ESTD: 1980

SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE (AUTONOMOUS)
(Affiliated to JNTUK, Kakinada), (Recognised by AICTE, New Delhi)
Accredited by NAAC with 'A' Grade
Recognised as Scientific and Industrial Research Organisation
CHINNA AMIRAM (P.O):: BHIMAVARAM :: W.G.Dt., A.P., INDIA :: PIN: 534 204

SCHEME OF INSTRUCTION & EXAMINATION
(Regulation R17)

M.TECH. (COMPUTER SCIENCE & TECHNOLOGY)
DEPARTMENT OF COMPUTER SCIENCE &ENGINEERING
(With effect from **2017-2018**Admitted Batch onwards**)**
Under Choice Based Credit System

I-SEMESTER

Code No.	Name of the Subject	Credits	Lec-ture Hrs	Tutorial Hrs	Lab Hrs	Contact Hrs/ Week	Internal Marks	External Marks	Total Marks
M17 CST 1101	Advanced Data structures and Algorithm Analysis	3	3	1	--	4	30	70	100
M17 CST 1102	Mathematical Foundations of Computer Science	3	3	1	--	4	30	70	100
M17 CST 1103	Computer Organization and Architecture	3	3	1	--	4	30	70	100
M17 CST 1104	Database Management Systems	3	3	1	--	4	30	70	100
M17 CST 1105	Advanced Operating Systems	3	3	1	--	4	30	70	100
M17 CST 1106	Data Warehousing and Data Mining	3	3	1	--	4	30	70	100
M17 CST 1107	CST LAB-1	2	--	--	3	3	50	50	100
* M17 CST 1108	CST LAB-2	--	--	--	3	3	--	--	--
Total		**20**	**18**	**6**	**6**	**30**	**230**	**470**	**700**

*- Audit Course

Code: M17 CST 1101

ADVANCED DATA STRUCTURES AND ALGORITHM ANALYSIS

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. Student will learn about advanced data structures
2. Practice the algorithms for manipulating advanced data structures, and how to analyze the time and memory requirements of them.
3. Student will master some complex searching and sorting algorithms and their data structures, advanced types of trees, basic computational geometry procedures, and graph representations and graph algorithms.
4. Student will learn when and how to use techniques for developing algorithms, such as divide-and-conquer and dynamic programming.
5. Student will also become skilled in algorithmic analysis and algorithm development using the latest techniques.

COURSE OUTCOMES:

1. Could be able to write programs and class libraries given a specification.
2. Implement various data structures.
3. Implement and analyze various sorting algorithms.
4. Understand abstract data types.
5. Know how they are implemented in C++ programming language.

SYLLABUS

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 andTraversals.

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. Search Trees- 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 Structure, A Pseudocode Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon,Cengage
2. Data Structures, Algorithms and Applications in java, 2/e, SartajSahni, UniversityPress
3. Data Structures And Algorithm Analysis, 2/e, Mark Allen Weiss,Pearson.

REFERENCES BOOKS:

1. Data Structures And Algorithms, 3/e, Adam Drozdek,Cengage.
2. C and Data Structures, A Snap Shot Oriented Treatise Using Live Engineering Examples, N.B.Venkateswarulu, E.V.Prasad, S Chand &Co,2009.

Code: M17 CST 1102

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To explain with examples the basic terminology of functions, relations and sets.
2. To perform the operations associated with functions, relations and sets.
3. To relate practical examples appropriate to the set, function, relation or relation model and interpret the associated operations and terminology.
4. To describe the importance and limitations of predicate logic.
5. To relate ideas of mathematical induction to recursion and recursively defined structures.

COURSE OUTCOMES:

1. Critical, logical-mathematical reasoning
2. Ability to apply mathematical knowledge and logic in solving problems.
3. Students develops the ability to illustrate basic terminology of functions, relations and demonstrate knowledge of their associated operations.
4. Able to demonstrate practical applications and use of basic counting principles of permutations and combinations.
5. Able to represent and apply theory in solving computer science applications

SYLLABUS

UNIT- I:

Mathematical Logic: Statements and notations, Connectives, Well-formed formulas, Truth Tables, tautology, equivalence implication, Normal forms, Theory of inference for the statement calculus, Rules of inference, Consistency of premises and indirect method of proof, Automatic Theorem Proving Predicate calculus: Predicates, statement functions, variables and quantifiers, predicate formulas, free & bound variables, universe of discourse, inference theory of predicate calculus

UNIT- II :

Set theory & Relations: Introduction, Relations and ordering, Properties of binary Relations, Equivalence, Compatibility Relations, Partial ordering, Hasse diagram. Functions: composition of functions, Inverse Function, Recursive Functions, Lattice and its Properties, Pigeon hole Principles and its application. Algebraic structures: Algebraic systems, Examples and general properties, Semi groups and Monoids, groups, sub groups, Definitions, Examples, homomorphism, Isomorphism and related problems.

UNIT- III:

Elementary Combinatorics: Basis of counting, Enumeration of Combinations & Permutations, Enumerating of Combinations & Permutations with repetitions and constrained repetitions, Binomial Coefficients, Binomial Multinomial theorems, principles of Inclusion –Exclusion.

UNIT- IV:

Recurrence Relations: Generating Function of Sequences, Calculating Coefficient of generating functions, Recurrence relations, Solving recurrence relation by substitution and Generating functions, The method of Characteristic roots, Solution of Inhomogeneous Recurrence Relation.

UNIT- V:

Graph Theory: Representation of Graph, Spanning Trees, BFS, DFS, Kruskals Algorithm, Binary trees, Planar Graphs, Graph Theory and Applications, Basic Concepts, Isomorphism and Sub graphs, Multi graphs and Euler circuits, Hamiltonian graphs, Chromatic Numbers

TEXT BOOKS:

1. Discrete Mathematical Structures with Applications to computer science, J.PTremblery, R.Manohar,TMH.
2. Discrete Mathematical for computer Scientists & Mathematicians, J.L. Molt, A.KandelT.P.Baker,PHI

REFERENCE BOOKS:

1. Elements of Discrete Mathematics, C L Liu, D P Mohanpatra,TMH
2. Discrete Mathematics, Schaum's Outlines, Lipschutz, LipsonTMH.
3. Discrete Mathematical Structures, Kolman, Busby, Ross, 6th ed., PHI,2009

Code: M17 CST 1103

COMPUTER ORGANIZATION AND ARCHITECTURE

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To have a thorough understanding of the basic structure operation of Digital Computer.
2. To discuss in detail the operation of the arithmetic unit including the algorithms & implementation of fixed-point addition, Subtraction, multiplication &division.
3. To study the different ways of communicating with I/O devices and standard I/O interfaces.
4. To study the hierarchical memory system including cache and Virtual memory

Course Outcomes:

1. Apply the basic knowledge about Different Number Systems, Digital logic to the Functional components of computer. **[K 3]**
2. Students will be able to Describe the major components of a computer. **[K 2]**
3. Students will be able to classify different Computer Instructions. **[K 2]**
4. Students will be able to Describe Instruction set architecture. **[K 2]**
5. Recognize the importance of peripheral devices. **[K 2]**
6. Students should be able to classify Computer memories **[K 2]**

SYLLABUS

UNIT – I

Number System and Computer Arithmetic Signed and Unsigned Numbers, Additional and Subtraction, Multiplication, Division, Floating Point Representation Logical operations, Gray Code, BCD Code, Error Detecting Code, Boolean Algebra, Simplification of Boolean Expressions – Maps.

UNIT – II

Combinational and Sequential Circuits, Decoders, Encoders, Multiplexers, Half and Full adders, Shift Registers, Flip-Flops, Binary Counters, Memory Unit.

UNIT -III

Memory Organization, Memory Hierarchy, Main Memory, Auxilary Memory, Associative Memory, Cache Memory Virtual Memory concept.

UNIT – IV

Arithmetic and Logic Unit Design, Addition and Subtraction, Sign and Unsigned Numbers, Multiplication and Division algorithms, BCD adders.

UNIT – V

Input – Output organization peripheral Devices, Input – Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, DMA, Input – Output Processor, Serial Communication.

TEXT BOOKS:

1. Computer System Architecture, 3/e, Morris Mano, Pearson/PHI
2. Micro Processor and Interfacing, 2/e, Douglas V, TMH.

REFERENCE BOOKS:

1. Digital Logic and Computer Organisation, Rajaraman, Radha Krishnan,PHI.
2. Micro Computer Systems: 8086/8088 family, 2/e, Liu, Gibson,PHI.
3. Computer Organisation and Architecture, 7/e, Stallings,Pearson.

Code: M17 CST 1104

DATABASE MANAGEMENT SYSTEMS

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. Discovering the relational model and formal query languages
2. Preparing SQL commands for definition, constructing and manipulation of databases
3. Applying conceptual and logical database design
4. Applying normalization on tables
5. Scheduling concurrent transactions using locking protocols and protocols without locking
6. Discussing transaction recovery techniques.
7. Exploring the various indexing techniques

COURSE OUTCOMES:

On successful completion of the course a student will able

1. To construct SQL commands for creating database objects, populating tables, and retrieve data
2. To prepare queries in formal query languages
3. To explore the features of RDBMS
4. To apply conceptual database design
5. To apply logical database design
6. To normalize the tables.
7. To know different protocols of Concurrency control
8. To apply Recovery techniques of DBMS
9. To understand different indexing techniques

SYLLABUS

UNIT- I:

Database System Applications, Purpose of Database Systems, View of Data – Data Abstraction, Instances and Schemas, Data Models – the ER Model, Relational Model, Other Models – Database Languages – DDL, DML, Database Access from Applications Programs, Transaction Management, Data Storage and Querying, Database Architecture, Database Users and Administrators, History of Database Systems. Introduction to Database design, ER diagrams, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises. Relational Model: Introduction to the Relational Model – Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical database Design, Introduction to Views–Destroying/altering Tables and Views.

UNIT- II:

Relational Algebra and Calculus: Relational Algebra – Selection and Projection, Set operations, Renaming, Joins, Division, Examples of Algebra Queries, Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus. Form of Basic SQL Query – Examples of Basic SQL Queries, Introduction to Nested Queries, Correlated Nested Queries, Set – Comparison Operators, Aggregate Operators, NULL values – Comparison using Null values – Logical connectives – AND, OR and NOT – Impact on SQL Constructs, Outer Joins, Disallowing NULL values, Complex Integrity Constraints in SQL Triggers and Active Databases.

UNIT- III :

Introduction to Schema Refinement – Problems Caused by redundancy, Decompositions – Problem related to decomposition, Functional Dependencies - Reasoning about FDS, Normal Forms – FIRST, SECOND, THIRD Normal forms – BCNF –Properties of Decompositions- Loss-less join Decomposition, Dependency preserving Decomposition, Schema Refinement in Database Design – Multi valued Dependencies – FOURTH Normal Form, Join Dependencies, FIFTH Normal form, Inclusion Dependencies.

UNIT- IV:

Overview of Transaction Management: The ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions – Lock Based Concurrency Control, Deadlocks – Performance of Locking – Transaction Support in SQL. Concurrency Control: Serializability, and recoverability – Introduction to Lock Management – Lock Conversions, Dealing with Dead Locks, Specialized Locking Techniques – Concurrency Control without Locking. Crash recovery: Introduction to Crash recovery, Introduction to ARIES, the Log , Other Recovery related Structures, the Write-Ahead Log Protocol, Check pointing, recovering from a System Crash, Media recovery

UNIT-V:

Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing – Clustered Indexes, Primary and Secondary Indexes, Index data Structures – Hash Based Indexing, Tree based Indexing, Comparison of File Organizations. Storing data: Disks and Files:The Memory Hierarchy – Redundant Arrays of Independent Disks. Tree Structured Indexing: Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM) B+ Trees: A Dynamic Index Structure, Search, Insert, Delete. Hash Based Indexing: Static Hashing, Extendable hashing, Linear Hashing, Extendable vs. Linear Hashing.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishna, Johannes Gehrke, TMH, 3rd Edition, 2003.
2. Database System Concepts, A.Silberschatz, H.F. Korth, S. Sudarshan, McGraw hill, VI edition,2006.
3. Fundamentals of Database Systems 5th edition. RamezElmasri, ShamkantB.Navathe, Pearson Education,2008.

REFERENCE BOOKS:

1. Database Management System Oracle SQL and PL/SQL,P.K.Das Gupta,PHI.
2. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning,2008.
3. Database Systems, A Practical approach to Design Implementation and Management Fourth edition, Thomas Connolly, Carolyn Begg, Pearson education.

Code: M17 CST 1105

ADVANCED OPERATING SYSTEMS

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To explain the concepts of distributed systems
2. To know network protocols and RPC
3. To explain the concepts of shared memory in Distributed systems
4. To understand Process, Processors a and Synchronization in Distributed systems
5. To explain File and Directory Services in Distributed systems

COURSE OUTCOMES:

On successful completion of the course a student will able

1. To understands the concept of Distributed systems
2. To understand the concepts of shared memory and process synchronization
3. To handle deadlocks in distributed systems
4. To understand failures and Recovery in distributed systems
5. To understand File and directory structure in Distributes operating systems

SYLLABUS

UNIT - I:

Architectures of Distributed Systems - System Architecture types - issues in distributed operating systems - communication networks - communication primitives. Theoretical Foundations - inherent limitations of a distributed system - lamp ports logical clocks - vector clocks - casual ordering of messages - global state - cuts of a distributed computation - termination detection. Distributed Mutual Exclusion - introduction - the classification of mutual exclusion and associated algorithms - a comparative performance analysis.

UNIT - II:

Distributed Deadlock Detection -Introduction - deadlock handling strategies in distributed systems - issues in deadlock detection and resolution - control organizations for distributed deadlock detection - centralized and distributed deadlock detection algorithms -hierarchical deadlock detection algorithms. Agreement protocols - introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, applications of agreement algorithms. Distributed resource management: introduction-architecture - mechanism for building distributed file systems - design issues - log structured file systems.

UNIT - III:

Distributed shared memory-Architecture- algorithms for implementing DSM - memory coherence and protocols - design issues. Distributed Scheduling - introduction - issues in load distributing - components of a load distributing algorithm - stability - load distributing algorithm - performance comparison - selecting a suitable load sharing algorithm - requirements for load distributing -task migration and associated issues. Failure Recovery and Fault tolerance: introduction- basic concepts - classification of failures - backward and forward error recovery, backward error recovery- recovery in concurrent systems - consistent set of check points - synchronous and asynchronous check pointing and recovery - check pointing for distributed database systems- recovery in replicated distributed databases.

UNIT - IV:

Protection and security -preliminaries, the access matrix model and its implementations. -safety in matrix model- advanced models of protection. Data security - cryptography: Model of cryptography, conventional cryptography- modern cryptography, private key cryptography, data encryption standard- public key cryptography - multiple encryption - authentication in distributed systems.

UNIT - V:

Multiprocessor operating systems - basic multiprocessor system architectures - inter connection networks for multiprocessor systems - caching - hypercube architecture. Multiprocessor Operating System - structures of multiprocessor operating system, operating system design issues- threads- process synchronization and scheduling. Database Operating systems :Introduction- requirements of a database operating system Concurrency control : theoretical aspects - introduction, database systems - a concurrency control model of database systems- the problem of concurrency control - serializability theory- distributed database systems, concurrency control algorithms - introduction, basic synchronization primitives, lock based algorithms-timestamp based algorithms, optimistic algorithms - concurrency control algorithms, data replication.

TEXT BOOKS:

1. MukeshSinghal, Niranjan G.Shivaratri, "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", TMH, 2001

REFERENCE BOOKS:

1. Andrew S.Tanenbaum, "Modern operating system", PHI,2003
2. Pradeep K.Sinha, "Distributed operating system-Concepts and design", PHI,2003.
3. Andrew S.Tanenbaum, "Distributed operating system", Pearson education,2003

Code: M17 CST 1106

DATA WAREHOUSING AND DATA MINING

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To differentiate Online Transaction Processing and Online Analytical processing
2. Learn Multidimensional schemas suitable for data warehousing
3. Understand various data mining functionalities
4. To inculcate knowledge on data mining query languages.
5. To know in detail about data mining algorithms
6. The objective of this course is to study various techniques involved in data mining, data warehousing.

COURSE OUTCOMES:

1. Extract knowledge using data mining techniques
2. At the closing stage of the course, students will be able to analyse different operations and techniques involved in data mining.
3. Evaluate Classification algorithms.
4. Evaluate Clustering algorithms.
5. Describe Multidimensional data model and data mining primitive.

SYLLABUS

UNIT I: DATA WAREHOUSING:

Data warehousing components –Building a Data warehouse –- Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools–Metadata.

UNIT II: BUSINESS ANALYSIS:

Reporting and Query tools and Applications – Tool Categories – The Need for Applications – Cognos Impromptu – Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools and the Internet.

UNIT III: DATA MINING:

Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives –Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing.

UNIT IV: ASSOCIATION RULE MINING AND CLASSIFICATION:

Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction – Basic Concepts – Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines –Associative Classification – Lazy Learners – Other Classification Methods – Prediction.

UNIT V : CLUSTERING AND TRENDS IN DATA MINING:

Cluster Analysis – Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods – Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data – Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.

TEXT BOOKS:

1. Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining and OLAP",Tata McGraw – Hill Edition, Thirteenth Reprint2008.
2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques",Third Edition, Elsevier,2012.

REFERENCE BOOKS:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining",Person Education,2007
2. K.P. Soman, Shyam Diwakar and V. Aja, "Insight into Data Mining Theory andPractice", Eastern Economy Edition, Prentice Hall of India,2006
3. G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern EconomyEdition, Prentice Hall of India,2006
4. Daniel T. Larose, "Data Mining Methods and Models", Wiley-Interscience,2006.

Code: M17 CST 1107

CST LAB-1

Lab	**: 3 Periods**	**Int.Marks**	**: 50**
Exam	**: 3 Hrs**	**Ext. Marks**	**: 50**
		Credits	**: 2**

COURSE OBJECTIVES:

1. To introduce the graduate, simple linear & non-linear data structures.
2. To make the student write ADTs, for all data structures
3. To make the student learn different algorithm design techniques.
4. To understand the design aspects of operating system.
5. To study the process management concepts & Techniques.
6. To study the storage management concepts.

COURSE OUTCOMES: At the end of this course student able to

1. Implement Linear data structures
2. Non-linear data structures
3. Sorting techniques Design of various projections
4. Use of an operating system to develop software
5. Write software systems based on multiple cooperating processes or threads
6. Implement file organization techniques
7. Implement file allocation strategies
8. Implement process scheduling & synchronization algorithms
9. Implement memory management scheme like best fit, worse fit etc.

SYLLABUS

Data Structures Programs:

1. To implement Stacks& Queues using Arrays & Linked Lists
2. To implement Stack ADT, Queue ADT using arrays & Linked Lists
3. To implement Dequeue using Double Linked List &Arrays
4. To perform various Recursive & Non-recursive operations on Binary Search Tree
5. To implement BFS & DFS for a graph
6. To implement Merge & Heap sort of given elements
7. To perform various operations on AVL trees
8. To implement Krushkal's algorithm to generate a min-cost spanning tree
9. To implement Prim's algorithm to generate min-cost spanning tree.
10. To implement functions of Dictionary using Hashing

Operating system programs:

1. Program to implement FCFS(First Come First Serve)scheduling Algorithms
2. Program to implement SJF(Shortest Job First)Scheduling Algorithm
3. Program to implement Priority Scheduling algorithm
4. Program to implement Round Robin Scheduling algorithm
5. Program to implement FIFO(First In First Out) Page Replacement Algorithm
6. Program to implement LRU(least Recently used)Page Replacement Algorithm
7. Program to implement LFU(Least Frequently used)Page Replacement Algorithm
8. Write a program to implement how Disk Scheduling is done in operating system
9. Draw the appropriate C.P.U performance graphs for SJF Scheduling Algorithm

REFERENCE BOOKS:

1. "Data structures using c and c++" by Y. Langsam , M. J. Augenstein, A.M. Tanenbaum, PHI
2. "Data structures and algorithmanalysis in c++" by M. A. Weiss, Pearson Education India,3rd edition (2007)
3. "Advanced UNIX Programming" by Marc J.Rochkind , Addison-Wesley Professional, 2nd edition (May 9, 2004)
4. "UNIX Systems programming" by Kay A Robbins and Steven Robbins, Prentice Hall

Code: M17 CST 1108

CST LAB-2

Lab	**: 3 Periods**	**Int.Marks**	**: --**
Exam	**: --**	**Ext. Marks**	**: --**
		Credits	**: --**

COURSE OBJECTIVES:

1. To practice data definition, data manipulation and data control commands of SQL
2. To create procedures, functions using PL/SQL
3. Study features of two commercial DBMS
4. Create forms and reports
5. To design a mini-project
6. To implement a mini-project covering all the commands learnt

COURSE OUTCOMES:

At the end of this course student will be able to

1. To create tables and views.
2. To execute SQL queries.
3. To modify the data and structure of tables and views.
4. To apply triggers for data modification events
5. To create procedures and functions using PL/SQL.
6. To design a database mini-project.
7. To implement a min-project

SYLLABUS

List of Experiments:

1. SQL commands (DDL,DML and DCL)
2. Functions and Procedures
3. Triggers, views and sequences
4. Practiceto create Forms
5. Practice to create Reports
6. Implement a Mini Project
    A. Write problem statement
    B. Draw ER diagrams
    C. Convert to Tables
    D. Normalization
    E. Insert appropriate data
    F. Security design
    G. Forms
    H. Reports

REFERENCE BOOKS:

1. Oracle Database 11g The Complete Reference, McGraw Hill Professional, 2008.
2. Nilesh Shah, Database Systems Using Oracle, Pearson Education India, 2016.
3. Rick F Vander Lans, Introduction to SQL, Fourth Edition, Pearson Education, 2007

SCHEME OF INSTRUCTION & EXAMINATION
(Regulation R17)

M.TECH. (COMPUTER SCIENCE & TECHNOLOGY)
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
(With effect from **2017-2018**Admitted Batch onwards**)**
Under Choice Based Credit System

II-SEMESTER

Code No.	Name of the Subject	Credits	Lec-ture Hrs	Tutorial Hrs	Lab Hrs	Contact Hrs/ Week	Internal Marks	External Marks	Total Marks
M17CST 1201	Cyber Security	3	3	1	--	4	30	70	100
M17CST 1202	Computer Networks	3	3	1	--	4	30	70	100
M17CST 1203	Big Data Analytics	3	3	1	--	4	30	70	100
M17CST 1204	Machine Learning	3	3	1	--	4	30	70	100
#ELE-1	Elective-I	3	3	1	--	4	30	70	100
#ELE-2	Elective-II	3	3	1	--	4	30	70	100
M17CST 1213	CST LAB 3	2	--	--	3	3	50	50	100
*M17CST 1214	CST LAB 4	--	--	--	3	3	--	--	--
Total		**20**	**18**	**6**	**6**	**30**	**230**	**470**	**700**

	Course Code	Course
# ELE-1	M17CST 1205	Software Engineering
	M17CST 1206	Artificial Intelligence
	M17CST 1207	Compiler Design
	M17CST 1208	Embedded Systems
# ELE-2	M17CST 1209	Image Processing
	M17CST 1210	Parallel Algorithms
	M17CST 1211	Cloud Computing
	M17CST 1212	Mobile Computing

***Audit Course**

Code: M17 CST 1201

CYBER SECURITY

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. Comprehend the history of computer security and how it evolved into information security.
2. Understand the threats posed to information security and the more common attacks associated with those threats.
3. Understand the concept of developing encryption and decryption algorithms
4. Understand the various techniques of encryption, key management in security and its importance.
5. Understand the threats present in computer networks and counter measures for the same.
6. Understand the Need of Web security and Intrusion Detection Systems.

COURSE OUTCOMES:

1. Able to understand the basic concepts and goals of Information security.
2. Able to examine different classical cryptosystems.
3. Able to understand the ideas of public key cryptosystems and digital signature schemes.
4. Able to examine different network security protocols.
5. Able to understand access control and authentication mechanisms.
6. Able to understand appropriate procedures required to secure networks.

SYLLABUS

UNIT I:

Introduction:

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

UNIT II:

Conventional Encryption:

Conventional Encryption Principles, Conventional encryption algorithms, cipher block modes of operation, location of encryption devices, key distribution Approaches of Message Authentication, Secure Hash Functions and HMAC

UNIT III:

Number Theory: Prime and Relatively Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese Remainder theorem, Discrete logarithms

Public key: Public key cryptography principles, public key cryptography algorithms, digital signatures, digital Certificates, Certificate Authority and key management Kerberos, X.509 Directory Authentication Service

UNIT IV:

IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management

Transport Level Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction(SET)

Email Privacy: Pretty Good Privacy (PGP) and S/MIME.

UNIT V:

Intrusion Detection: Intruders, Intrusion Detection systems, Password Management.

Malicious Software: Viruses and related threats & Countermeasures.

Fire walls: Firewall Design principles, Trusted Systems.

TEXT BOOKS:

1. Network Security & Cryptography: Principles and Practices, William Stallings, PEA, Sixth edition.
2. Hack Proofing your Network, Russell, Kaminsky, Forest Puppy, WileyDreamtech.

REFERENCE BOOKS:

1. Network Security & Cryptography, Bernard Menezes, Cengage, 2010.

Code: M17 CST 1202

COMPUTER NETWORKS

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. Build an understanding of the fundamental concepts of computer networks.
2. Familiarize the student with various Computer Network protocols.
3. To make the student to implement various Network Layers.
4. Allow the student to gain expertise in some specific areas of networks such as the design and maintenance of individual Computer Networks.

COURSE OUTCOMES:

After completing this course the student able to demonstrate the knowledge and ability to:
1. Independently understand basic computer network technology.
2. Identify the different types of network topologies and protocols.
3. Explain various transmission media and implement various multiplexing techniques.
4. Implement various Link layer protocols like flow control and error control.
5. Implement various medium access control mechanisms and protocols.
6. Understand Wireless LAN protocols and architectures.
7. Implement Network layer design issues like switching mechanisms, routing and traffic management.

SYLLABUS

UNIT – I

Introduction: Network Topologies WAN, LAN, MAN. Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models

UNIT – II

Physical Layer – Fourier Analysis – Bandwidth Limited Signals – The Maximum Data Rate of a Channel - Guided Transmission Media, Digital Modulation and Multiplexing: Frequency Division Multiplexing, Time Division Multiplexing, Code Division Multiplexing, Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols

UNIT – III

The Data Link Layer - Services Provided to the Network Layer – Framing – Error Control – Flow Control, Error Detection and Correction – Error-Correcting Codes – Error Detecting Codes, Elementary Data Link Protocols- A Utopian Simplex Protocol-A Simplex Stop and Wait Protocol for an Error free channel-A Simplex Stop and Wait Protocol for a Noisy Channel, Sliding Window Protocols-A One Bit Sliding Window Protocol-A Protocol Using Go-Back-N- A Protocol Using Selective Repeat

UNIT – IV

The Medium Access Control Sub layer-The Channel Allocation Problem-Static Channel Allocation-Assumptions for Dynamic Channel Allocation, Multiple Access Protocols-Aloha-Carrier Sense Multiple Access Protocols-Collision-Free Protocols-Limited Contention Protocols-Wireless LAN Protocols, Ethernet-Classic Ethernet Physical Layer-Classic Ethernet MAC Sub layer Protocol-Ethernet Performance-Fast Ethernet Gigabit Ethernet-10-Gigabit Ethernet-Retrospective on Ethernet, Wireless LANs-The 802.11 Architecture and Protocol Stack-The 802.11 Physical Layer-The802.11 MAC Sub layer Protocol-The 805.11 Frame Structure-Services

UNIT – V

Design Issues-The Network Layer Design Issues – Store and Forward Packet Switching-Services Provided to the Transport layer- Implementation of Connectionless Service-Implementation of Connection Oriented Service-Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms-The Optimality Principle-Shortest Path Algorithm, Congestion Control Algorithms-Approaches to Congestion Control-Traffic Aware Routing-Admission Control-Traffic Throttling-Load Shedding.

TEXT BOOKS:

1. Computer Networks, Tanenbaum and David J Wetherall, 5th Edition, Pearson Edu,2013.
2. Computer Networks: A Top Down Approach, Behrouz A. Forouzan, Firouz Mosharraf, McGraw Hill Education

REFERENCE BOOKS:

1. Larry L. Peterson and Bruce S. Davie, Computer Networks - A Systems Approach (5th ed), Morgan Kaufmann/ Elsevier, 2011

Code: M17 CST 1203

BIGDATA ANALYTICS

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To provide advanced knowledge and skills in the fields of Computer science and engineering.
2. To introduce java concepts related to data structures and map reduce programs
3. To impart the architectural concepts and configuration of Hadoop
4. Introducing map reduce paradigm
5. To introduce programming platforms like PIG and HIVE in Hadoop echo system.

COURSE OUTCOMES:

At the end of the course the student will be able to
1. Implement data structures and map reduce paradigm using java
2. Configure Hadoop distributed file system
3. Understand Hadoop I/O
4. Write scripts using PIG and run them in local and distributed modes
5. Apply structure to Hadoop data with HIVE

SYLLABUS

UNIT-I
Data structures in Java: Linked List, Stacks, Queues, Sets, Maps; Generics: Generic classes and Type parameters, Implementing Generic Types, Generic Methods, Wrapper Classes, Concept of Serialization

UNIT-II
Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) – Building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, Job Tracker, Task Tracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XMLfiles.

UNIT-III
Writing MapReduce Programs: A Weather Dataset, Understanding Hadoop API for MapReduce Framework (Old and New), Basic programs of Hadoop MapReduce: Driver code, Mapper code, Reducer code, Record Reader, Combiner, Partitioner

UNIT-IV
Hadoop I/O: The Writable Interface, Writable Comparable and comparators, Writable Classes: Writable wrappers for Java primitives, Text, Bytes Writable, Null Writable, Object Writable and Generic Writable, Writable collections, implementing a Custom Writable: Implementing a Raw Comparator for speed, Custom comparators

UNIT-V

Pig: Hadoop Programming Made Easier:

Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin

Applying Structure to Hadoop Data with Hive:

Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data

TEXT BOOKS:

1. Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons,INC
2. Hadoop: The Definitive Guide by Tom White, 3rd Edition,O'reilly
3. Hadoop in Action by Chuck Lam, MANNINGPubl.
4. Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce BrownRafaelCoss

REFERENCE BOOKS:

1. Hadoop in Practice by Alex Holmes, MANNING Publications.
2. Hadoop MapReduce Cookbook, SrinathPerera, Thilina Gunarathne

SOFTWARE LINKS:

1. Hadoop: http://hadoop.apache.org/
2. Hive:https://cwiki.apache.org/confluence/display/Hive/Home

Code: M17 CST 1204

MACHINE LEARNING

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

The main objective of this course is for the students

1. To achieve basic knowledge of artificial intelligence
2. A deepened technical understanding of machine learning research and theories
3. To give experience of the use and design of machine learning and data mining algorithms for applications
4. To critically review and compare different algorithms and methods.
5. To plan, design, and implement learning components and applications.

COURSE OUTCOMES:

1. The student will be able understand the two main areas of Machine Learning i.e. Supervised and unsupervised learning.
2. To understand main models and algorithms for Regression, Classification particularly beyond binary classification.
3. To understand variety of learning algorithms.
4. To evaluate and compare the performance of learning algorithms.
5. To understand support vector machine.

SYLLABUS

UNIT -I: The ingredients of machine learning, Tasks: the problems that can be solved with machine learning, Models: the output of machine learning, Features, the workhorses of machine learning. **Binary classification and related tasks:** Classification, Scoring and ranking, Class probability estimation

UNIT- II: Beyond binary classification: Handling more than two classes, Regression, Unsupervised and descriptive learning. **Concept learning**: The hypothesis space, Paths through the hypothesis space, Beyond conjunctive concepts

UNIT- III: Tree models: Decision trees, Ranking and probability estimation trees, Tree learning as variance reduction. **Rule models:** Learning ordered rule lists, Learning unordered rule sets, Descriptive rule learning, First-order rule learning

UNIT -IV: Linear models: The least-squares method, The perceptron: a heuristic learning algorithm for linear classifiers, Support vector machines, obtaining probabilities from linear classifiers, Going beyond linearity with kernel methods. **Distance Based Models:** Introduction, Neighbors and exemplars, Nearest Neighbors classification, Distance Based Clustering, Hierarchical Clustering.

UNIT- V: Probabilistic models: The normal distribution and its geometric interpretations, Probabilistic models for categorical data, Discriminative learning by optimizing conditional likelihood Probabilistic models with hidden variables. **Features:** Kinds of feature, Feature transformations, Feature construction and selection. Model ensembles: Bagging and random forests, Boosting

TEXT BOOKS:

1. Machine Learning: The art and science of algorithms that make sense of data, PeterFlach, Cambridge.
2. Machine Learning, Tom M. Mitchell,MGH.

REFERENCE BOOKS:

1. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben- David,Cambridge.
2. Machine Learning in Action, Peter Harington, 2012,Cengage.

Code: M17 CST 1205

SOFTWARE ENGINEERING
(ELECTIVE-I)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. The students had strong knowledge in Software Systems and about various process models.
2. The students can able to build systems by following well defined Software Engineering Principles.
3. The students can able to distinguish between Structured Design approach and Object Oriented design approach.
4. The students can build quality software systems by implementing effective Testing phase.
5. To utilise various Computer Aided Software Engineering Tools.

COURSE OUTCOMES:

At the end of the course the student could able to

1. Understand the nature of software and various software process models.
2. Gather, analyse and Specify Software Requirements for any system.
3. Design various aspects of the system like System design, Database design, User Interface design etc., by following Structural Design of Object Oriented Design
4. Apply various Software testing techniques to increase the reliability of the system
5. Understand various Software Quality Management Techniques
6. Use various Computer Aided Software Engineering (CASE) Tools.

SYLLABUS

UNIT-I:

Software and Software Engineering: The Nature of Software, The Unique Nature of Web Apps, Software Engineering, Software Process, Software Engineering Practice, Software Myths.

Process Models: A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Terminology, Product and Process.

UNIT-II:

Requirements Analysis and Specification: Requirements Gathering and Analysis, Software Requirement Specification (SRS), Formal System Specification.

Software Design: Overview of the Design Process, How to Characterize of a Design? Cohesion and Coupling, Layered Arrangement of Modules, Approaches to Software Design

UNIT – III:

Function-Oriented Software Design: Overview of SA/SD Methodology, Structured Analysis, Developing the DFD Model of a System, Structured Design, Detailed Design, Design Review, over view of Object Oriented design.

User Interface Design: Characteristics of Good User Interface, Basic Concepts, Types of User Interfaces, Fundamentals of Component-based GUI Development, A User Interface Design Methodology.

UNIT – IV:

Coding And Testing: Coding, Code Review, Software Documentation, Testing, Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Program Analysis Tool, Integration Testing, Testing Object-Oriented Programs, System Testing, Some General Issues Associated with Testing

UNIT – V:

Software Reliability And Quality Management: Software Reliability, Statistical Testing, Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity Model.

Computer Aided Software Engineering: Case and its Scope, Case Environment, Case Support in Software Life Cycle, Other Characteristics of Case Tools, Towards Second Generation CASE Tool, Architecture of a Case Environment

TEXT BOOKS:

1. Software Engineering A Practitioner's Approach, Roger S. Pressman, Seventh Edition McGraw Hill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, Third Edition,PHI.
3. Software Engineering, Ian Sommerville, Ninth edition, Pearson education

REFERENCE BOOKS:

1. Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill,2008
2. Software Engineering, A Precise Approach, Pankaj Jalote, WileyIndia,2010.
3. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
4. Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition, 2006.

Code: M17 CST 1206

ARTIFICIAL INTELLIGENCE
(ELECTIVE-I)

Lecture	**: 3 Periods**	**Int.Marks**	**:30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To introduce different artificial intelligence techniques
2. To learn characteristics of AI problems
3. Learn recent algorithms in artificial intelligence
4. To introduce expert systems in AI
5. To describe advanced knowledge representation in AI

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COURSE OUTCOMES:

1. Able to learn artificial intelligence techniques
2. Understand the concept of knowledge representation
3. Able to apply logic concepts to ascertain facts
4. Able to apply heuristic search methods in reaching the goal
5. Able to solve problems using advanced knowledge representation methods.
6. Able to understand expert systems

SYLLABUS

UNIT-I:

Introduction to artificial intelligence: Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of ai languages, current trends in AI

UNIT-II:

Problem solving: state-space search and control strategies : Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative-deepening a*, constraint satisfaction

Problem reduction and game playing: Introduction, problem reduction, game playing, alpha-beta pruning, two-player perfect information games

UNIT-III:

Logic concepts: Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic

UNIT-IV:

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames **advanced knowledge representation techniques:** Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web.

UNIT-V:

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools

TEXT BOOKS:

1. Artificial Intelligence- Saroj Kaushik, CENGAGELearning,
2. Artificial intelligence, A modern Approach, 2nd ed, Stuart Russel, Peter Norvig,PEA
3. Artificial Intelligence- Rich, Kevin Knight, Shiv Shankar B Nair, 3rd ed,TMH
4. Introduction to Artificial Intelligence, Patterson,PHI

REFERNCE BOOKS:

1. Atificial intelligence, structures and Strategies for Complex problem solving, -George F Lugar, 5th ed,PEA
2. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
3. Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier

Code: M17 CST 1207

COMPILER DESIGN
(ELECTIVE-I)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To learn the various system software like assemblers, loaders, linkers and macro.
2. To study the features of design phases and parsing techniques of a Compiler.
3. To learn the various techniques of syntax directed translation & code optimization.
4. To introduce the major concept areas of language translation and compiler design.
5. To enrich the knowledge in various phases of compiler ant its use, code optimization techniques, machine code generation, and use of symbol table.
6. To extend the knowledge of parser by parsing LL parser and LR parser.

COURSE OUTCOMES:

1. To acquire the knowledge of modern compiler & its features
2. To use the knowledge of patterns, tokens & regular expressions
3. To learn the new code optimization techniques to improve the performance of a program in terms of speed & space
4. Able to design and implement parsers
5. Able to compile simple C programs using their own designed compiler

SYLLABUS

UNIT – I

Introduction Language Processing, Structure of a compiler the evaluation of Programming language, The Science of building a Compiler application of Compiler Technology Programming Language Basics.
Lexical Analysis-: The role of lexical analysis buffing, specification of tokens. Recognitions of tokens the lexical analyzer generator lexical

UNIT –II

Syntax Analysis: The Role of a parser, Context free Grammars Writing A grammar, top down parsing bottom up parsing, ,Shift Reduce parser, Operator Precedence Parser, Predictive Parser, Introduction to LR Parser.

UNIT –III

More Powerful LR parser (SLR, CLR, LALR), Using Armigers Grammars Equal Recovery in Lr parser, Syntax Directed Transactions Definition, Evolution order of SDTS Application of SDTS. Syntax Directed Translation Schemes.

UNIT – IV

Intermediated Code: Generation Variants of Syntax trees 3 Address code Quadruples, Triples and Indirect Triples, Types and Deceleration, Translation of Expressions, Type Checking, code optimization, The principle sources of optimization, Loop Optimization, DAG, Global data flow analysis.

UNIT – V

Code Generation: A simple code generator, Register allocation and assignment, Code generation from DAG, Peep hole optimization, Symbol table, Activation Record, Runtime Environments, Stack allocation of space, access to Non Local date on the stack Heap Management code generation.

TEXT BOOKS:

1. Compilers, Principles Techniques and Tools. Alfred V Aho, Monical S. Lam, Ravi SethiJefferyD. Ullman,2nd edition, pearson,2007
2. Compiler Design K.Muneeswaran,OXFORD
3. Principles of compiler design, 2nd edition, Nandhini Prasad,Elsevier.

REFERENCE BOOKS:

1. Compiler Construction, Principles and Practice, Kenneth C Louden, CENGAGE
2. Implementations of Compiler, A New approach to Compilers including the algebraic methods,Yunlinsu, SPRINGER

Code: M17 CST 1208

EMBEDDED SYSTEMS
(ELECTIVE-I)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To provide in-depth knowledge about Embedded Processor, its hardware and software.
2. To explain the programming concepts, Embedded programming in C & Assembly language.
3. To explain various architectures of Embedded Systems.
4. To explain Real Time Operating Systems.
5. To explain about Inter task communication.
6. To explain about Embedded software development tools.

COURSE OUTCOMES:

On successful completion of the course a student will able

1. To describe the differences between general computing system and Embedded System.
2. To recognize the classification of Embedded System.
3. To understand various architectures of Embedded System.
4. To design Real Time Embedded System using the concepts of RTOS.
5. To load embedded software on Host machine.
6. To test Host machine.

SYLLABUS

UNIT I:

Examples of Embedded Systems – Typical Hardware – Memory – Microprocessors – Busses – Direct Memory Access – Introduction to 8051 Microcontroller – Architecture-Instruction set – Programming-Microprocessor Architecture – Interrupt Basics – The Shared-Data problem – Interrupt Latency.

UNIT II:

Round–Robin Architecture - Round–Robin with Interrupts Architecture - Function-Queue- Scheduling Architecture – Real-Time Operating Systems Architecture – Selection of Architecture.

UNIT III:

Tasks and Task States – Tasks and Data – Semaphores and Shared Data – Semaphore Problems – Semaphore variants, Message Queues – Mailboxes – Pipes – Timer Functions – Events – Memory Management – Interrupt Routines in RTOS Environment.

UNIT IV:

RTOS design – Principles – Encapsulation Semaphores and Queues – Hard Real-Time Scheduling Considerations – Saving Memory Space – Saving Power.

UNIT V:

Host and Target Machines – Linker/Locator for Embedded Software- Getting Embedded Software into the Target System, Testing on your Host Machine – Instruction Set Simulators – Laboratory Tools used for Debugging.

TEXT BOOKS:

1. David A. Simon, An Embedded Software Primer, Pearson Education, Inc., 1999
2. Sriram V Iyer and Pankaj Gupta, Embedded Real Time Systems programming, TMH, 2004

REFERENCE BOOKS:

1. Frank Vahid/ Tony Givargis, Embedded Systems Design – A Unified Hardware/Software Introduction, John Wiley & Sons, 2006
2. Raj Kamal, Embedded Systems, Architecture, Programming and Design, Tata McGraw-Hill Education, 2011

Code: M17 CST 1209

IMAGE PROCESSING
(ELECTIVE-II)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. Overview of digital image processing field
2. Understand the fundamental digital image processing algorithms and implementation
3. Gain experience in applying image processing algorithms to real problems.
4. Cover the basic theory and algorithms that are widely used in digital image processing.
5. Expose students to current technologies and issues that are specific to image processing systems

COURSE OUTCOMES:

1. Demonstrated understanding of the basic concepts of two-dimensional signal acquisition, sampling, and quantization.
2. Demonstrated understanding of spatial filtering techniques, including linear and nonlinear methods.
3. Demonstrated understanding of 2D Fourier transform concepts, including the 2D DFT and FFT
4. Uses of Fourier transform in frequency domain filtering.
5. Demonstrated understanding of the fundamental image enhancement algorithms such as histogram modification, contrast manipulation, and edge detection.

SYLLABUS

UNIT I:

Introduction: Digital Image representation, fundamentals steps in Digital Image Processing, Applications of Computer graphics and Image Processing, Fundamentals on Pixel concepts,

UNIT II:

Transformations: Translations, Scaling, rotation, reflection and shear transformations, Homogeneous coordinates, **Composite Transformations**- Reflection about an arbitrary line; Windowing and clipping, viewing transformations, Cohen- Sutherland clipping algorithm

UNIT III:

Digital Image Properties: Metric and topological properties of Digital Images, Histogram, entropy, Visual Perception, Image Quality, Color perceived by humans, Color Spaces, Palette Images, color Constancy

Color Images: Pixel brightness transformations, Local Preprocessing, image smoothing, Edge detectors, Robert Operators, Laplace, Prewitt, Sobel, Fri-chen, Canny Edge detection

UNIT IV:

Mathematical Morphology: Basic Mathematical Concepts, Binary dilation and Erosion, Opening and closing, Gray Scale dilation and erosion, Skeleton, Thinning, Thickening Ultimate erosion, Geodesic transformations, Morphology and reconstruction, Morphological Segmentation

UNIT V:

SEGMENTATION: Threshold detection methods, Optimal Thresholding, Edge based Segmentation-Edge image thresholding, Edge relaxation, Border tracing, Hough Transforms, Region based segmentation: Region Merging Region Splitting, Splitting and Merging, Watershed Segmentation.

Image Data Compression: Image data Properties, Discrete Image Transformations in data compression, Discrete Cosine and Wavelet Transforms, Types of DWT and merits; Predicative Compression methods, Hierarchical and Progressive Compression methods, Comparison of Compression methods, JPEG-MPEG Image Compression methods.

TEXT BOOKS:

1. Computer Graphics C Version, Donald Hearn, M Paulli Baker , Pearson (Unit I and UnitII)
2. Image Processing, Analysis and Machine Vision, Millan Sonka, VaclovHalvoc, Roger Boyle, Cengage Learning, 3ed, (Unit III, Unit IV, Unit V and UnitVI)
3. Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods. Pearson Prentice hall.

REFERENCE BOOKS:

1. Computer & Machine Vision, Theory , Algorithms , Practicles, E R Davies, Elsevier,4ed
2. Digital Image Processing with MATLAB and LABVIEW, Vipul Singh, Elsevier

Code: M17 CST 1210

PARALLEL ALGORITHMS
(ELECTIVE-II)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To understand the scope, design and model of parallelism.
2. Know the parallel computing architecture.
3. Know the Characteristics, model and design of parallel algorithms.
4. Analytical modelling and performance of parallel programs.
5. Solve a complex problem with message passing model and programming with MPI.

COURSE OUTCOMES:

Students who complete this course successfully are expected to

1. Recall fundamental concepts of parallelism
2. Design and analyze the parallel algorithms for real world problems
3. Implement parallel algorithms on available parallel computer systems.
4. Ability to analyse parallel algorithms for sorting and searching on different parallel architectures.
5. Try to utilize Multicore Architectures.

SYLLABUS

UNIT I: Introduction:

Computational demand in various application areas, advent of parallel processing, terminology-pipelining, Data parallelism and control parallelism-Amdahl's law.

UNIT II: Scheduling:

Organizational features of Processor Arrays, Multi processors and multi-computers. Mapping and scheduling aspects of algorithms. Mapping into meshes and hyper cubes-Load balancing-List scheduling algorithm Coffman-graham scheduling algorithm for parallel processors.

UNIT III: Algorithms:

Elementary Parallel algorithms on SIMD and MIMD machines, Analysis of these algorithms. Matrix Multiplication algorithms on SIMD and MIMD models. Fast Fourier Transform algorithms. Implementation on Hyper cube architectures. Solving linear system of equations, parallelizingaspects of sequential methods back substitution and Tri diagonal.

UNIT IV: Sorting:

Parallel sortingmethods, Odd-even transposition Sorting on processor arrays, Bitonic, merge on shuffle-exchange network,2D-Mesh processor and Hypercube Processor network. Parallel Quicksort on Multi processors. Hyper Quicksort on hypercube multi computers. Parallel search operations. Ellis algorithm and Manber and Ladner's Algorithms for dictionary operations.

UNIT V: Searching

Parallel algorithms for Graph searching, All Pairs shortest paths and minimum cost spanning tree. Parallelization aspects of combinatorial search algorithms with Focus on Branch and Bound Methods and Alpha-beta Search methods.

TEXT BOOKS:

1. Parallel computing theory and practice, Michel J. Quinn
2. Programming Parallel Algorithms, Guy E. Blelloch, Communications of theACM

REFERENCE BOOKS:

1. Parallel Computing: Architectures, Algorithms and Applications,C. Bischof, C. Bischof, M. Bucker, P. Gibbon, G. Joubert, T. Lippert,IOS Press,2008
2. Introduction to Parallel Processing Algorithms and Architectures,Behrooz Parhami, Kluwer Publications,2002
3. Introduction to Parallel Algorithms, Joseph JaJa, Pearson,1992

Code: M17 CST 1211

CLOUD COMPUTING
(ELECTIVE-II)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To impart fundamental concepts of cloud computing.
2. To differentiate Parallel and distributed computing.
3. To impart knowledge in design of cloud computing.
4. To impart knowledge in applications of cloud computing.
5. To impart knowledge in different aspects of security in cloud computing.

COURSE OUTCOMES:

1. Understanding the protocols and mechanisms that support cloud computing
2. Understanding the hardware necessary for cloud computing
3. Understanding Cloud Resource Virtualization
4. Understanding Cloud Resource Management and Scheduling
5. Understand cloud security
6. Develop a novel cloud application

SYLLABUS

UNIT I:

Introduction: Network centric computing, Network centric content, peer-to –peer systems, cloud computing delivery models and services, Ethical issues, Vulnerabilities, Major challenges for cloud computing

Parallel and Distributed Systems: introduction, architecture, distributed systems, communication protocols, logical clocks, message delivery rules, concurrency, model concurrency with Petri Nets.

UNIT II:

Cloud Infrastructure: At Amazon, The Google Perspective, Microsoft Windows Azure, Open Source Software Platforms, Cloud storage diversity, Inter cloud, energy use and ecological impact, responsibility sharing, user experience, Software licensing.

Cloud Computing : Applications and Paradigms: Challenges for cloud, existing cloud applications and new opportunities, architectural styles, workflows, The Zookeeper, The Map Reduce Program model, HPC on cloud, biological research

UNIT III:

Cloud Resource virtualization: Virtualization, layering and virtualization, virtual machine monitors, virtual machines, virtualization- full and para, performance and security isolation, hardware support for virtualization, Case Study: Xen, vBlades

Cloud Resource Management and Scheduling: Policies and Mechanisms, Applications of control theory to task scheduling, Stability of a two-level resource allocation architecture, feed back control based on dynamic thresholds, coordination, resource bundling, scheduling algorithms, fair queuing, start time fair queuing, cloud scheduling subject to deadlines, Scheduling Map Reduce applications, Resource management and dynamic application scaling

UNIT IV:

Storage Systems: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system., Apache Hadoop, Big Table, Megastore (text book 1), Amazon Simple Storage Service(S3) (Text book 2)

Cloud Security: Cloud security risks, security – atop concern for cloud users, privacy and privacy impact assessment, trust, OS security, Virtual machine security, Security risks

UNIT V:

Cloud Application Development: Amazon Web Services : EC2 – instances, connecting clients, security rules, launching, usage of S3 in Java, Installing Simple Notification Service on Ubuntu 10.04, Installing Hadoop on Eclipse, Cloud based simulation of a Distributed trust algorithm, Cloud service for adaptive data streaming (Text Book1)

Google: Google App Engine, Google Web Toolkit (Text Book 2)

Micro Soft: Azure Services Platform, Windows live, Exchange Online, Share Point Services, Microsoft Dynamics CRM (Text Book 2)

TEXT BOOKS:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, MKElsevier
2. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, RobertElsenpeter, TMH

REFERNCE BOOK:

1. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH

Code: M17 CST 1212

MOBILE COMPUTING
(ELECTIVE-II)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. Introduction of an advanced element of learning in the field of wireless communication.
2. Introduce the students to the concepts of wireless devices and mobile computing.
3. To introduce wireless communication and networking principles, that support connectivity to cellular networks, wireless internet and sensor devices.
4. To introduce various platforms for mobile computing.

COURSE OUTCOMES:

1. A working understanding of the characteristics and limitations of mobile hardware devices including their user-interface modalities
2. The ability to develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.
3. A comprehension and appreciation of the design and development of context-aware solutions for mobile devices.
4. A student will be able to understand various protocols for mobile computing
5. A student will be able to understand various platforms for mobile computing
6. A student will be able to understand various routing algorithm.

SYLLABUS

UNIT- I

Introduction: Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices.

GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS.

UNIT –II

(Wireless) Medium Access Control (MAC): Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11)

UNIT –III

Mobile Network Layer: IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP.

UNIT –IV

Mobile Transport Layer: Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks.

Database Issues: Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process &QoS Issues.

UNIT- V

Data Dissemination and Synchronization: Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software, and Protocols.

Mobile Ad hoc Networks (MANETs) : Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc. , Mobile Agents, Service Discovery.

Protocols and Platforms for Mobile Computing: WAP, Bluetooth, XML, J2ME, Java Card, PalmOS, Windows CE, SymbianOS, Linux for Mobile Devices, Android.

TEXT BOOKS:

1. Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition,2009
2. Raj Kamal, "Mobile Computing", Oxford University Press, 2007, ISBN:0195686772

REFERENCE BOOKS:

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing, Technology Applications and Service Creation" Second Edition, Mc GrawHill.
2. UWE Hansmann, LotherMerk, Martin S. Nocklous, Thomas Stober, "Principles of Mobile Computing," Scond Edition,Springer.

Code: M17 CST 1213

CST LAB-3
(OBJECT ORIENTED SOFTWARE ENGINEERING LAB)

Lab	**: 3 Periods**	**Int.Marks**	**: 50**
Exam	**: 3 Hrs**	**Ext. Marks**	**: 50**
		Credits	**: 2**

COURSE OBJECTIVES:

1. To understand the Object-oriented modelling using UML
2. To enable the student to get knowledge in SDLC
3. To give a detailed understanding of processes and techniques for building large object-oriented software systems.
4. To develop skills to evolve object-oriented systems from analysis, to design, to implementation
5. To develop skills to work as a team for developing a software project.
6. Introducing the various design approaches, models and metrics.

COURSE OUTCOMES:

1. To familiarize with modern software engineering methods and tools
2. To design complex software solutions.
3. To implement complex software solutions.
4. To test software.
5. To document software
6. To work as part of a software team
7. To develop significant projects

LIST OF EXPERIMENTS IN OOSE LAB:

The course is realized as a project-like assignment that can, in principle, by a team of three/four students working full time. Typically, the assignments have been completed during the semester. The project deliverables include

1. Documentation including
2. A problem statement
    i. A requirements document
    ii. A Requirements Analysis Document.
3. A System Requirements Specification.
4. A design document
    i. A Software Design Description and a System Design Document.
5. A test specification.
6. Manuals/guides for
    i. Users and associated help frames

ii. Programmers

iii. Administrators (installation instructions)

7. A project plan and schedule setting out milestones, resource usage and estimated costs.
8. A quality plan setting out quality assurance procedures
9. An implementation.

REFERENCE BOOKS:

1. Project-based software engineering: An Object-oriented approach, Evelyn Stiller, CathieLeBlanc, Pearson Education
2. Visual Modelling with Rational Rose 2002 and UML, Terry Quatrini, Pearson Edusction
3. UML2 Toolkit, Hans -Erik Eriksson, Wiley

Code: M17 CST 1214

CST LAB-4

Lab	**: 3 Periods**	**Int.Marks**	**: --**
Exam	**: --**	**Ext. Marks**	**: --**
		Credits	**: --**

COURSE OBJECTIVES:

The objectives of this course are to give students:

1. An applied understanding of the principles of network and computer security.
2. A hands-on experience in attack execution, and the use of tools in such attacks.
3. A hands-on experience in the use of intrusion detection techniques.
4. Data analysis using R
5. Practice data preprocessing using Weka
6. Practiceclassificationusing Weka
7. PracticeClusteringusingWeka

COURSE OUTCOMES:

1. Able to install Virtual Box or any other equivalent software on the host OS.
2. Able to use tool NMAP for information gathering.
3. Conduct-network based attacks on networking infrastructure (Routing, Firewalls) using WIreshark.
4. Conduct attacks on wireless networks.
5. Install and configure intrusion detection systems.
6. Able to use R in various applications
7. Performing data preprocessing using Weka
8. Performing classification using Weka
9. Performing Clustering using Weka

DATA ANALYTICS LAB LIST OF EXPERIMENTS:

1. Introduction to exploratory data analysis using R

   Load the 'iris. CSV' file and display the names and type of each column.

   Find statistics such as min, max, range, mean, median, variance, standard deviation for each column of data.

   Generate histograms and density plots for each sepal length, sepal width, petal length, petalwidth.

   Generate box plots for each of the numerical attributes. Identify the attribute with the highest variance.

2. Study of homogeneous and heterogeneous data structures such as vector, matrix, array, list, data frame in R.

3. Introduction to regression using R

Air Velocity (cm/sec)	20,60,100,140,180,220,260,300,340,380
Evaporation Coefficient(mm2 /sec)	0.18, 0.37, 0.35, 0.78, 0.56, 0.75, 1.18, 1.36, 1.17, 1.65

Use R to perform linear regression on the given the data.
Analyze the significance of residual standard-error value, R-squared value,F-statistic. Find the correlation coefficient for this data and analyze the significance of the correlation value.
Use a Quantile-Quantile plot to determine whether the residuals are normally distributed.
Perform a log transformation on the 'Air Velocity'column, perform linear regression again, and analyze all the relevant values.

4. Introduction to the Weka machine learning toolkit

Create an ARFF (Attribute-Relation File Format) file and read it in WEKA. Explore the purpose of each button under the preprocess panel after loading the ARFF file. Also, try to interpret using a different ARFF file, *weather.arff*, provided with WEKA**.**

5. Performing data preprocessing in Weka – Part1

Study **Unsupervised Attribute Filters** such as **Replace Missing Values** to replace missing values in the given dataset, **Add** to add the new attribute Average, **Discretize** to discretize the attributes into bins. Explore **Normalize** and **Standardize** options on a dataset with numerical attributes.

6. Perform data preprocessing in Weka – Part 2

Study the **Unsupervised Instance Filters such as Remove Range** filter to remove the last two instances, **R**

7. Classification using the Weka toolkit – Part 1

Demonstration of classification process using id3 algorithm on categorical dataset(weather).
Demonstration of classification process using naïve Bayes algorithm on categorical dataset ('vote').
Demonstration of classification process using Random Forest algorithm on datasets containing large number of attributes.

8. Classification using the Weka toolkit – Part 2

Demonstration of classification process using J48 algorithm on mixed type of dataset after discretizing numeric attributes.
Perform cross-validation strategy with various fold levels. Compare the accuracy of the results.

9. Performing clustering in Weka

Apply hierarchical clustering algorithm on numeric dataset and estimate cluster quality. Apply DBSCAN algorithm on numeric dataset and estimate cluster quality. Apply COBWEB clustering algorithm on categorical dataset and estimate cluster quality.

10. Association rule analysis in Weka

Demonstration of Association Rule Mining on supermarket dataset using Apriori Algorithm.
Demonstration of Association Rule Mining on supermarket dataset using FP-Growth Algorithm.

INFORMATION SECURITY LAB LIST OF EXPERIMENTS:

1. Learn to install Virtual Box or any other equivalent software on the host OS.
2. Perform an experiment to grab a banner with telnet and perform the task using Netcat.
3. Perform an experiment for Port Scanning with nmap.
4. Using nmap

   i)Find Open ports on a system.

   ii) Find machines which are active.

   iii) Find the version of remote OS on other systems.

   iv) Find the version of s/w installed on other system using nmap.
5. Perform an experiment on Active and Passive finger printing using XProbe2 and nmap.
6. Perform an experiment to demonstrate how to sniff for router traffic by using the tool wireshark.
7. Perform wireless audit of an access point / router and decrypt WEP and WPA (softwares- nets tumbler or airsniff).
8. Install JCrypttool and demonstrate Asymmetric, Symmetric crypto algorithm, Hash and Digital signatures studied in theory Network Security and Management.
9. Demonstrate Intrusion Detection System (IDS) using tool Snort.

REFERENCE BOOKS:

1. Build Your Own Security Lab: A field guide for network Testing, Michael Gregg, Wiley India edition, ISBN: 9788126516919

SCHEME OF INSTRUCTION & EXAMINATION
(Regulation R17)

M.TECH (COMPUTER SCIENCE & TECHNOLOGY)
DEPARTMENT OF COMPUTER SCIENCE &ENGINEERING
(With effect from **2017-2018**Admitted Batch onwards**)**
Under Choice Based Credit System

III-SEMESTER

Code No	Course Title	Scheme of Examination	C	Int.	Ext.	Total
M17 CST 2101	Comprehensive Viva-Voce	Viva-Voce	2	50	---	50
M17 CST 2102	Seminar-I	Oral Presentation	2	50	---	50
M17 CST 2103	Project Work Part-I	Review	16	50	---	50
		Total	**20**	**150**	**---**	**150**

1. The Viva-Voce for the Comprehensive Viva-Voce and Seminar-I shall be held with the Project Guide, PG coordinator, and Head of the Department. The marks shall be awarded in the ratio of 20, 10 and 20 Marks by the members respectively.
2. Candidates can do their Project Work Part-I&II work within the department or in any industry/research organization for two semesters (i.e. 3rd and 4th semesters). In case of thesis done in an industry/research organization, one advisor (Guide) should be from the department and one advisor (Co-Guide) should be from the industry/research organization.
3. The Project Work Part-I should be submitted at the end of 3rd Semester and it will be evaluated through Review by a committee consisting of Head of the Department, PG coordinator and Project guide. The marks shall be awarded in the ratio of 20, 10 and 20 Marks by the members respectively.

SCHEME OF INSTRUCTION & EXAMINATION
(Regulation R17)

M.TECH (COMPUTER SCIENCE & TECHNOLOGY)
DEPARTMENT OF COMPUTER SCIENCE &ENGINEERING
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IV-SEMESTER

Code No	Course Title	Scheme of Examination	C	Int.	Ext.	Total
M17 CST 2201	Seminar-II	Oral presentation	2	50	-	50
M17 CST 2202	Project Work Part-II	Viva-voce	18	-	100	100
		Total	**20**	**50**	**100**	**150**

1. The viva-voce for Seminar-II shall be held with the Project Guide, PG coordinator, and Head of the Department. The marks shall be awarded in the ratio of 20, 10 and 20 Marks by the members respectively.
2. A publication of a paper on the thesis work in a National/International Journal at the end of 4th semester is mandatory for the submission of thesis work.
3. The Project Work Part-II should be submitted at the end of 4th semester and it will be evaluated through Viva–Voce examination by a committee consisting of External Examiner, Head of the Department, Project guide and PG coordinator. The marks shall be awarded in the ratio of 40, 20, 20 and 20 Marks by the members respectively.