searching, Insertion, Deletion.

UNIT V: Search Trees- AVL Trees, Definition, Height of AVL Tree, Operations-, Insertion, Deletion and Searching, Introduction to Red-Black and Splay Trees, B-Trees, Height of B-Tree, Insertion, Deletion and Searching, Comparison of Search Trees.

Text Books:

1. Data Structures: A Pseudo Code Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon and Cengage
2. Data Structures, Algorithms and Applications in java, 2/e, Sartaj Sahni, University Press

Reference Books:

1. Data Structures and Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson.
2. Data Structures and Algorithms, 3/e, Adam Drozdek, Cengage
3. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering

Course Code: MCSE – 108 **Breakup: 3 – 0 – 1 – 3**
Course Name: Advance Database Management System

Course Objectives: (CO): Objective of the course is:

CO1	To understand the different types of database system architectures
CO2	To administer a database by recommending and implementing procedures including database tuning, backup, query processing, query optimization and recovery.
CO3	To learn advanced querying with Decision support system and information retrieval.
CO4	To study and design distributed database with its applications

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Identify advance database concepts and database models.
CO2	Apply and analyze various terms related to transaction management in centralized and distributed database
CO3	Produce data modelling and database development process for object –oriented DBMS.
CO4	Understand query optimization and concurrency control
CO5	Understand the recovery and backup process

Course Details:

Data storage and querying
Overview of Physical Storage Media, RAID, File Organization, Organization of Records in Files Data-Dictionary Storage

Indexing and Hashing
Basic Concepts, Ordered Indices, B+-Tree Index Files, Static Hashing, Dynamic Hashing Bitmap Indices

Query Processing and Query Optimization
Measures of Query Cost, Selection Operation, Sorting, Join and other Operation, Evaluation of Expressions, Transformation of Relational Expressions, Estimating Statistics of Expression Results Choice of Evaluation Plans

Transactions
Transaction Concept, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Recoverability, Test for Serializability

Concurrency Control
Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols Validation-Based Protocols, Multi-Version Schemes, Snapshot Isolation

Recovery System
Failure Classification, Recovery Algorithm

Case studies of various DBMS

Introduction to Distributed Databases

Text Book and References:

1. Database System Concepts, Abraham Silberschatz), Henry F. Korth, S. Sudarshanl, McGraw Hill; 7th edition, 2021
2. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill Education; Third edition 2014
3. Fundamentals of Database Systems, Elmasri Ramez , Navathe Shamkant, Pearson Education; Seventh edition 2017

Course Code: MCSE – 201 **Breakup: 3 – 0 – 1 – 4**
Course Name: Digital Image Processing

Course Objectives: (CO): Objective of the course is:

CO1	Describe and explain basic principles of digital image processing.
CO2	Design and implement algorithms that perform basic image processing (e.g. noise removal andimage enhancement).
CO3	Design and implement algorithms for advanced image analysis (e.g. image compression,image segmentation).
CO4	Assess the performance of image processing algorithms and systems.

Course Outcomes (CO): After the completion of the course, student will be able to

CO1	Demonstrate the components of image processing
CO2	Explain various filtration techniques.
CO3	Apply image compression techniques.
CO4	Discuss the concepts of wavelet transforms.
CO5	Analyze the concept of morphological image processing.

Course Details:
UNIT I: Introduction: Fundamental steps in Image Processing System, Components of Image Processing System, Elements of Visual Perception, Image Sensing and acquisition, Image sampling & Quantization, Basic Relationship between pixels. Image Enhancement Techniques: Spatial Domain Methods: Basic grey level transformation, Histogram equalization, Image subtraction, image averaging.

UNIT II: Spatial filtering: Smoothing, sharpening filters, Laplacian filters, Frequency domain filters, Smoothing and sharpening filters, Homomorphism is filtering. Image Restoration & Reconstruction: Model of Image Degradation/restoration process, Noise models, Spatial filtering, Inverse filtering, Minimum mean square Error filtering, constrained least square filtering, Geometric mean filter, Image reconstruction from projections. Color Fundamentals, Color Models, Color Transformations.

UNIT III: Image Compression: Redundancies- Coding, Interpixel, Psycho visual; Fidelity, Source and Channel Encoding, Elements of Information Theory; Loss Less and Lossy Compression; Run length coding, Differential encoding, DCT, Vector quantization, Entropy coding, LZW coding; Image Compression Standards-JPEG, JPEG 2000, MPEG; Video compression.

UNIT IV: Wavelet Based Image Compression: Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT), Continuous, Wavelet Transform, Fast Wavelet Transform, 2-D wavelet Transform, JPEG-2000 encoding.

UNIT V: Image Segmentation: Discontinuities, Edge Linking and boundary detection, Thresholding, Region Based Segmentation, Watersheds; Introduction to morphological operations; binary morphology- erosion, dilation, opening and closing operations, applications;

basic gray-scale morphology operations; Feature extraction; Classification; Object recognition. Digital Image Watermarking: Introduction, need of Digital Image Watermarking, applications of watermarking in copyright protection and Image quality analysis.

Text Books:

1. Digital Image Processing. 2nd ed. Gonzalez, R.C. and Woods, R.E. India: Person Education, (2009)

Reference Books:

1. Digital Image Processing. John Wiley, Pratt, W. K, (2001)
2. Digital Image Processing, Jayaraman, S., Veerakumar, T. and Esakkiranjan, S. (2009),Tata McGraw-Hill

Bucket-1

Course Code: MCSE – 301 **Breakup: 3 – 0 – 0– 3**
Course Name: Machine Learning

Course Objectives: (CO): Objective of the course is:

CO1	To understand the basic theory underlying machine learning.
CO2	To be able to formulate machine learning problems corresponding to different applications.
CO3	To understand a range of machine learning algorithms along with their strengths and weaknesses.
CO4	To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Course Outcomes (CO): After the completion of the course, student will be able to

CO1	Appreciate the importance of visualization in the data analytics solution
CO2	Apply structured thinking to unstructured problems.
CO3	Understand a very broad collection of machine learning algorithms and problems
CO4	Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory
CO5	Develop an appreciation for what is involved in learning from data.

Course Details:

Introduction: Introduction to machine learning, supervised learning, unsupervised learning Reinforcement learning.
Revision: Basics of Probability Theory, Basics of Linear Algebra and Statistical Decision Theory.
Supervised learning: Linear regression: Linear Regression, Linear discriminant analysis, Polynomial Regression. Ridge Regression, Lasso Regression. Parameter Estimation: Least Square, Least Mean Square, Gradient Descent.
Classification: Two class classification, Multi-class classification, Concept of Loss functions for classification
Classification algorithms: Logistic Regression: Introduction. to Logistic Regression, Types of Logistic Regression, Regression Models, Binary Logistic Regression Model, Multinomial Logistic Regression Model, Naive Bayes: Bayes Theorem, The Naive Bayes' Classifier.
Decision trees, Regression trees, Stopping criteria &pruning.
SVM: Formulation, interpretation&analysis,SVMsforlinearlynon-separabledata,SVM kernels. SVM hinge loss formulation.
Artificial Neural Networks: Concept of Perceptron & Parameter Estimation, Early artificial neural network models , Feed forward networks, Recurrent Networks. Concept of Back propagation, Initialization, training & validation, Maximum Likelihood estimate.
Unsupervised learning:
Clustering: Partitional clustering, Hierarchical clustering, K- Means, II- NN, Dimensionality reduction, BIRCH algorithm.

Association Mining: Frequent Itemset Mining, Apriori algorithm, FP-growth algorithm. Evaluation Measures & Hypothesis Testing: Evaluation measures, Bootstrapping & cross validation, 2 class evaluation measures, The ROC curve.

Introduction to Advance Topics: Recommendation systems, Deep learning etc.

Text Book and References:

1. Tom M. Mitchell : "Machine Learning", 2013.
2. Hal Daume III: "A Course in Machine Learning, 2012.
3. Christopher M. Bishop, "" Pattern Recognition and Machine Learning", 2010.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Francis Bach : "Deep Learning", 2017.

Bucket-1

Course Code: **MCSE – 306** **Breakup:** **3 – 0 – 0 – 3**
Course Name: **Natural Language Processing**

Course Objectives: (CO): Objective of the course is:

CO1	Teach students the leading trends and systems in natural language processing.
CO2	Understand the concepts of morphology, syntax, semantics and pragmatics of the language and that they are able to give the appropriate examples that will illustrate the concepts.
CO3	Recognize the significance of pragmatics for natural language understanding.
CO4	Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Apply the computational knowledge for Natural Language Processing to understand the properties of natural languages, its algorithms for processing linguistic information in various tasks such as Machine translation, Information extraction and retrieval, and Speech Technology to solve global problems related to NLP.
CO2	Understand the concepts of linguistic foundations that underlie natural language processing, which would provide the knowledge for building components of NLP systems.
CO3	Discover the capabilities, analyze them and explore the limitations of current natural language technologies, and some of the algorithms and techniques that underline these technologies to take up various research challenges in the field
CO4	Demonstrate the concepts of morphology, syntactic analysis, semantic interpretation and pragmatics of the language, and understanding them to apply in different research areas

Course Details:

Introduction to Natural Language Understanding, Linguistic Background: Outline of English Syntax, Knowledge Representation and Reasoning: A Representation Based on FOPC

Grammars and Parsing: Grammars and Sentence Structure, What Makes a Good Grammar, A Top-Down parser, Bottom-Up Chart Parser, Transition Network Grammars, Top-Down Chart Parsing, Finite State Models and Morphological Processing, Grammars and Logic Programming Features and Augmented Grammars: Feature Systems and Augmented Grammars, Augmented Transition Networks

Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomena in Language, Toward Efficient Parsing, Human Preferences in Parsing

Encoding Uncertainty: Shift-Reduce Parsers, A Deterministic Parser, Techniques for Efficient Encoding of Ambiguity

Ambiguity Resolution: Statistical Methods, Basic Probability Theory, Estimating Probabilities, Part of Speech Tagging, Obtaining Lexical Probabilities, Probabilistic Context Free Grammars

Semantics and Logical form: Semantics and Logical form, Word senses and ambiguity, Encoding ambiguity in the logical form, Verbs and states in logical Form, Thematic roles

Text Books & References:

1. James Allen, Natural Language Understanding, Pearson; 2nd edition 1994
2. Jurafsky & Martin – Speech & Language Processors, Prentice Hall; 2nd edition 2008

Bucket-1

Course Code: **MCSE – 310** **Breakup:** **3 – 0 – 0 – 3**
Course Name: **Big Data Analytics**

Course Objectives: (CO): Objective of the course is:

CO1	To know the fundamental concepts of big data and analytics.
CO2	To explore tools and practices for working with big data
CO3	To learn about stream computing
CO4	To know about the research that requires the integration of large amounts of data

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Identify Big Data and its business implications.
CO2	Use various techniques for mining data stream
CO3	List the components of Hadoop and Hadoop Eco-System
CO4	Apply Map Reduce programming model to access and process data on Distributed File System.
CO5	Manage job execution in Hadoop environment and develop Big Data solutions by applying Hadoop Eco System components

Course Details:

Unit-I: Introduction to Big Data: Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, Big Data technology components, Big Data importance and applications, Big Data features and security, compliance, auditing and protection, Big Data privacy and ethics, Big Data Analytics, Challenges of conventional systems, intelligent data analysis, nature of data, analytic processes and tools, analysis vs reporting, modern data analytic tools

Unit-II: Hadoop: History of Hadoop, Apache Hadoop, the Hadoop Distributed File System, components of Hadoop, data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, Hadoop Echo System.

Map Reduce: Map Reduce framework and basics, how Map Reduce works, developing a Map Reduce application, unit tests with MR unit, test data and local tests, anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats, Map Reduce features, Real-world Map Reduce

Unit-III: HDFS (Hadoop Distributed File System): Design of HDFS, HDFS concepts, benefits and challenges, file sizes, block sizes and block abstraction in HDFS, data replication, how does HDFS store, read, and write files, Java interfaces to HDFS, command line interface, Hadoop file system interfaces, data flow, data ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: compression, serialization, Avro and file-based data structures.

Hadoop Environment: Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop configuration, security in Hadoop, administering Hadoop, HDFS monitoring & maintenance, Hadoop benchmarks, Hadoop in the cloud

Unit-IV: Hadoop Eco System and YARN: Hadoop ecosystem components, schedulers, fair and capacity, Hadoop 2.0 New Features - NameNode high availability, HDFS federation, MRv2, YARN, Running MRv1 in YARN.

NoSQL Databases: Introduction to NoSQL MongoDB: Introduction, data types, creating, updating and deleing documents, querying, introduction to indexing, capped collections Spark: Installing spark, spark applications, jobs, stages and tasks, Resilient Distributed 09

Databases, anatomy of a Spark job run, Spark on YARN

SCALA: Introduction, classes and objects, basic types and operators, built-in control structures, functions and closures, inheritance.

Unit-V: Hadoop Eco System Frameworks: Applications on Big Data using Pig, Hive and HBase Pig - Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators

Hive - Apache Hive architecture and installation, Hive shell, Hive services, Hive metastore, comparison with traditional databases, HiveQL, tables, querying data and user defined functions, sorting and aggregating, Map Reduce scripts, joins & subqueries

HBase – Hbase concepts, clients, example, Hbase vs RDBMS, advanced usage, schema design, advance indexing, Zookeeper – how it helps in monitoring a cluster, how to build applications with Zookeeper. IBM Big Data strategy, introduction to Infosphere, BigInsights and Big Sheets, introduction to Big SQL.

Bucket-1

Course Code: **MCSE-311** **Breakup:** **3 – 0 – 0 – 3**
Course Name: **Data Mining and Data Warehousing**

Course Objectives: (CO): Objective of the course is:

CO1	Understand and implement classical models and algorithms in data warehouses and data mining
CO2	Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
CO3	Master data mining techniques in various applications like social, scientific and environmental context.
CO4	Develop skill in selecting the appropriate data mining algorithm for solving practical problems

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand data mining principles and techniques: Introduce DM as a cutting edge business intelligence method and acquaint the students with the DM techniques for building competitive advantage through proactive analysis, predictive modelling, and identifying new trends and behaviours. Learning objectives include:
CO2	Building basic terminology.
CO3	Learning how to gather and analyse large sets of data to gain useful business understanding
CO4	Learning how to produce a quantitative analysis report/memo with the necessary information to make decisions
CO5	Describing and demonstrating basic data mining algorithms, methods, and tools
CO6	Identifying business applications of data mining
CO7	Overview of the developing areas - web mining, text mining, and ethical aspects of data mining

Course Details:

Unit I:
Data Warehousing: Need for data warehousing , Basic elements of data warehousing, Data Mart, Data Warehouse Architecture, extract and load Process, Clean and Transform data, Star ,Snowflake and Galaxy Schemas for Multidimensional databases, Fact and dimension data, Partitioning Strategy-Horizontal and Vertical Partitioning.

Unit II:
Data Warehouse and OLAP technology, Multidimensional data models and different OLAP Operations, OLAP Server: ROLAP, MOLAP, Data Warehouse implementation ,Efficient Computation of Data Cubes, Processing of OLAP queries, Indexing data.

Unit III:
Data Mining: Data Preprocessing ,Data Integration and Transformation, Data Reduction, Discretizaion and Concept Hierarchy Generation , Basics of data mining, Data mining techniques, KDP (Knowledge Discovery Process), Application and Challenges of Data Mining, Introduction

of Web Structure Mining, Web Usage Mining, Spatial Mining, Text Mining, Security Issue, Privacy Issue, Ethical Issue.

Unit IV:

Mining Association Rules in Large Databases: Association Rule Mining, Single-Dimensional Boolean Association Rules, Multi-Level Association Rule, Apriori Algorithm, Fp-Growth Algorithm, Time series mining association rules, latest trends in association rules mining.

Unit V:

Classification and Clustering Distance Measures, Types of Clustering, K-Means Algorithm, Decision Tree Induction, Bayesian Classification, Association Rule Based, Other Classification Methods, Prediction, Classifier Accuracy, Categorization of methods, Partitioning methods, Outlier Analysis.

Text Books and References:

1. Data Mining: Concepts and Techniques, A volume in The Morgan Kaufmann Series in Data Management Systems, Third Edition, 2012
2. P.Ponnian, "Data Warehousing Fundamentals", John Wiley & Sons Inc; 2nd edition 2010
3. M.H.Dunham, "Data Mining Introductory & Advanced Topics", Pearson Education.
4. Ralph Kimball, "The Data Warehouse Lifecycle Tool Kit", John Wiley.
5. M.Berry , G.Linoff, "Master in Data Mining", Wiley; 3rd edition 2008
6. W.H.Inmon, "Building the Data Ware houses", Wiley; 4th edition 2005
7. E.G. Mallach , "The Decision Support & Data Warehouse Systems", McGraw-Hill Education 2000
8. Data Warehousing in the Real World: A practical guide for building Decision Support Systems, D. Murray, Addison-Wesley; 1st edition 1997
9. David Hand, Heikki Manila, Padhraic Symth, "Principles of Data Mining", PHI 2004..
10. Alex Bezon, Stephen J.Smith, "Data Warehousing, Data Mining & OLAP", McGraw Hill Education 1 July 2017

Bucket-1

Course Code: **MCSE-315** **Breakup:** **3 – 0 – 0- 3**
Course Name: **Deep Learning**

Course Objectives: (CO): Objective of the course is:

CO1	Learn the concept, syntax, and semantics and gain introductory knowledge in Deep Learning principles through examples that provide useful exposure to the various concepts of Artificial Intelligence.
CO2	to give a basic overview of the mathematical foundations of the field, and present a number of techniques/architectures which have become de-facto standard for a large number of applications in vision, NLP and other areas

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the main fundamentals that drive Deep Learning
CO2	Be able to build, train and apply fully connected deep neural networks
CO3	Know how to implement efficient CNN or RNN.
CO4	Understand the key features in a neural network's architecture

Course Details:

Introduction: History of Neural network, an overview of Linear models, Hebbian learning Processing units: Perceptrons (classification), Limitations of Linear nets and Perceptrons, Activation functions, Error functions.

Neural Network : Neural network architecture, Multi-layer neural network, Practical advice, Optimization, Bias-variance dilemma, Overfitting, Inductive bias,

Training Neural Network: Risk minimization, loss function, back propagation, regularization, model selection, and Optimization.

Conditional Random Fields: Linear chain, partition function, Markov network, belief propagation, Training CRFs, Hidden Markov Model, Entropy.

Deep Learning: Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network.

Probabilistic Neural Network: Hopfield Net, Boltzman machine, RBMs, Sigmoid net, Autoencoders.

Deep Learning research: Object recognition, sparse coding, computer vision, natural language processing.

Deep Learning Tools: Caffe, Tlieano, Torch.

Text Books and References:

1. Goodfel1ow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016..
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education,
5. Ravindran, K. M. Ragsdell , and G. V. Reklaitis , ENGINEERING OPTIMIZATION: Methods and Applications , John Wiley & Sons, Inc. , 2016

Bucket-2

Course Code: MCSE-302 **Breakup: 3 – 0 – 0 – 3**
Course Name: Advance Computer Networks

Course Objectives: (CO): Objective of the course is:

CO1	Aims to provide a broad coverage of some new advanced topics in the field of computer networks (wireless networks, mobile networks, VPN networks, Mobile IP, etc.)
CO2	Familiarize the student with the basic taxonomy and terminology of the computer networking area.

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	To identify and discuss the concepts underlying IPv6 protocol, and their main characteristics and functionality
CO2	To understand the principles and functionality of mobile IP, explaining its concretization in IPv6; to understand the needs of optimization of the mobility mechanisms and description of some extensions that aim to reduce handover latency and requirements from terminals;
CO3	To recognize the need for service integration and discuss how it can be accomplished;
CO4	To explain and exemplify current QoS architectures and mechanisms, and the QoS support challenges in future networks;
CO5	To understand and explain the design issues in transport services w.r.t. applications and services requirements

Course Details:

Revision of Computer Networks, Seven Layer Architecture, TCP/IP Suite of protocols etc. Transport Layer: Flow and error control, multiplexing, establishing and releasing a connection, Transmission control protocol – header, services, connection management, convention control, sliding window and timers. User datagram protocol, Domain name services.

Unix network programming, socket abstraction client – server architecture.

Session presentation, application layers, Example protocols: Email (SMTP) Telnet, FTP, etc.

Internet security: firewalls. Network managements: SNMP.

IPV6: IPV6 Versus IPV4, Structure of IPV6 Protocol : general header structure , extension headers , IPV6 addressing : Types , notation, prefix notation , unicast, anycast , multicast addresses etc.

Security in IPV6: Basic Security Requirement and techniques, open security issues in current internet, IPSec frame work Quality of service in IPV6

ICMPV6: error messages, neighbor discovery, Auto configuration, path MTU discovery.

Wireless networks: Overview of 802.11 networks, 802.11 MAC, wired Equivalent privacy, Wireless communication technology: FHSS, DSSS, CDMA etc.

Mobility networks: Mobile IP, security related issues

Text Books and References:

All books used in the computer network

1. 802.11 wireless networks : The definitive guide, Mathew S. Gast, O'relly,2nd edition 2005
2. Wireless communication & networks: William Stallings, Pearson; 1st edition 2015
3. IPV6 Essentials , Silvia Hagen ,O'Reilly Media; 3rd edition 2014
4. TCP/IP Clearly Explained, Peter Loshin, Morgan Kaufmann; 4th edition 2003
5. Mobile IP design , Principle & Practices , Charles Perkin, Bobby Woolf, Sherman R. Alpert, Prentice Hall; First Edition 1998

Bucket-2

Course Code: **MCSE-307** **Breakup:** **3 – 0 – 0 – 3**
Course Name: **Cryptography and Network Security**

Course Objectives: (CO): Objective of the course is:

CO1	Evaluate security mechanisms using rigorous approaches by key ciphers and Hash functions
CO2	Identify and classify particular examples of attacks and factors driving the need for network security
CO3	Compare and contrast symmetric and asymmetric encryption systems
CO4	Usage of network security tools and applications to understand the system level security

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Summarize different classical encryption techniques
CO2	Identify mathematical concepts for different cryptographic algorithms
CO3	Demonstrate cryptographic algorithms for encryption/key exchange
CO4	Identify security issues in network, transport and application layers and outline appropriate security protocols
CO5	Summarize different authentication and digital signature schemes

Course Details:

Unit I:

Introduction to security attacks and mechanisms, Introduction to cryptology.

Conventional Encryption: Convention encryption model, Classical encryption techniques – substitution ciphers & transposition ciphers, cryptanalysis,

stereography, stream & block ciphers.

Modern Block Ciphers: Block ciphers principles, Shannon's theory of confusion and diffusion, fiestal structure, Data Encryption Standards (DES), Strength of DES, Differential & Linear Cryptanalysis of DES, Block Cipher modes of Operation, Triple DES, IDEA encryption and decryption. Strength of IDEA, Confidentiality using conventional encryption, traffic confidentiality, key distribution, random number generation.

Unit II:

Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's & Euler's Theorem, primarily testing, Euclid's Algorithm, Chinese remainder theorem, Discrete algorithms.
Principles of Public-Key cryptosystems, RSA algorithm, Security of RSA, Key management, Diffle- Hellman key exchange algorithm, Introductory idea of Elliptic curve cryptography, Elganal encryption.

Unit III:
Message authentication and hash functions: Authentication requirements, Authentication functions, message authentication codes, hash function, birthday attacks, security of hash function. & MACS, MD5 message digest algorithm, Secure Hash Algorithm (SHA).
Digital signatures: Digital signatures, Authentication protocol, digital signature standard (DSS), proof of digital signature algorithm.

Unit IV:
Authentication Application: Kerberos & X.509, directory authentication service, electronic mail security- Pretty Good Privacy (PGP), S7 MIME.

Unit V:
IP Security: Architecture, Authentication Header, Encapsulating security payloads, combining security associations, Key management.
Web security: Secure Socket Layer & Transport security, Secure electronic Transaction (SET).
System security: Intruders, Viruses and related threads, Firewall design principles, trusted systems.

Text Books and References:

1. William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall, New Jersey,5th edition 2010
2. Johannes A. Buchmann, Introduction to Cryptography", Springer- Verlag, 2nd edition 2004.
3. Bruce Schneier, Practical Cryptography, Pearson Education India

Bucket-2

Course Code: **MCSE – 312** **Breakup : 3 – 0 – 0 – 3**
Course Name: **Adhoc and Sensor Networks**

Course Objectives: (CO): Objective of the course is:

CO1	To know the constraints of the wireless physical layer that affect the design and performance of ad hoc and sensor networks, protocols, and applications
CO2	To understand MAC, Routing protocols that have been proposed for ad hoc and sensor networks
CO3	To understand the energy issues in sensor networks and how they can be addressed using scheduling, media access control, and special hardware;
CO4	To explain various security threats to ad hoc networks and describe proposed solutions

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	In depth knowledge in multi cast routing algorithms, mobility and its impact on routing protocols, application performance, quality of ser vice guarantees, and security.

Course Details:

Overview of Wireless LAN, PAN IEEE 802.11 Bluetooth Wireless WANs and MANs Cellular Architecture WLL IEEE 802.16 Wireless Internet IP and TCP in Wireless domain.

AD HOC Wireless Networks Cellular and Ad hoc networks Applications of Ad hoc networks Issues in Ad hoc networks MAC protocols for Ad hoc networks. Routing Protocols for Ad hoc Networks Classification Table driven, On demand, Hierarchical Routing P rotocols Energy Management in Ad hoc Networks. Emerging trends in Ad hoc Networks Mobility models for Ad hoc Networks.

Wireless Sensor Networks Architecture Data Dissemination and Gathering Location Discovery Applications of WSNs Operating system and programming for Sensor Network Security Ultra Wideband Systems Hybrid Wireless Networks

1. Wireless Networks: Anurag Kumar, D. Manjunath, Joy Kuri, (1st Ed.), Morgan Kaufman (2008)
2. Ad Hoc Wireless Networks: Architectures and Protocols, C. Siva Ram Murthy and B. S. Manoj,(2nd Ed.),Pearson Education (2005)
3. Ad Hoc & Sensor Networks: Theory and Applications, Carlos de Morais Cordeiro and Dharma Prakash Agrawal, (1st Ed.), World Scientific (2007)
4. Algorithms and Protocols for Wireless Sensor Networks: Azzedine Boukerche (Edited volume), Wiley IEEE press (2008)
5. Wireless Sensor Networks (1st Ed.), Ian F. Akyildiz nad and Mehmet Can Vuran, Wiley IEEE press (2010)
6. Wireless sensor network, Kazem shorbay, Daniel Minoli and Taieb znati (1st Ed.), Wiley IEEE press (2007)

Bucket-2

Course Code: **MCSE-316** **Breakup:** **3 – 0 – 0- 3**
Course Name: **Cyber Security and Privacy**

Course Objectives: (CO): Objective of the course is:

CO1	Understand the fundamental s of cyber security and cyber crimes.
CO2	Understand the tools and methods in cybercrimes and understanding computer forensics

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the basic concepts of cyber security and cyber crimes.
CO2	Understand the security policies and cyber laws

Course Details:
Syllabus:

- Foundations, cyber security, information security and related concepts, Principles of information security management, Confidentiality, Integrity, Availability and related concepts.
- Security management, Governance, Risk and Compliance (GRC) , Contingency planning, incidence response, disaster recovery and business continuity.
- Understanding security policy, security behavior , Risk management: Risk identification, threat modeling, strategies.
- Control strategies and protection mechanisms (Guest lecture), Cryptography for security.
- Information security and privacy, Regulatory landscape: Fair information practices, US regulatory frameworks.
- Regulatory landscape: EU's GDPR and its implications and other privacy and cyber security regulations, Cyber security and privacy in the Indian context, evolution and issues.
- Economics of privacy, privacy calculus and trade-offs, privacy paradox, Managing stakeholders, making choices on security and privacy

Text Books & References:

1. Michael E. Whitman, Herbert J. Mattord, (2018). Principles of Information Security, 6th edition, Cenage Learning, N. Delhi.

References

1. Darktrace, "Technology" https://www.darktrace.com/en/technology/#machine-learning, accessed November 2018.
2. Van Kessel, P. Is cyber security about more than protection? EY Global Information Security Survey 2018-2019.
3. Johnston, A.C. and Warkentin, M. Fear appeals and information security behaviors: An empirical study. MIS Quarterly, 2010.
4. Arce I. et al. Avoiding the top 10 software security design flaws. IEEE Computer Society Center for Secure Design (CSD), 2014.

Bucket-3

Course Code: **MCSE-303** **Breakup: 3 – 0 – 0– 3**
Course Name: **Distributed Processing**

Course Objectives: (CO): Objective of the course is:

CO1	Introduction to the design of distributed systems and algorithms that support distributed computing

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	To provide hardware and software issues in modern distributed systems.
CO2	To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.
CO3	To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.
CO4	To know about Shared Memory Techniques.
CO5	Have Sufficient knowledge about file access
CO6	Have knowledge of Synchronization and Deadlock

Course Details:

Introduction: Introductory Concept of Process, Concurrent Process, Synchronization Problems like Dining Philosopher, Producer Consumer, Readers writers problem, Process Deadlocks, Deadlock Vs Starvation, Models of Deadlocks, Model of Resources, Graph Theoretic Model of State, Necessary & sufficient condition for deadlock, Introduction of Distributed Processing , Issues in Distributed systems, Global knowledge, naming, scalability, Compatibility, Process Synchronization, Security issues.

Theoretical Foundation for Distributed Systems: Limitation of Distributed System, absence of global clock, shared memory, Logical Clocks, Lamports & Vectors logical Clocks, casual ordering of messages, global state, termination detection

Distributed Mutual Exclusion: Classification of distributed mutual exclusion, requirement of mutual exclusion algorithm, Token Based and non token based algorithm, performance metric for distributed mutual exclusion Algorithms

Distributed Deadlock Detection: System model, resource vs communication deadlocks, dead lock prevention, avoidance, detection & Resolution, Centralised deadlock detection, distributed dead lock detection, path pushing algorithm, Edge chasing algorithm

Agreement Protocols: Introduction, System Model, Classification of Agreement Problem, Byzantine Agreement Problem Consensus Problem, Interactive Consistency Problem, Solution to Byzantine Agreement Problem Application of Agreement Protocol, Atomic Commit in Distributed Database System

Distributed Resource Management: Distributed File System, Mechanism for building distributed file system, Mounting caching Hints Bulk Data Transfer, Encryption , Design Issues

, Naming & Naming Resolution, Caches on Disk or Main Memory, Writing Policy, Distributed Shared Memory, Architecture & Motivation, Algorithms for Implementing Distributed Shared Memory, Client Server, Migration, Read Application full Replication Algorithms, Memory Coherence protocols.
Advanced issues in Distributed System: Distributed Scheduling , issues in load distribution, Component of load distributing algorithm, stability Performance comparison, task migration, Introduction to Fault Tolerance, Data Security Encryption , Distributed resource management, Multiprocessing Operating System, Database

Operating system: Distributed Algorithms: Introduction to Communication protocols, Balanced Sliding Window Protocol, Routing Algorithm Destination based routing, APSP Problem, Deadlock Free Packet Switching, Introduction to Wave Traversal Algorithms, Election Algorithms.

Text Books & References:

1. Mukesh Singhal &Niranjan Shivaratri "Advanced Concepts in Operating System" McGraw Hill Education, 2017
2. Tel , Gerald, "Introduction to Distributed Algorithm" Cambridge University Press; 2nd edition 2000
3. Distributed Systems: Concepts and Design, Coulouris, Pearson Education India; 4th edition 2008
4. Distributed Systems, Andrew S Tanenbaum (Author), Maarten Van Steen, Maarten Van Steen 2023

Bucket-3

Course Code: **MCSE-308** **Breakup: 3 – 0 – 0– 3**
Course Name: **Internet of Things**

Course Objectives: (CO): Objective of the course is:

CO1	To Understand Smart Objects and IoT Architectures.
CO2	To learn about various IOT-related protocols
CO3	To build simple IoT Systems using Arduino and Raspberry Pi.
CO4	To understand data analytics and cloud in the context of IoT
CO5	To develop IoT infrastructure for popular applications.

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Summarize on the term 'internet of things' in different contexts.
CO2	Analyze various protocols for IoT.
CO3	Design a PoC of an IoT system using Rasperry Pi/Arduino
CO4	Apply data analytics and use cloud offerings related to IoT.
CO5	Analyze applications of IoT in real time scenario

Course Details:

UNIT I: Fundamentals Of Iot: Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II: Iot Protocols: IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.

UNIT III: Design And Development: Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.

UNIT IV: Data Analytics And Supporting Services: Structured Vs Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning – No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web Application Framework, Django, AWS for IoT, System Management with NETCONF-YANG.

UNIT V: Case Studies/Industrial Applications: Cisco IoT system, IBM Watson IoT platform, Manufacturing, Converged Plant wide Ethernet Model (CPwE), Power Utility Industry, Grid Blocks Reference Model, Smart and Connected Cities: Layered architecture, Smart Lighting,

Smart Parking Architecture and Smart Traffic Control.

Text Books:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017

Reference Books:

2. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015
3. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).
4. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Jan Ho¨ ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
5. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.
6. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O'Reilly Media, 2011.

Bucket-3

Course Code: **MCSE – 313** **Breakup : 3 – 0 – 0 – 3**
Course Name: **Cloud Computing**

Course Objectives: (CO): Objective of the course is:

CO1	To explain the evolving computer model called cloud computing.
CO2	To introduce the various levels of services that can be achieved by cloud.
CO3	To describe the security aspects in cloud.

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Ability to understand various service delivery models of a cloud computing architecture.
CO2	Evaluate the ways in which the cloud can be programmed and deployed
CO3	Understanding cloud service providers
CO4	Analyzing the Infrastructure as a Service in Cloud computing
CO5	Apply cloud programming and software environments in different systems

Course Details:

Overview of cloud computing: What is a cloud, Definition of cloud, Definition of cloud, characteristics of cloud, Why use clouds, How clouds are changing, How clouds are changing, Driving factors towards cloud, Comparing grid with cloud and other computing systems, workload patterns for the cloud, "Big Data", IT as a service.

Cloud Computing Concepts: Concepts of cloud computing, Cloud computing leverage the Internet, Positioning cloud to a grid infrastructure, Elasticity and scalability, Virtulazation, Characteristics of virtualization, Benefits of virtualization, Virtualization in cloud computing, Hypervisors, Multitenancy, Types of tenancy, Application programming interfaces (API), Billing and metering of services, Economies of scale, Management, tooling, and automation in cloud computing. Management, Desktops in the Cloud, Security.

Cloud service delivery: Cloud service, Cloud service model architectures, Infrastructure as a service (IaaS) architecture, Infrastructure as a service (IaaS) details, Platform as a service (PaaS) architecture, Platform as a service (PaaS) details, Platform as a service (PaaS), Examples of SaaS applications, Trade-off in cost to install versus, Common cloud management platform reference architecture Architecture overview diagram, Common cloud management platform, cloud deployment scenarios Cloud deployment models, Public clouds, Hybrid clouds, Community, Virtual private clouds, Vertical and special purpose. Migration paths for cloud, Selection criteria for cloud deployment.

Security in cloud computing: Cloud security reference model, How security gets integrated, cloud security, Understanding security risks, Principal security dangers to cloud computing, Virtualization and multitenancy, Internal security breaches, Data corruption or loss, User account and service hijacking Steps to reduce cloud security breaches, Steps to reduce cloud security breaches, Reducing cloud security, identity management; Detection and forensics, Identity management Detection and Identity management, Benefits of identity, Encryption techniques, Encryption & Encrypting data, Symmetric key encryption, Asymmetric key encryption, Digital signature, What is SSL? IBM Smart Cloud, Amazon Web Services, Google Cloud platform,

Windows Azure platform, A comparison of Cloud Computing Platforms, Common building Books.

Text Books and References:

1. Raj Kumar Buyya, James Broberg, Andrezei M Goscinski, Cloud Computing Principles and paradigms 2011
2. Michael Miller, Cloud Computing 2008
3. Judith Hurwith, Robin Bllor, Marcia Kaufman, Fern Halper, Cloud Computing for dummies, 2009
4. Anthony T Velte, Toby J Velte and Robert Elsenpeter, Cloud Computing A Practical Approach, McGraw Hill, 2010.
5. Barrie Sosinksky, Cloud Computing Bible, Wiley, 2011.6. Borko Furht, Armando Escalante (Editors), Handbook of Cloud Computing, Springer, 2010.

Bucket-3

Course Code: **MCSE-317** **Breakup:** **3 – 0 – 0- 3**
Course Name: **Multicore Computer Architecture**

Course Objectives: (CO): Objective of the course is:

CO1	To understand the need for multi-core processors, and their architecture.
CO2	To understand the challenges in parallel and multi-threaded programming.
CO3	To learn about the various parallel programming paradigms,
CO4	To develop multicore programs and design parallel solutions.

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand concept of Parallel processor architecture in designing a modern computer for the future customers needs
CO2	To understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.
CO3	To understand the performance and efficiency in advanced multiple-issue processors.
CO4	To understand the performance of multicore processors using SPEC benchmarks.

Course Details:

Syllabus:

- Instruction Execution Principles, Introduction to Instruction Pipeline, Introduction to Superscalar Pipelines
- Cache Memory Design Concepts
- Basic Cache Optimizations
- Advanced Cache Optimizations
- DRAM Technology
- Tiled Chip Multi-Core Processors & Network-on-Chip
- Network-on-Chip Architectures
- QoS for TCMPs at Storage and Interconnect Levels

Text Books & References:

1. Multi Core Architecture & Programing, M Shayamala Devi, Vijay Nicole Imprints Pvt. Ltd
2. Fundamentals of Parallel Multicore Architecture, Yan Solihin, Chapman & Hall/CRC Computational Science, 2015
3. Multicore Programming-Increased Performance through Software Multi–threading", Shameem Akhter and Jason Roberts, Intel Press, 2006.

Bucket-4

Course Code: **MCSE-304** **Breakup:** **3 – 0 – 0- 3**
Course Name: **Computer Vision**

Course Objectives: (CO): Objective of the course is:

CO1	To introduce students the fundamentals of image formation
CO2	To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition
CO3	To develop an appreciation for various issues in the design of computer vision and object recognition systems
CO4	To provide the student with programming experience from implementing computer vision and object recognition applications

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Identify basic concepts, terminology, theories, models and methods in the field of computer vision
CO2	describe known principles of human visual system
CO3	describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition,
CO4	describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition,

Course Details:

Syllabus:

UNIT I

Image Formation Models:Monocular imaging system, Orthographic& Perspective Projection, Camera model and Camera calibration, Binocular imaging systems

UNIT II

Image Processing and Feature Extraction:Image representations (continuous and discrete), Edge detection

UNIT III

Motion Estimation:Regularization theory, Optical computation, Stereo Vision, Motionestimation, Structure from motion

UNIT IV

Shape Representation and Segmentation:Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medialrepresentations, Multiresolution analysis

UNIT V

Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal Component analysis, Shape priors for recognition.

TEXT BOOKS:

1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.

REFERENCE BOOKS:

1. Richard Szeliksy "Computer Vision: Algorithms and Applications" (http://szeliski.org/Book/)
2. Haralick& Shapiro, "Computer and Robot Vision", Vol II
3. G_erardMedioni and Sing Bing Kang "Emerging topics in computer vision"
4. Emanuele Trucco and AllessandroVerri "Introductory Techniques for 3-D Computer Vision", Prentice Hall, 1998.
5. Olivier Faugeras, "Three-Dimensional Computer Vision", The MIT Press, 1993.

Bucket-4

Course Code: **MCSE-314** **Breakup:** **3 – 0 – 0- 3**
Course Name: **Augmented Reality**

Course Objectives: (CO): Objective of the course is:

CO1	The objective of this course is to provide a foundation to the fast growing field of AR and make the students aware of the various AR devices

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Describe how AR systems work and list the applications of AR
CO2	Understand and analyse the hardware requirement of AR.
CO3	Use computer vision concepts for AR and describe AR techniques
CO4	Analyse and understand the working of various state of the art AR devices

Course Details:
Syllabus:

UNIT I
What Is Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality

Augmented Reality Concepts- How Does Augmented Reality Work? Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience.

UNIT II
Augmented Reality Hardware – Displays – Audio Displays, Haptic Displays, Visual Displays, Other sensory displays, Visual Perception , Requirements and Characteristics, Spatial Display Model. Processors – Role of Processors, Processor System Architecture, Processor Specifications. Tracking & Sensors - Tracking, Calibration, and Registration, Characteristics of

Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion.

UNIT III

Computer Vision for Augmented Reality - Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Simultaneous Localization and Mapping, Outdoor Tracking Augmented Reality Software - Introduction, Major Software Components for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application.

UNIT IV

Marker-based approach- Introduction to marker-based tracking, types of markers, marker camera pose and identification, visual tracking, mathematical representation of matrix multiplication Marker types- Template markers, 2D barcode markers, imperceptible markers. Marker-less approach- Localization based augmentation, real world examples Tracking methods- Visual tracking, feature based tracking, hybrid tracking, and initialisation and recovery.

UNIT V

AR Components – Scene Generator, Tracking system, monitoring system, display, Game scene AR Devices – Optical See- Through HMD, Virtual retinal systems, Monitor bases systems, Projection displays, Video see-through systems Introduction to mixed reality, Applications of mixed reality, Input and Output in Mixed reality, Computer Vision and Mixed Reality, simultaneous localization and mapping (SLAM), variants of SLAM - dense tracking and mapping (DTAM), parallel tracking and mapping (PTAM) and semi-direct monocular visual odometry (SVO).

TEXT BOOKS:

1. Allan Fowler-AR Game Development‖, 1st Edition, A press Publications, 2018, ISBN 978-1484236178
2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016),ISBN-10: 9332578494

REFERENCE BOOKS:

1. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381
2. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0

Bucket-4

Course Code: **MCSE-318** **Breakup:** **3 – 0 – 0- 3**
Course Name: **Remote Sensing**

Course Objectives: (CO): Objective of the course is:

CO1	To impart understanding of basic and fundamentals of remote sensing components.
CO2	To gain knowledge about various remote sensing missions

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understanding basic components of remote Sensing
CO2	Students may able to obtain knowledge of the sensor characteristics of various RS Systems
CO3	Acquire knowledge of different missions & their utility
CO4	Students may able to understand functioning, data acquisition and orbit operations of missions

Course Details:
Syllabus:

UNIT I
Definition; History of Remote Sensing; Physics of Remote Sensing: Electromagnetic Radiation (EMR), Characteristics; Electromagnetic Spectrum (EMS); Interactions Between Matter and Electro-Magnetic Radiation; Energy Interaction in The Atmosphere; Energy Interactions with The Earth's Surface. Radiation Laws. Atmospheric Windows; Types of Remote Sensing with Respect to Wavelength Regions

UNIT II
Sensor and Platforms. Sensor Technology; Historical Development; Types of Platforms and Sensors– Airborne Remote Sensing; Space Borne Remote Sensing; Orbital Elements of Satellite; Sensor Types Characteristics: Active and Passive Remote Sensing; Imaging Systems; Non-Imaging Sensors; Across Track and Along Track Scanners; Framing and Scanning Systems; Characteristics of Optical Sensors; Resolution.

UNIT III
Remote Sensing Satellites and Data Products: Overview of Different Satellite and Sensors for Earth Observations– Coarse; Medium and High-Resolution Missions (Landsat Series; SPOT; Ikonos; Quickbird; ASTER; Sentinel; Aqua and Terra (MODIS); SAR and Future Missions.

UNIT IV
IRS Missions: IRS 1A; IRS 1B; IRS-P2; IRS-1C; IRS-P3; IRS-1D; Oceansat (IRS-P4); IRS P6 / Resourcesat-1; Cartosat-1; Cartosat-2; Cartosat-2A; Chandrayan-1; RISAT-1; RISAT-2; Oceansat-2; Cartosat-2B; Resourcesat-2; Megha-Tropiques; SARAL; Resourcesat-2A; Mars Orbiter Mission Spacecraft.

Text Books & References:

1. Lillesand, T., Kiefer, R. W., & Chipman, J. (2014). Remote Sensing and Image Interpretation.
2. John Wiley & Sons. Rees, W. G. (2012). Physical Principles of Remote Sensing. Cambridge University Press.
3. Jensen, J. R. (2009). Remote Sensing of The Environment: An Earth Resource Perspective 2/E. Pearson Education India.
4. Sabins, F. F. (2007). Remote Sensing: Principles and Applications. Waveland Press.

Bucket-5

Course Code: **MCSE-305** **Breakup:** **3 – 0 – 0- 3**
Course Name: **Distributed Databases**

Course Objectives: (CO): Objective of the course is:

CO1	To Introduce various Distributed Database Applications in real world scenario
CO2	To be learning more about various Distributed Database Techniques
CO3	Applying efficient Advanced Techniques to solve engineering problems

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Compare various Distributed Databases methods
CO2	understand and identify the analytical characteristics of Distributed Databases algorithms.
CO3	Employ algorithm to model engineering problems, when appropriate.

Course Details:

Syllabus:

UNIT I

Introduction Distributed Data Processing Promises of DDBs Complicating Factors and Problem Areas.

Architecture of distributed systems Architectural Models for Distributed DBMSs Homogeneous Heterogeneous Client/server Distributed Databases versus Replicated Databases

UNIT II

Distributed Database Design Alternative Design Strategies Distribution Design Issues Fragmentation Allocation.

Concepts of Database links Introduction Types Database Links Creating and Managing Database Links Restrictions through Database Links Practical Scenarios and examples

Transparencies Database link name resolution Schema object name resolution Location trans-RPC, creating location transparencies using views, synonyms and procedures Managing statement trans

UNIT III

Transaction processing Concept and Properties of Transactions Remote and Distributed SQL Statements Shared SQL for Remote and Distributed Statements Remote and Distributed Transactions

72PC and 3PC Mechanisms and its types Semantic Data Control View Management Data Security

Semantic Integrity control

UNIT IV

Query processing and Query optimization strategies Distributed Query Processing Methodology. Distributed Query Optimization. New query optimization techniques in distributed database. Distributed Query Optimization problems and some solutions. Advantages of query optimization techniques in distributed database

UNIT V

Autonomy and Security in Distributed Databases Site Autonomy DD Security Authentication trough

Database Links Authentication without Password Supporting User Accounts and Roles Centralized

User and Privilege Management Data Encryption Database Auditin

Current Trends in Distributed Database Data Delivery Alternatives Data Warehousing World Wide Web Push-based Technologies Mobile Databases. Real Application Clusters(RAC) Cloud based databases

REFERENCE BOOKS:

1. Principles of Distributed Database Systems by M. TAMER OZSU, Patrick Valduriez, S. Sridhar (Pearson Publication)

2. Database system concepts', 6th Edition –Abraham Silberschatz, Henry Korth, S, Sudarshan, (McGraw Hill International)

3. Distributed Databases by Stefano Ceri, Giuseppe Pelagatti(TMH) 4. Oracle Documentation

Bucket-5

Course Code: **MCSE-309** **Breakup:** **3 – 0 – 0- 3**
Course Name: **Management Information System**

Course Objectives: (CO): Objective of the course is:

CO1	To describe the role of information technology and decision support systems in business and record the current issues with those of the firm to solve business problems.
CO2	To introduce the fundamental principles of computer-based information systems analysis and design and develop an understanding of the principles and techniques used.
CO3	To enable students understand the various knowledge representation methods and different expert system structures as strategic weapons to counter the threats to business and make business more competitive.
CO4	To provide the theoretical models used in database management systems to answer business questions.

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Relate the basic concepts and technologies used in the field of management information systems
CO2	Compare the processes of developing and implementing information systems
CO3	Outline the role of the ethical, social, and security issues of information systems.
CO4	Apply the understanding of how various information systems like DBMS work together to accomplish the information objectives of an organization.

Course Details:

Syllabus:

UNIT I
Management information system in a digital firm: MIS concept - Definition –Role of the MIS - Impact of the MIS-MIS and the user - Management as a control system - MIS a support to management - Development process of the MIS.

UNIT II
System analysis and design: System - Need for system analysis - System analysis of the existing system - System analysis of a new requirements - System Development Model - Structured System Analysis and Design - Object Oriented Analysis.

UNIT III
Information system applications: MIS applications, DSS – GDSS - DSS applications in E enterprise - Knowledge Management System and Knowledge Based Expert System - Enterprise Model System and E-Business, E- Commerce, E-communication, Business Process Reengineering

UNIT IV
Technology of information system: Data process- Transaction and application process Information system process; Unified communication and network; Security challenges in E-enterprises; Security threats and Vulnerability-Controlling security threat and vulnerability

UNIT V
Data base management system: Objectives of data base approach- Characters of database Management systems- Data processing system- Components of DBMS packages - Data base administration- Data models - Data warehouse

REFERENCE BOOKS:

1. Jawadekar, W.S., “Management Information Systems”, Tata McGraw Hill Private Limited, New Delhi, 2009.
2. Kenneth C. Laudon and Jane P. Laudon: “Management Information Systems” 9/e, Pearson Education, New Delhi.
3. Alex Leon and Mathew Leon: “Data Base Management Systems”, Vikas Publishing House, New Delhi.
4. Goyal, D.P.: “Management Information System”, MACMILLAN India Limited, New Delhi, 2008.
5. Mahadeo Jaiswal, Monika Mital: “Management Information System”, Oxford University Press, New Delhi, 2008.

Bucket-5

Course Code: **MCSE-319** **Breakup:** **3 – 0 – 0- 3**
Course Name: **Bioinformatics**

Course Objectives: (CO): Objective of the course is:

CO1	To understand the fundamental concepts in Cell Biology & Biochemistry.
CO2	To integrate fundamental concepts of cell biology and biochemistry and relate the molecular mechanism with Bioinformatics
CO3	To learn research concepts in Cell Biology & Biochemist

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	learn the basics of Genetics & Molecular Biology
CO2	relate the basic knowledge in Genetics & Molecular Biology and see how it can be applied through Bioinformatics perspective
CO3	realize the scope of Genetics & Molecular Biology in frontiers of Life Science Research.
CO4	learn the basic methodology in Bioinformatics

Course Details:
Syllabus:

Unit 1: Cell Structure and function of cell, Introduction of DNA, RNA, Protein, Carbohydrate and Lipids,
Structure of Protein (primary, secondary Tertiary and quaternary), Gene and non-coding RNA. Protein folding and function, Nucleic acid-Protein interaction. Enzymes: details of enzyme nomenclature and classification; units of enzyme activity; coenzymes and metal cofactors; temperature and pH effects; Michaelis-Menten kinetics; Inhibitors and activators; active site and catalytic mechanisms; covalent and non-covalent regulations; is enzymes; osmoles and intracellular modulation of enzymes.

Unit 2: Biological Databases both protein and Nucleotide, Sequence similarity search program and Algorithm, Pairwise and Multiple Sequence Alignment program, Shannon Entropy, BLAST Algorithm, FASTA Algorithm, Protein Substitution Matrix (BLOSUM and PAM), Nucleotide Substitution Matrix, Profile, Heuristic based approach
Unit 3: Computational representations of molecular biological data storage techniques: databases (flat, relational and object oriented), and controlled vocabularies, general data retrieval techniques: indices, Boolean search, fuzzy search and neighboring, application to biological data warehouses.
Unit 4: Hidden Markov Model and their application for profile analysis, Genetic Algorithm and its use inStructure Prediction of biomolecules, Nussinov algorithm for RNA secondary structure prediction, SOM,Cluster Analysis: Nearest neighbor search, Search using stem numbers, Search using text signatures, Phylogenetic Analysis Tools: Maximum Likelihood, Parsimony methods, Distance methods, Model Comparison.

Text Books and References:

1. Fundamentals of Biochemistry, D., Voet, Voet, J.G. & Pratt, C. W. (John Wiley & Sons, 2 2006) edition,
2. Computational Molecular Biology: An Algorithmic Approach, Pavel Pevzner (MIT Press, 2000)

3. An Introduction to Bioinformatics Algorithms, Neil C. Jones (The MIT Press 2004)
4. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids**,** Richard Durbin,Sean R. Eddy , Anders Krogh, Graeme Mitchison (Cambridge University Press 1998)
5. Bioinformatics: Sequence and Genome Analysis, David W. Mount **(**Cold Spring Harbor LaboratoryPress 2001
6. Statistical methods in bioinformatics: an introduction, Ewens, W. J. & Grant, G. R., (New York.Springer, 2001)