Department of INFORMATION TECHNOLOGY
R.V.R. &J.C. COLLEGE OF ENGINEERING (A) :: GUNTUR – 522019.

PROPOSED SCHEME OF EXAMINATION AND INSTRUCTION FOR M.TECH(CST) w.e.f 2017-18

I/II M.TECH (COMPUTER SCIENCE & TECHNOLOGY) :: FIRST SEMESTER

Sl. No	Code No & Subject	Hours/Week		Credits	Evaluation of Marks			
		Lecture	Practical		Internal	External		Total
						Theory	Practical	
1	CT511 – Advanced Data Structures and Algorithms	4	--	4	40	60	--	100
2	CT512– Database Technologies	4	--	4	40	60	--	100
3	CT513– Advanced Operating Systems	4	--	4	40	60	--	100
4	Elective – I	4	--	4	40	60	--	100
5	Elective – II	4	--	4	40	60	--	100
6	Elective – III	4	--	4	40	60	--	100
7	CT551– Advanced Programming Lab	--	3	2	40	--	60	100
8	CT552– Database Technologies Lab	--	3	2	40	--	60	100
TOTAL		24	6	28	320	360	120	800

I/II M.TECH (COMPUTER SCIENCE & TECHNOLOGY) :: SECOND SEMESTER

Sl. No	Code No & Subject	Hours/Week		Credits	Evaluation of Marks			
		Lecture	Practical		Internal	External		Total
						Theory	Practical	
1	CT521 – Cryptography & Network Security	4	--	4	40	60	--	100
2	CT522 –Distributed Systems	4	--	4	40	60	--	100
3	CT523 –Machine Learning	4	--	4	40	60	--	100
4	Elective-IV	4	--	4	40	60	--	100
5	Elective-V	4	--	4	40	60	--	100
6	Elective- VI	4	--	4	40	60	--	100
7	CT561 –Machine Learning Lab	--	3	2	40	--	60	100
8	CT562 – Industry Related Lab	--	3	2	40	--	60	100
TOTAL		24	6	28	320	360	120	800

II/II M.TECH (COMPUTER SCIENCE & TECHNOLOGY) :: FIRST SEMESTER

Sl. No	Code No & Subject	Hours/Week		Credits	Evaluation of Marks		
		Lecture	Practical		Internal	External	Total
1	CT 611 – MOOCS	--	--	2	--	--	--
2	CT 651 – Summer Internship	--	--	2	100	--	100
3	CT 652 – Project Phase - I	--	--	4	100	--	100
TOTAL		--	--	8	200	--	200

II/II M.TECH (COMPUTER SCIENCE & TECHNOLOGY) :: SECOND SEMESTER

Sl. No	Code No & Subject	Hours/Week		Credits	Evaluation of Marks		
		Lecture	Practical		Internal	External	Total
1	CT 661 – Project Phase - II	--	--	10	40	60	100

TOTAL MARKS: 1900 **TOTAL: 74 Credits**

R.V.R. & J.C. College of Engineering (A):: GUNTUR
M.Tech (COMPUTER SCIENCE & TECHNOLOGY)
w.e.f. 2017-18

Proposed Electives:

1. CT571 – Automata and Formal Languages
2. CT572 – Advanced Computer Architecture
3. CT573 – Advanced Web Technologies
4. CT574 – Advanced Software Engineering
5. CT575 – Artificial Intelligence
6. CT576 – Digital Image Processing
7. CT577 – Speech Processing and Synthesis
8. CT578 – Multimedia Systems
9. CT579 – Information Security
10. CT580 – Web Services
11. CT581 – Wireless Networks
12. CT582 – Embedded Systems
13. CT583 – Big Data Analytics
14. CT584 – Cloud Computing
15. CT585 – Internet of Things
16. CT586 – Mobile Computing
17. CT587 – Agile Software Development
18. CT588 – Data Engineering
19. CT589 – Evolutionary Computation
20. CT590 – Cyber Security
21. CT591 – Fuzzy Set Theory and Applications
22. CT592 – Natural Language Processing
23. CT593 – Software Architecture
24. CT594 – Semantic Web

RVR & JC COLLEGE OF ENGINEERING:: GUNTUR
M.Tech(Computer Science & Technology)
Syllabus w.e.f. 2017-18
CT 511 – Advanced Data Structures and Algorithms

Lecture: 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. Fundamentals of analysis of algorithm at depth.
2. Study of advanced data structures and its uses.
3. Analysis of problems from different domains.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. Identify and use suitable data structures for given problem from different domains.
2. Appreciate the role of Linked List algorithms in solving variety of problems.
3. Appreciate the role of Optimization by using linear programming.
4. Analyze the various algorithms from different domains.
5. Understand the importance of advanced algorithms and techniques.

UNIT – I: **[9 Periods]**

Data Structures Basics: Structure and Problem Solving, Data structures, Data structure Operations, Algorithm: complexity, Time- space tradeoff. Algorithm- Complexity Notations: Introduction, Mathematical Notation and Functions, Algorithmic Notation, Control Structures, Complexity of Algorithms, Rate of Growth, Asymptotic Notations for complexity of Algorithms.

UNIT – II: **[10 Periods]**

Linked List: Introduction, Linked lists, Representation of linked lists in Memory, Traversing a linked list, Searching a linked list, Memory allocation and Garbage collection, insertion into linked list, Deletion from a linked list, Types of linked list. Stack and Queue: Introduction, Array Representation of Stack, Linked List Representation of stack, Application of stack, Queue, Array Representation of Queue, Linked List Representation of Queue.

UNIT – III: **[10 Periods]**

Sorting Techniques: Notation and Concepts, Insertion Sort, Selection Sort, Bubble Sort, Merge Sorting, Heap Sort, Radix Sort, Quick Sort. Searching Techniques: Sequential Searching, Binary Searching, Search Trees, Hash-Table Methods, hash functions and relates analysis

UNIT – IV: **[10 Periods]**

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Sequential and Other Representations of Trees, Tree Traversal. Balanced Trees: AVL- tree – structure, operations, its application, B-Tree – structure, operations, its application.

UNIT – V: **[10 Periods]**

Dynamic Programing: matrix chain multiplication, cutting rod problem and its analysis Graph algorithms Bellman ford algorithm, Dijkstra algorithm, Johnson's All pair shortest path algorithm for sparse graphs

Text Books:

1. T.H. Coreman , C.E. Leiserson, R.L. Rivest, and C. Stein, “Introduction to algorithms”,2nd edition, PHI publication 2005.
2. Ellis Horowitz, SartajSahni , S. Rajsekaran. “Fundamentals of computer algorithms” University Press.

References:

1. Robert Sedgewick Philippe Flajolet, “An Introduction to the Analysis of Algorithms”, First Edition,

2. G.A.V. Pai, “Data Structures and Algorithms”, TMH, 2009.

CT 512 - Data Base Technologies

Lecture : 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. Fundamental Concepts of Databases.
2. Query Optimization, Transaction Processing, Active databases.
3. Temporal Databases, Multimedia Databases, Ontology and Latest developments in databases.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. Use Data Models and understand the Database Context.
2. Know the Query optimization and concurrency control techniques.
3. Acquire the knowledge of Distributed Databases and Issues in Big Data.
4. Know the importance of Active Database systems and Deductive databases.
5. Know the Temporal databases, ontologies and multimedia databases.

UNIT - I : Relational Data Model , SQL, Data modelling using ER, Basics of Fundamental Dependencies and Normalization of Relational Databases.

UNIT - II: Algorithms for Query processing and Optimization, Introduction to Transaction Processing Concepts and Theory, Concurrency Control Techniques.

UNIT - III: Distributed Database Concepts, NOSQL Databases and Big Data Storage Systems, Big Data Technologies based on MapReduce and Hadoop.

UNIT - IV: Active database systems: Basic concepts, Issues, Architectures, Research relational prototypes—the Starburst Rule System, Commercial relational approaches. Deductive Database systems- Architectural approaches, Research prototypes, Updates in deductive databases, Integration of deductive database and object database technologies, Constraint databases.

UNIT - V : The Latest Developments: Temporal databases - Basic concepts, Temporal data models, Temporal query languages, Ontologies - Ontology theoretical foundations, Environments for building ontologies, Structured, semi-structured and unstructured data, Multimedia databases.

Text Books:

1. , Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems, 7th Edition, Pearson Edn., 2016.(UNIT - I to UNIT - III).

2. Elisa Bertino, Barbara Catania, GianPieroZarri, “Intelligent Database Systems “, Addison Wesley Publications, 2001(UNIT - IV & UNIT - V).

References:

1. Database Systems, Ramez Elmasri and Shamkant B.Navathe, Pearson Education, 6th edition.
2. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill, 3rd Edition.
3. *Database Systems: The Complete Book by Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom,* Pearson Prentice Hall, 2009, 2nd edition.
4. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, Addison Wesley.
5. Database systems: A Practical approach to design, implementation and management, Connoly/Begg, Addison Wesley, 3rd edition.

CT 513 – Advanced Operating Systems

Lecture : 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. Fundamentals of Operating System, Process Scheduling and Synchronization.
2. Concepts of Memory management, File management and Device management.
3. Concepts of Distributed Operating systems.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. Design and implement inter process communication mechanisms.
2. Analyze, Design and implement Different CPU Scheduling algorithms and classical problems of synchronization.
3. Design and implement Memory management and Page replacement algorithms.
4. Know the concepts of Distributed Operating system.
5. Use files and files systems in different Operating Systems environment.

UNIT – I: **[10 Periods]**

Introduction: Operating System, types of Operating Systems, Operating System Structure, Services, System Calls, Virtual Machines, Operating System Design And Implementation.

Process Management: Process Concepts, Operations on Processes, Cooperating Processes, Threads, Inter Process Communication.

UNIT – II: **[10 Periods]**

Process Scheduling: Scheduling Algorithms, Multiple -Processor Scheduling, Thread Scheduling.

Process Synchronization & Deadlocks: The Critical Section Problem, Semaphores and Monitors, Classical Problems of Synchronization,Deadlocks,Methods For Handling Deadlocks: Deadlock- Prevention, Avoidance, Detection,& Recovery.

UNIT – III: **[10 Periods]**

Memory Management & File System Implementation: Paging and Segmentation, Virtual Memory, Demand Paging, Page Replacement Algorithms, Thrashing, File System Implementation -Access Methods, Directory Structure, Protection, Allocation Methods, Free Space Management, Directory Management, Device Drivers.

UNIT – IV: **[10 Periods]**

Distributed Operating Systems: Distributed System Goals, Types Of Distributed Systems, Styles & Architecture Of Distributed Systems, Threads, Virtualization, Clients, Servers, Code Migration, and Communication in Distributed Systems.

UNIT – V: **[10 Periods]**

Distributed Systems & Synchronization: Clock Synchronization, Logical Clocks, Mutual Exclusion, Global Positioning Of Nodes, Data-Centric Consistency Models, Client-Centric Consistency Models, Consistency Protocols.

Case Study: Over View Of UNIX, LINUX, Windows NT , Android And IOS Operating systems.

Text Books:

1. Silberschatz & Galvin, “Operating System Concepts”, Wiley.
2. Andrew S.Tanenbaum, Maarten Van teen, “DISTRIBUTED SYSTEMS”, Second edition,.

References:

1. William Stallings-“Operating Systems”- 5th Edition – PHI.
2. Charles Crowley, ‘Operating Systems: A Design-Oriented Approach’, Tata Hill Co.,1998 edition.
3. Andrew S.Tanenbaum, ‘Modern Operating Systems’, 2nd edition, 1995, PHI.
4. Advanced Concepts in Operating systems.Distributed, Database and Multiprocessor operating systems, Mukesh singhal, Niranjan G.Shivaratri, Tata McGraw Hill Edition.
5. Dhamdhere, “Operating Systems - A concept based approach”, 2nd Edition, TMH, 2006.
6. Pradeep K. Sinha, “Distributed Operating Systems - Concepts and Design”, 2nd Edition, IEEE 1997.
7. Daniel P Bovet and Marco Cesati, “Understanding the Linux Kernel “, 3rd Edition,’ Reilly, 2005.

CT 521 – Cryptography & Network Security

Lecture: 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. Network security attacks and Symmetric Ciphers.
2. Concepts on Asymmetric ciphers like RSA and Elliptic curve algorithms.
3. Cryptography data integrity algorithms and network security.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. Identify common network security vulnerabilities/attacks, classical and symmetric encryption schemes.
2. Know the cipher modes of operations and Public-key Cryptography.
3. Design Hash techniques and Digital signatures schemes.
4. Know the concepts of key management schemes and know the web security SSL/TLS .
5. Analyze wireless and IP Security technologies.

UNIT-I: **[10 Periods]**

Introduction: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security.

Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography.

Block Ciphers and the Data Encryption Standard: Block Cipher Principles, The Data Encryption Standard (DES), A DES Example, The Strength of DES, Differential and Linear Cryptanalysis, AES Structure, AES Round Functions, AES Key Expansion.

UNIT-II: **[10 Periods]**

Block Cipher Operation: Multiple Encryption and Triple DES, Electronic Codebook Mode, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode.

More Number Theory: Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms.

Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems, The RSA Algorithm.

Other Public-Key Cryptosystems: Diffie-Hellman Key Exchange, ElGamal Cryptosystem, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

UNIT-III: **[10 periods]**

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3.

Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Message Authentication Codes, Security of MACs, HMAC. **Digital Signatures:** Digital Signatures, Digital Signature Standard (DSS)

UNIT-IV: **[10 periods]**

Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public Key Infrastructure.

User Authentication Protocols: Remote User Authentication Principles, Remote User Authentication Using Symmetric Encryption, Kerberos, Remote User Authentication Using Asymmetric Encryption.

Transport-Level Security: Web Security Issues, Secure Sockets Layer (SSL), Transport Layer Security (TLS).

UNIT-V : **[10 periods]**

Wireless Network Security: IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security.

Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME.

IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations.

Text Book:

1. William Stallings, "Cryptography and Network Security" 5th Edition, Pearson Education.

Reference Books:

1. Behrouz A.Forouzen, Debdeep Mukhopadhyay, "Cryptography & Network Security", 2nd Edition, TMH.
2. Atul Kahate, "Cryptography and Network Security", 3rd Edition.
3. Chalie Kaufman, Radia Perlman, Mike Speciner, "Network Security", 2nd Edition, (PHI / Eastern Economy Edition)
4. Wade Trappe & Lawrence C.Washington, "Introduction to Cryptography with Coding Theory", 2/e, Pearson.

CT 522 – Distributed Systems

Lecture: 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. challenges and issues of incorporating distributed OS concepts
2. operating system principles, Distributed Computing techniques,
3. Synchronization, Processes and Shared Data access files.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. Develop, test and debug RPC based client-server programs in Unix.
2. Design and build application programs on distributed systems.
3. Improve the performance and reliability of distributed programs.
4. Know newer distributed file systems for any OS.
5. Build and Use Distributed System

UNIT : I: **(9 Periods)**

INTRODUCTION & COMMUNICATION OF DISTRIBUTED SYSTEMS: Introduction & Goals - Hardware Concepts - Software concepts - Design issues - layered protocols - ATM Networks - client server model - Remote Procedure calls - Group Communication

UNIT 2: **(10 Periods)**

SYNCHRONIZATION IN DISTRIBUTED SYSTEMS: Clock synchronization - mutual exclusion - Election algorithms - Atomic transactions - Transaction model - Implementation and Concurrency control – Deadlocks.

UNIT 3: **(10 Periods)**

PROCESSES AND PROCESSORS IN DISTRIBUTED SYSTEMS: Threads - Threads design issues and implementation - System models - processor allocation - Design & implementation issues - Example processor allocation algorithms and Scheduling Fault tolerance–Types - Use of redundancy - Real time distributed systems - Real time Scheduling and communication

UNIT 4: **(10 Periods)**

DISTRIBUTED FILE SYSTEMS AND SHARED MEMORY: Distributed File Systems Design - DFS Implementation - Example DFS - Trends - Shared memory Introduction - Consistency models - Page-based distributed shared memory - Shared-variable distributed shared memory - Object-based distributed shared memory – Comparison.

UNIT 5: **(10 Periods)**

CASE STUDY Introduction to amoeba - Object and Capabilities - Process Management - Memory management - Group Communication – FLIP - Amoeba Servers - Introduction to MACH - Process Management - Memory management – Communication

Text Books:

1. Andrew S Tanenbaum - Distributed Operating Systems - Pearson Education, 2001.
2. MukeshSingalNiranjan G Shivrartri, - Advanced Concepts in Operating Systems - McGraw Hill International , 1994.

Reference Books:

1. Distributed Operating System – P.K.Sinha, PHI, 2008.
2. Web resources http://www.e-reading.link/book.php?book=143358

CT 523 – Machine Learning

Lecture: 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. goals and objectives of machine learning to build real-world systems.
2. classification and prediction techniques and to build systems that explore unknown and changing environments.
3. machine learning theory and models that exhibit high accuracies.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. know the basics of machine learning.
2. use machine learning to build real-world systems.
3. apply classification and prediction techniques.
4. build systems that explore unknown and changing environments.
5. know advanced machine learning techniques.

Unit-I: **[9 Periods]**

Introduction to Machine Learning. Supervised Learning, Bayesian Decision Theory and Naïve Bayesian Approaches, Parametric Model Estimation.

Unit-II: **[9 Periods]**

Dimensionality Reduction Centering on PCA, Clustering1: Mixture Models, K-Means and EM, Non-Parametric Methods Centering on kNN and Density Estimation.

Unit-III: **[9 Periods]**

Clustering2: Density-based Approaches, Decision and Regression Trees, Comparing Classifiers, Ensembles: Combining Multiple Learners

Unit-IV **[9 Periods]**

Support Vector Machines, More on Kernel Methods,

Unit-V: **[9 Periods]**

Belief Networks, Reinforcement Learning, Neural Networks, Computational Learning Theor**ooks**

Text Books:

1. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, 2010.

References:

1. Tom Mitchell, “Machine Learning”, Mc Graw Hill publications, 1997.
2. Christopher. M.Bishop, “Pattern Recognition and Machine Learning”, Springer publications, October, 2007.
3. Ethem Alpaydin, “Introduction to Machine Learning”, 2nd Edition, MIT Publisher, 2010.

CT 571 – Automata and Formal Languages

Lecture : 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Objectives: At the end of the Course Students will understand d

1. concepts of Finite automata theory and its applications.
2. concepts of Regular expressions, regular languages, Context-free grammars and languages.
3. designing principles of push-down automata, Turing machines and Undecidability.

Course Outcomes: After successful completion of this course, student will be able to

1. design finite state machines.
2. design ϵ-NFA, conversion between Finite automata and Regular expressions.
3. apply pumping lemma for Regular languages, construct parse trees for CFG and ambiguous grammars.
4. construct push-down automata and apply pumping lemma for CFL.
5. design Turing Machines and analyze Undecidability.

UNIT – I: **(15 Periods)**

Automata: Introduction to Automata, The central concepts of automata theory - Alphabets, Strings, Languages.

Finite Automata: An Informal picture of finite automata, Deterministic finite automata (DFA) - Definition of DFA, DFA processing strings, Notations for DFA, Extended transition function, the language of DFA, Non deterministic finite automata (NFA) - Definition of NFA, Extended transition function, the language of NFA, Equivalence of DFA and NFA.

Finite Automata with ϵ-transitions: Use of **ϵ-**transition, notation for an **ϵ-**NFA,**ϵ-**closures, extended transitions and languages, Applications, Moore and mealy machines.

UNIT – II: **(14 Periods)**

Regular Expressions and Languages: Regular expressions, finite automata and regular expressions, Algebraic laws of regular expressions.

Properties of Regular Languages: Proving languages are not regular -Pumping lemma for regular languages, Applications of the pumping lemma, Closure Properties of Regular Languages, Equivalence and minimization of automata - Minimization of DFA

UNIT – III: **(14 Periods)**

(Construction based treatment & proofs are excluded)

Context Free Grammars: Context Free Grammars, Parse Trees, Constructing parse trees, derivations and parse trees, ambiguous grammars.

Pushdown Automata: Definition of the Pushdown automata, the languages of PDA, Equivalences of PDA's and CFG's.

UNIT – IV: **(14 Periods)**

Context free languages: Normal form's for context- Free grammars, the pumping lemma for context free languages.

Properties of Context free languages: closure properties for context free languages, Decision properties for CFL's.

UNIT – V: **(13 Periods)**

Introduction to Turing Machines: The Turing Machine, programming techniques for Turing machines.

Undecidability: a language that is not recursively enumerable, an undecidable problem that is RE, Undecidability problems about TM, Post's Correspondence problem.

Text Book:

1. John. E. Hopcroft, R.Motwani, & Jeffery.D Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Education, 2009.

Reference Books:

1. Daniel I.A. Cohen, Introduction to Computer Theory, 4th Edition, John Wiley & sons, 2003.
2. KLP Mishra & N.Chandrasekharan, Theory of Computation, 3rd Edition,PHI,2006.

CT 572 – Advanced Computer Architecture

Lecture : 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. high performance computing architectures.
2. concepts of system interconnection and performance measures.
3. pipelined processors and programming concepts for parallel computers.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. know the concepts of parallel computer models and its properties.
2. familiarize with interconnection architectures and performance measures.
3. analyze design structures for pipelined processors.
4. familiarize with scalable, multithreaded and dataflow architectures.
5. know the parallel programming models and code optimization techniques.

UNIT – I: **[12 Periods]**

Parallel Computer Models: The state of computing, Classification of parallel computers, Multiprocessors and Multicomputers, Multivector and SIMD computers.

Program and network properties: Conditions of parallelism, Data and resource Dependences, Hardware and Software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms.

UNIT – II: **[12 Periods]**

System Interconnect Architectures: Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multi-port memory, Multistage and combining network.

Principles of Scalable Performance: Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws - Amdahl's law for fixed load, Gustafson's law for scaled problems, Memory Bounded Speedup Model.

UNIT-III: **[12 Periods]**

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction.

Pipelining: Arithmetic Pipeline Design, Computer Arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines.

UNIT –IV: **[12 Periods]**

MULTI Processors: Multiprocessor System Interconnect, Cache Coherence and Synchronization Mechanisms, Message-passing Mechanism.

Scalable, Multi-Threaded and Dataflow Architectures: Latency-Hiding Techniques, Principles of Multithreading, Scalable and Multithreaded Architectures.

UNIT-V: **[12 Periods]**

Parallel Models, Languages and Compilers: Parallel Programming Models, Parallel Languages and Compilers, Dependence analysis of Data Arrays.

Parallel Models, Languages and Compilers: code optimization and Scheduling, Loop parallelization and pipelining.

Text Book:

1. Kai Hwang, "Advanced Computer Architecture", TMH.

Reference Books:

1. D.A. Patterson and J.L.Hennessey, "Computer organization and Design", Morgan Kaufmann, 2nd Edition.
2. V.Rajaram & C.S.R.Murthy, "Parallel Computer", PHI.
3. Barry Wilkinson and Michael Allen, “Parallel Programming” Pearson Education.

CT 573 – Advanced Web Technologies

Lecture : 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the course the students will understand

1. the concepts to develop dynamic complex web applications.
2. the concepts of XML, Web servers, Ruby script and PHP.
3. Java Server side technologies and Semantic Web Concepts.

Course Learning Outcomes: At the end of the course the students will be able to

1. design static web pages.
2. design dynamic Web documents using client side scripting.
3. develop XML applications and web documents with ruby script & PHP.
4. write java server side programs.
5. familiar with Semantic Web technologies.

UNIT –I: **[9 Periods]**

Introduction: XHTML, Cascading Style Sheets (CSS), JavaScript: Introduction to Scripting, Control Statements, Functions, Arrays, Objects

UNIT –II: **[9 Periods]**

Dynamic HTML: Object Model and Collections, Dynamic HTML: Event Model, XML: Introduction, DTD, Schema, XSL

UNIT –III: **[12 Periods]**

Web Servers: (IIS and Apache), Ruby on Rails, PHP: Introduction, Using Variables and Operators, Controlling Program Flow,Working with Arrays, Using Functions and Classes

UNIT –IV: **[11 Periods]**

SERVLETS : Overview, Servlet Implementaion, Servlet Configaration, Servlet Lifecycle, Servlet request, Servlet response, Session Tracking, Cookies.

AJAX-ENABLED RICH INTERNET APPLICATIONS : Introduction, Traditional Web Applications vs Ajax Application, XML Http Request Object, Creating AjaX Application.

UNIT –V: **[9 Periods]**

JSP: JSP Directives, Scripting Elements, Standard Actions, Implicit Objects, Scope.

SEMANTIC WEB: Introduction, A Layered Approach, RDF, OWL**.**

Text Books:

1. Harvey M. Deitel and Paul J. Deitel, **"**Internet & World Wide Web How to Program**",** 4/e**,** Pearson Education.(Unit – I to IV)
2. Antoniou Grigoris , Groth Paul, Harmelen Frank Van, Hoekstra Rinke, "A Semantic Web Primer" , 3 ed , PHI publications.(Unit – V)

References:

1. Vikram Vaswani, "PHP: A Beginner's Guide", McGraw-Hill.
2. Subrahmanyam Allamraju et.al, "Professional Java Server Programming", APress.
3. Jim Keogh, "The complete Reference J2EE", Tata McGraw Hill.
4. Tom NerinoDoli smith, **"**JavaScript & AJAX for the web**",** Pearson Education, 2007.
5. Joshua Elchorn, **"**Understanding AJAX**",** Prentice Hall 2006.
6. Karin K Brietman, Marco Antonio Casanova, Walter Truszkowski, "Semantic Web – Concepts", Technologies and Applications, Springer 2007.

CT 574 – Advanced Software Engineering

Lecture : 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. concepts of software engineering and its principles.
2. learn the verification and design of architectures.
3. know the advanced topics software process and its management.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. know software engineering basics and qualities of software.
2. apply software engineering principles in development.
3. apply verification of software in software development.
4. apply the concepts of software production process.
5. know advanced topics such as management of software engineering.

UNIT-I: **[10 Periods]**

Software Engineering : The Role of Software Engineering in System Design, A Shortened History of Software Engineering, The Role of Software Engineer, The Software Life Cycle, The Relationship of Software Engineering to Other Areas of Computer Science, The Relationship Software Engineering to other Disciplines.

Software: Its Nature and Qualities: Classification of Software Qualities, Representative Qualities and Quality Requirement in Different Application Areas.

UNIT – II: **[10 Periods]**

Software Engineering Principles: Rigor and Formality, Separation of Concerns, Modularity, Abstraction, Anticipation of Change, Generality, Instrumentality.

Design and Software Architecture: The software Design Activity and its objectives, Modularization Techniques, Handling Anomalies.

UNIT – III: **[10 Periods]**

Verification: Goals and requirements of verification, Approaches to verification, Testing, Analysis, Symbolic Execution, Model Checking, Putting it All Together, Debugging.

UNIT – IV: **[10 Periods]**

The Software Production Process: What is a Software Process Model?, Why Are Software Process Models Important?, The Main Activities of Software production, An Overview of Software Process Models, Dealing with Legacy Software.

UNIT –V: **[10 Periods]**

Management of Software Engineering: Management Functions, Project Planning, Project Control, Organization, Risk Management.

Text Books:

1. Fundamentals of Software Engineering – Carlo Ghezziet, Mehdi Jazayeri, Dino Mndrioli, 2nd edition, PHI.

Reference Books:

1. Software Engineering – Design, Reliability Management – Pressman.
2. Web Engineering, The Discipline of Systematic Development of Web Applications, edited by GertiKappel, Birgit Proll, Siegfried Reich, Werner Rretschitzegger, John Wiley & Sons, Ltd.
3. Software Engineering, Theory and Practice, Shari Lawrence Pfleeger, 2nd edition, Pearson Education.
4. Software Engineering, Ian Sommerville, 9th edition, Always Learning, Pearson Education.
5. Fundamentals of Software Engineering, 4th edition, Rajib Mall, PHI.
6. Software Engineering with Abstraction, Berzins and Luqi

CT 575 – Artificial Intelligence

Lecture : 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. concepts of artificial intelligence.
2. problem solving techniques using Artificial Intelligence.
3. the concepts of Expert Systems and machine learning.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. identify problems that are amenable to solve by AI methods.
2. Identify appropriate AI methods to solve a given problem.
3. formalize a given problem in the language/framework of different AI methods.
4. implement basic AI algorithms.
5. design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

UNIT I: [9 Periods] INTRODUCTION TO Al AND PRODUCTION SYSTEMS: Introduction to AI-Problem formulation, Problem. Definition -Production systems, Control strategies, Search strategies. Problem

characteristics, Production system characteristics -Specialized production system- Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction - Related algorithms, Measure of performance and analysis of search algorithms.

UNIT II: [9 Periods] REPRESENTATION OF KNOWLEDGE: Game Playing - Knowledge representation, Knowledge Representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

UNIT III: **[9 Periods]**

KNOWLEDGE INFERENCE: Knowledge representation -Production based system, Frame based system. Inference - Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning – Certainty factors, Bayesian Theory-Bayesian Network-Dempster - Shafer theory.

UNIT IV: **[9 Periods] PLANNING AND MACHINE LEARNING:** Basic plan generation systems - Strips - Advanced plan generation systems – K strips -Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.

UNIT V: **[9 Periods]**

EXPERT SYSTEMS: Expert systems - Architecture of expert systems, Roles of expert systems –

Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells.

Text Books:

1. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill- 2008. (Unit-I,II,IV,V).
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007. (Unit-III)

References:

1. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.
2. Stuart Russel and Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education, 2007.
3. Deepak Khemani "Artificial Intelligence", Tata McGraw Hill Education 2013.
4. http://nptel.ac.in/

CT 576 – Digital Image Processing

Lecture : 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. basic theory and algorithms those are widely used in digital image processing.
2. basic approaches in digital image processing.
3. concepts of color image processing, shape representation and description.

Course Learning Outcomes: After successful completion of this course, student will be able to familiarize with

1. overview of image processing systems, Image formation and perception, Continuous and digital image representation.
2. image enhancement in spatial and frequency domain filtering.
3. image compression and image segmentation.
4. the mathematical morphology and shape representation methods.
5. color image processing and object recognition.

UNIT – I: **[10 Periods]**

Introduction: Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.

Digital Image Fundamentals: Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels.

UNIT - II : **[18 Periods]**

Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformation, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing spatial Filters, Sharpening spatial Filters.

Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, Smoothing frequency domain Filters, Sharpening frequency-domain Filters, Holomorphic Filtering, Implementation.

UNIT – III: **[20 Periods]**

Image Compression: Image Compression Models, Error-free Compression, Lossy Compression, Image Compression Standards.

Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

UNIT – IV: **[13 Periods]**

Morphological Image Processing: Dilation and Erosion, The Hit-or-Miss Transformation, Some basic Morphological Algorithms, Extension to Gray-Scale Images.

Representation and Description: Representation, Boundary Descriptors, Regional Descriptors, Use of principal components for Description.

UNIT-V: **[10 Periods]**

Color Image Processing: Color fundamentals, color models, Pseudo color image processing, Basics of color image processing, color image smoothening, color image sharpening, Noise in color images.

Object Recognition: Patterns and Patterns classes, Recognition based on Decision-Theoretic Models, Matching shape Numbers, string Matching, Syntactic Recognition of Strings, and Syntactic Recognition of Trees.

Text Book:

1. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing' Addison Wesley Pubs (Second Edition).

Reference Books:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle Image Processing. Analysis, and Machine Vision (Second Edition).
2. A.K.Jain, 'Fundamentals of Digital Image Processing' PHI.

CT 577 – Speech Processing and Synthesis

Lecture : 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. speech production and related parameters of speech.
2. techniques to analyze the speech.
3. speech modeling procedures and implementation issues.

Course Learning Outcomes: After Successful Completion of this course, student will be able to

1. know the fundamentals of speech and model speech production system.
2. extract and compare different speech parameters.
3. choose an appropriate statistical speech model for a given application.
4. design a speech recognition system.
5. use different speech synthesis techniques.

UNIT I: BASIC CONCEPTS [10 Periods] Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – Acoustics of speech production;

UNIT II:SPEECH ANALYSIS [10 Periods]

The Speech Signal :Production, Perception and Acoustic-phonetic characterization: Introduction, The speech-Production Process, Representing Speech in the Time and Frequency Domains, Speech Sounds and Features, Approaches to Automatic Speech Recognition by Machine.

UNIT III: SPEECH MODELING [8 Periods]

Hidden Markov Models: Introduction, Discrete –Time Markov processes, Extensions to Hidden Markov Models, Types of HMM's, continuous observation Densities in HMMs, Autoregressive HMMs, Variants on HMM Structures-Null Transitions and Tied States, Comparisons of HMMs, Implementation issues for HMMs, HMM system for Isolated word Recognition.

UNIT IV: SPEECH RECOGNITION [10 Periods]

Large Vocabulary Continuous Speech Recognition: Introduction, Subword Speech units, Subword Unit Models Based on HMMs, Training of Subword Units, Language Models for Large Vocabulary Speech Recognition, Statistical Language Modeling, Perplexity of the Language Model, Overall Recognition System Based on Subword Units, Context-Dependent Subword Units.

UNIT V: SPEECH SYNTHESIS **[10 Periods]**

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

Text Books:

1. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.(Unit – I to IV).
2. Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1997(Unit – V).

References:

1. Steven W. Smith, "The Scientist and Engineer‟s Guide to Digital Signal Processing", California Technical Publishing, 1997.
2. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education, 2004.
3. Claudio Becchetti and Lucio PrinaRicotti,"Speech Recognition", John Wiley and Sons, 1999.
4. Ben Gold and Nelson Morgan,"Speech and Audio Signal Processing, Processing and Perception of Speech and Music", Wiley- India Edition, 2006.

CT 578 – Multimedia Systems

Lecture : 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. Multimedia Information Representation and Multimedia Communications.
2. importance, use and issues in Compression Techniques.
3. developments in Multimedia Communications for Entertainment Networks.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. represent information in Multimedia Communications.
2. address Basic Text and Image Compression techniques.
3. apply and use Audio and Video Compression Standards.
4. apply the knowledge of selecting and using protocols ensuring Quality-of-Service(QoS) in developing multimedia applications.
5. know the entertainment functions and support hardware.

UNIT-I **[9 Periods]**

Multimedia Communications – Multimedia information representation, Multimedia Networks, Multimedia Applications.

Multimedia Information Representation – Digitization Principles, Text, Images, Audio, Video.

UNIT – II [9 Periods] Text and Image Compression – Compression Principles, Text Compression, Image Compression.

UNIT – III **[9 Periods]**

Audio and Video Compression– Audio Compression and Video Compression.

UNIT – IV **[9 Periods]**

Standards for Multimedia Communications– Reference Models, Standards related to Interpersonal Communications, Standards related to interactive applications over the internet.

UNIT –V **[9 Periods]**

Entertainment Networks – Cable TV Networks, Satellite Television Networks, Terrestrial Television Networks, High-Speed PSTN access Technologies.

Application Support Functions – ASN.1, Security, Data Encryption, Non repudiation, Authentication, Public Key Certification Authorities.

Text Books:

1. Fred Hassall, “Multimedia Communications, Applications, Networks, Protocols and Standards”, Pearson Educations, 2011.

Reference Books:

1. Prabhat K. Andleigh, Kiran Thakrar, Multimedia Systems Design, Always Learning, Pearson, 2015.
2. Ralf Steinmetz and Klara Nahrshedt, Multimedia Applications, Springer,2011.
3. Nigel Chapman & Jeny Chapman, Digital Multimedia, Wiley Publication, 2004.
4. John F. Koegel Buford , Multimedia Systems, Pearson Education, 1994.
5. Khalid Sayood, Introduction to Data Compression, 4th Edition, Morgan Kaufmann Publication, 2012.
6. Vasudev Bhaskaran, Konstantinous Konstantinides, Image and Video Compression Standards: Algorithms and Architectures, The Springer International Series in Engineering and Computer Science, 1997.
7. Shahriar Akarmullah, Digital Video Concepts, Methods, and Metrics: Quality, Compression, Performance, and Power Trade-off Analysis, Apress, 2014.

CT 579 – Information Security

Lecture : 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. SDLC for information security implementation.
2. issues related to legal, ethical, and professional in information security.
3. Risk control Security technology architectures and tools.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. know the security system development life cycle
2. familiarize with the legal, ethical, and professional issues in information security.
3. apply Risk control and management strategies.
4. know firewalls and firewall architectures.
5. familiarize with security technologies and tools.

UNIT I: **[9 Periods]**

Introduction to Information Security: The history of Information Security, What is Security?, CNSS Security Model.

Approaches to Information Security Implementation: The system development Life Cycle, The security systems development Life Cycle, Security Professionals and the Organization, Communities of Interest.

UNIT II: **[9 Periods]**

The Need for Security: Business Needs First, Threats, Attacks, and Secure Software Development.

Legal, Ethical, and Professional Issues in Information Security: Relevant U.S. Laws, International Laws and Legal Bodies, Ethics and Information Security, Codes of Ethics and Professional Organizations.

UNIT III: **[9 Periods]**

Risk Management: An Overview of Risk Management, Risk Identification, Risk Assessment.

Risk Control Strategies: Selecting a Risk Control Strategy, Quantitative Versus Qualitative Risk Control Practices, Risk Management Discussion Points, Recommended Risk Control Practices.

UNIT IV: **[9 Periods]**

Security Technology: Introduction**,** Firewalls and VPNs.

Firewall Architectures: Firewall Architectures, Protecting Remote Connections.

UNIT V: **[9 Periods]**

Security Technology: Introduction, Intrusion Detection and Prevention Systems, Honeypots, Honeynets, and Padded Cell Systems.

Other Security Tools: Scanning and Analysis Tool, Biometric Access Tools.

Text Book

1. Michael E. Whitman, Harbert J. Mattord, "Principles of Information Security", 4th Edition, Course Technology, CENGAGE Learning.

References:

1. Deven N. Shah, "Mark Stamp's Information Security: Principles and Practice (WIND)", Wiley.
2. David Alexander, Amanda Finch, David Sutton, Andy Taylor, "Information Security Management Principles", Second Edition, BCS, The Chartered Institute for IT.

CT 580 – Web Services

Lecture : 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Objectives: At the end of the Course Students will understand

1. web service technologies.
2. description language for Web services.
3. publish and consume web services.

Course Outcomes: After successful completion of this course, student will be able to

1. know the fundamentals of web services.
2. create XML namespaces and schemas for Web-services.
3. describe and provide information about Web Services.
4. write SOAP requests and responses to access web services.
5. write UDDI structures to publish and consume web services.

UNIT I: **[10 Periods]**

Introducing Web Services: The Basics of Web Services, The Next Generation of the Web, Interacting with Web Services, RPC-Oriented Interactions, Document-Oriented Interactions, The Technology of Web Services, XML for Business Collaboration: ebXML.

UNITII: **[10 Periods]**

Describing Information: XML, **Instance** and Schema, **Processing** XML Documents, **Namespaces,** Transformation, XML Specifications and Information, XML Specifications Related to Web Services, General Information.

UNITIII: **[10 Periods]**

Describing Web Services(WSDL):WSDL Basics, **WSDL** Elements, **The** Extensible WSDL Framework, Defining Message Data Types, Defining Operations on Messages, Mapping Messages to Protocols, Importing WSDL Elements, WSDL-Related Namespaces, Extensions for Binding to SOAP.

UNIT IV: [10 Periods] Accessing Web Services(SOAP): The SOAP Specification, **SOAP** Envelope, **SOAP** Header, **SOAP** Body, SOAP Faults, RPC Convention, SOAP Message Processing, SOAP Use of Namespaces, SOAP Multipart MIME Attachments, SOAP in the Context of Existing Systems.

UNIT V: **[10 Periods]**

Finding Web Services: UDDI Registry, **The** UDDI Organization, **The** Concepts Underlying UDDI **,** UDDI Data Model, Generic Data, The Business Entity, The Binding Template, The tModel, UDDI SOAP APIs, Updating the Registry, Retrieving Information, Using WSDL with UDDI, ebXML, Define the Documents, Deploying ebXML, The ebXML Specifications.

Text Book:

1. Eric Newcomer, “Understanding Web Services: XML, WSDL, SOAP, and UDDI”, Addison-Wesley Professional publications.

Reference Books:

1. G. Alonso, F. Casati and others,”Web Services” ,Springer, 2005.
2. Richard Monson-Haefel, “J2EE Web Services” Pearson Education

CT 581 – Wireless Networks

Lecture : 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. wireless networks, protocol stack and standards.
2. fundamentals of 3G Services, its protocols and applications.
3. evolution of 4G Networks, its architecture and applications.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. know the latest 3G/4G and WiMAX networks and its architecture.
2. design routing mechanism in mobile ad-hoc network.
3. know the fundamentals of Transport Layer Protocols.
4. Know the wireless network environment for any application using latest wireless protocols and standards.
5. Know the different type of applications for smart phones and mobile devices with latest network strategies.

UNITI: Wireless LAN [9 Periods]

Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum -IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security – IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX.

UNIT II: Mobile Network Layer [9 Periods]

Introduction – Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol – mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic source routing

UNIT III: Mobile Transport Layer [9 Periods]

TCP enhancements for wireless protocols – Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility – Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, Transaction oriented TCP – TCP over 3G wireless networks.

UNIT IV: Wireless Wide Area Network [9 Periods]

Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol.

UNIT V: 4G Networks **[9 Periods]**

Introduction – 4G vision – 4G features and challenges – Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.

Text Books:

1. Jochen Schiller, ”Mobile Communications”, Second Edition, Pearson Education 2012.(Unit I,II,III)
2. Vijay Garg , “Wireless Communications and networking”, First Edition, Elsevier 2007.(Unit IV,V)

References:

1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, “3G Evolution HSPA and LTE for Mobile Broadband”, Second Edition, Academic Press, 2008.
2. Anurag Kumar, D.Manjunath, Joy kuri, “Wireless Networking”, First Edition, Elsevier 2011.
3. Simon Haykin , Michael Moher, David Koilpillai, “Modern Wireless Communications”,

CT 582 – Embedded Systems

Lecture : 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Objectives

At the end of the course the students will understand

1. hardware and software components of an embedded system.
2. embedded system software architectures and interrupt mechanisms.
3. mechanisms for Synchronization, IPC and RTOS.
4. tools for development of Embedded system.

Course Outcomes

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

1. familiarize with embedded system concepts, hardware and software.
2. familiarize with the embedded system architecture and interrupt handling.
3. familiarize with solutions for shared data problems.
4. familiarize with Memory management techniques and RTOS concepts.
5. familiarize with system environment for development of Embedded system

UNIT – I (12 Periods)

A First Look at the Embedded Systems: Examples of Embedded Systems (Telegraph, cordless Bar-code scanner, Laser Printer, underground tank monitor, Nuclear Reactor Monitor), Typical Hardware.

Hardware Fundamentals: Terminology, Gates, A few other basic considerations, Timing Diagrams, Memory.

Advanced Hardware Fundamentals: Micro Processors, Buses, Direct Memory Access, interrupts, other common parts, Built-ins on the Micro Processor, conventions used on the Schematics.

UNIT – II (12 Periods)

Interrupts: Micro Processor Architecture, Interrupt Basics, The shared data problem, Interrupt Latency.

Survey of Software Architectures: Round-Robin, Round-Robin with Interrupts, Function-Queue-Scheduling Architecture, Real Time Operating System Architecture, Selecting an Architecture.

UNIT – III (12 Periods)

Introduction to Real Time Operating Systems: Tasks and Task states, Tasks and data Semaphores and shared data.

More Operating System Services: Message Queues, Mail boxes and pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS environment.

UNIT – IV (12 Periods)

Desktop Operating Systems versus RTOS -need for Board Support Packages – task management – race conditions– priority inversion – scheduling.

Basic Design Using a Real Time Operating System: Overview, Principles, An Example, Encapsulating Semaphores and Queues, Hard Real Time Considerations, Saving Memory Space, Saving Power.

UNIT – V **(12 Periods)**

Embedded Software Development Tools: Host and Target Machines, Linker/Locators for Embedded Software, Getting Embedded Software into the target System.

Debugging Techniques: Testing on Host Machine, Instruction Set Simulators, the *assert* macro, using Laboratory Tools.

Learning Resources:

Text Books:

1. David E.Simon, An Embedded Software Primer, Pearson Education Asia., 2000. (Units I, II, III and V and 2nd chapter in IV).
2. Sriram V.Iyer, Pankaj Gupta, Embedded Real-time Systems Programming, TataMcGraw Hill publishers, 2004. (First chapter in IV unit).

Reference Books:

1. D.Gajski, F.Vahid, S.Narayan, J.Gong, Specification and Design of Embedded Systems, Prentice Hall of India Pvt. Ltd.
2. Raj Kamal, Embedded Systems Architecture & Programming, Tata McGraw-Hill.

Web References:

1. https://spin.atomicobject.com/.../learn-embedded-systems-programming/
2. http://esd.cs.ucr.edu/
3. www.montefiore.ulg.ac.be/~boigelot/cours/embedded/slides/embedded.pdf

CT 583 – Big Data Analytics

Lecture: 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. Data Mining and Massive Data Management.
2. Mining of Massive Datasets using different Techniques.
3. Internet Recommendations and Social Network Analysis.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. know data mining in distributed file management environment.
2. apply the similarity principle on massive datasets.
3. know the key technical issues of Data Streams.
4. recognize the importance of link analysis and frequent item sets.
5. apply recommendation systems and social network graphs.

UNIT – I **[10 Periods]**

Data Mining: What is Data Mining?, Statistical Limits on Data Mining. Map Reduce and the New Software Stack, Distributed File Systems, Map Reduce, Algorithms Using Map Reduce, Extensions to Map Reduce, The Communication Cost Model.

UNIT – II **[10 Periods]**

Finding Similar Items: Applications of Near-Neighbor Search, Shingling of Documents, Similarity-Preserving Summaries of Sets, Finding Similar Items, Locality-Sensitive Hashing for Documents, Distance Measures, the Theory of Locality-Sensitive Functions.

UNIT – III **[10 Periods]**

Mining Data Streams: The Stream Data Model, Sampling Data in a Stream, Filtering Streams. Mining Counting Distinct Elements in a Stream, Estimating Moments, Counting Ones in a Window.

UNIT—IV **[10 Periods]**

Mining Link Analysis: Page Rank, Efficient Computation of Page Rank, Topic-Sensitive Page Rank, Link Spam.

Frequent Item Sets: The Market-Basket Model, Market Baskets and the A-Priori Algorithm, Handling Larger Data Sets in Main Memory.

UNIT – V **[10 Periods]**

Recommendation Systems: A model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering, Dimensionality Reduction.

Social-Network Graphs: Social Networks as Graphs, Clustering of Social-Network Graphs, Direct Discovery of Communities, Partitioning of Graphs.

Text Book:

1. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, “Mining of Massive Datasets”, 2nd Edition, 2014.

References:

1. Paul Zikopoulos et al, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw Hill Professional, USA, 2011.

2. Jimmy Lin and Chris Dyer, “Data Intensive Text Processing using MapReduce”, Morgan and Claypool Publishers, USA, 2010.

3. Tom White, “Hadoop: The Definitive Guide”, O`Reilly Publishers, USA, 2012.

4. EelcoPlugge, Tim Hawkins and Peter Membrey, “The Definitive Guide to MongoDB: The NoSQL Database for Cloud andDesktop Computing”, Apress, USA, 2010.

5. Norman Matloff, “The Art of R Programming: A Tour of Statistical Software Design”, No Starch Press, USA, 2011.

CT 584 – Cloud Computing

Lecture: 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. distributed concepts and Virtualization.
2. Cloud Programming and Cloud Services.
3. Cloud Security and Cloud Applications.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. use Cloud Computing environment Data Models and understand the Database Context.
2. Apply the hardware and software concepts and architecture of cloud computing.
3. Contrast the key technical and commercial issues concerning cloud computing versus traditional software models.
4. recognize peer-to-peer computing and overlay networks.
5. know the application development in Cloud Environment.

UNIT – I: **[10 Periods]**

DISTRIBUTED SYSTEM MODELS AND ENABLING TECHNOLOGIES: Scalable Computing over the Internet, Technologies for Network-Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds.

UNIT – II **[10 Periods]**

VIRTUAL MACHINES AND VIRTUALIZATION OF CLUSTERS AND DATA CENTERS: Implementation levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory and I/O devices.

UNIT III: [10 Periods] CLOUD PROGRAMMING AND SOFTWARE ENVIRONMENTS: Features of Cloud and Grid Platforms, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments.

UNIT IV: **[10 Periods]**

PEER-TO-PEER COMPUTING AND OVERLAY NETWORKS: Peer-to-Peer Computing Systems, P2P Overlay Networks and Properties, Routing, Proximity, and Fault Tolerance, Trust, Reputation and Security Management.

UNIT V: **[10 Periods]**

UBIQUITOUS CLOUDS AND THE INTERNET OF THINGS: Cloud Trends in Supporting Ubiquitous Computing, Enabling Technologies for the IoT, Innovative Applications of the IoT, Online Social and Professional Networking.

Text Books:

1. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing: From Parallel Processing to the Internet of Things", Morgan Kaufmann, 2012.

References:

1. Danielle Ruest and Nelson Ruest, "Virtualization: A Beginners Guide", Tata McGraw Hill, New Delhi, 2009.
2. Chris Wolf and Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", Apress, 2005.
3. Anthony T Velte, Toby J Velte and Robert Elsenpeter, "Cloud Computing – A Practical Approach", Tata McGraw Hill, NewDelhi, 2010.
4. Ronald L Krutz and Russell Dean Vines, "Cloud Security- A Comprehensive Guide to Secure Cloud Computing", Wiley India,New Delhi, 2010.

5 . James Murty, "Programming Amazon Web Services: S3 EC2 SQS FPS and Simpledb", Shroff Publishers, Mumbai, 2008.

5. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Eduction(INDIA) PVT. LTD., 2013.
6. Dr Kumar Saurabh, "Cloud Computing: Unleashing Next Gen Infrastructure to Application", 3rd edition, Wiley, 2014.

CT 585 – Internet of Things

Lecture: 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. issues, policy and challenges in the IoT.
2. components, protocols and managing the resources in the IoT.
3. deploying the resources in an IoT environment.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. know the components of IoT.
2. develop Programs for the IoT.
3. manage resources in IoT.
4. model the Internet of things for business.
5. develop applications for the web of things.

UNIT I: INTRODUCTION [9 Periods]

Definition – phases – Foundations – Policy– Challenges and Issues - identification - security – privacy. Components in internet of things: Control Units – Sensors – Communication modules – Power Sources – Communication Technologies – RFID – Bluetooth – Zigbee – WiFi – Rflinks – Mobile Internet –Wired Communication.

UNIT II: PROGRAMMING THE MICROCONTROLLER FOR IOT [9 Periods]

Basics of Sensors and actuators – examples and working principles of sensors and actuators – Cloud computing and IOT – Arduino/Equivalent Microcontroller platform – Setting up the board Programming for IOT – Reading from Sensors.

Communication: Connecting microcontroller with mobile devices – communication through Bluetooth and USB – connection with the internet using WiFi / Ethernet.

UNIT III: RESOURCE MANAGEMENT IN THE INTERNET OF THINGS [9 Periods]

Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture - The Role of Context - Design Guidelines -Software Agents for Object - Data Synchronization- Types of Network Architectures - Fundamental Concepts of Agility and Autonomy- Enabling Autonomy and Agility by the Internet of Things-Technical Requirements for Satisfying the New Demands in Production - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things- Agents for the behaviour of Objects

UNIT IV: BUSINESS MODELS FOR THE INTERNET OF THINGS [9 Periods]

The Meaning of DiY in the Network Society- Sensor-actuator Technologies and Middleware as a Basis for a DiY Service Creation Framework - Device Integration - Middleware Technologies Needed for a DiY Internet of Things Semantic Interoperability as a Requirement for DiY Creation -Ontology- Value Creation in the Internet of Things-Application of Ontology Engineering in the Internet of Things-Semantic Web-Ontology - The Internet of Things in Context of EURIDICE Business Impact

UNIT V: FROM THE INTERNET OF THINGS TO THE WEB OF THINGS: [9 Periods]

Resource-oriented Architecture and Best Practices- Designing RESTful Smart Things – Webenabling Constrained Devices - The Future Web of Things - Set up cloud environment – send data from microcontroller to cloud – Case studies – Open Source e-Health sensor platform – Be Close Elderly monitoring – Other recent projects.

TEXT BOOKS:

1. CharalamposDoukas, Building Internet of Things with the Arduino, Create space, April 2002.(Unit I & II).
2. Dieter Uckelmann et.al, “Architecting the Internet of Things”, Springer, 2011.(Unit III to V)

REFERENCES:

1. Luigi Atzor et.al, “The Internet of Things: A survey, “, Journal on Networks, Elsevier Publications, October, 2010
2. http://postscapes.com/
3. http://www.theinternetofthings.eu/what-is-the-internet-of-things

CT 586 – Mobile Computing

Lecture: 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. basic concepts of mobile communication.
2. architectures and protocols used for mobile communication/computing.
3. mobile device databases and operating systems.

Course Learning Outcomes: After successful completion of this course, student will be able to know

1. the basics of mobile communication and computing.
2. the architectures for mobile computing.
3. the protocols of the different layers in mobile communication.
4. mobile TCP.
5. the operating systems and databases suitable for the mobile devices.

UNIT I: **[10 Periods]**

MOBILE COMMUNICATION: An Overview: Mobile Communication, Mobile Computing, Mobile Computing Architecture, Mobile Devices, Mobile System Networks, Data Dissemination

MOBILE DEVICES AND SYSTEMS: Mobile Phones, Digital Music Players, Handled Pocket Computers, Handled Devices: Operating Systems, Smart Systems.

UNIT II: **[10 Periods]**

GSM AND SIMILAR ARCHITECTURES: GSM-Services and System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, New Data Services, General Packet Radio Services, High Speed Circuit Switched Data.

WIRELESS MEDIUM ACCESS CONTROL AND CDMA-BASED COMMUNICATION: Medium Access Control, Introduction to CDMA-based Systems, Spread Spectrum in CDMA Systems, Coding Methods in CDMA.

UNIT III: **[10 Periods]**

MOBILE IP NETWORK LAYER: IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, Dynamic Host Configuration Protocol.

MOBILE TRANSPORT LAYER: Conventional TCP/IP Transport Layer Protocols, Indirect TCP, Snooping TCP.

UNIT IV: **[10 Periods]**

MOBILE TCP: Other Methods of TCP-Layer Transmission for Mobile Networks, TCP Over 2.5G/3G Mobile Networks.

UNIT V: **[10 Periods]**

DATABASES: Database Hoarding Techniques, Data Caching, Client-Server Computing and Adaption, Transaction Models, Query Processing, Data Recovery Process.

MOBILE OPERATING SYSTEMS: Operating Systems, PalmOs, Windows CE, Symbian OS, Linux for Mobile Devices.

Text Book:

1. Raj Kamal, "Mobile Computing", OXFORD University Press.

Reference Books:

1. Prasant Kunar Pattnaik, Rajib Mall, " Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd.
2. UweHansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, " Principles of Mobile Computing", Springer.

CT 587 – Agile Software Development

Lecture: 4 Periods/Week
Practical: --

Internal: 40 Marks
External: 60 Marks
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. principles and practices associated with agile development methods.
2. agile methods for distributed projects.
3. in-depth explorations of agile development.

Course Learning Outcomes: After successful completion of this course, student will be able to familiarize with

1. various agile development methods.
2. inception phase of agile development.
3. technical strategy and release planning with agile development.
4. construction and transition phases of agile development.
5. Scrum and Sprint agile methodologies in system development.

UNIT – I: **[10 Periods]**

Introduction to Agile and Lean: Toward a Disciplined Agile Manifesto, Disciplined Agile Values, Disciplined Agile Principles, Lean Principles, Reality over Rhetoric.

Foundations of Disciplined Agile Delivery: Scrum, Extreme Programming (XP), Agile Modeling (AM), Agile Data, Lean Software Development, Open Unified Process (OpenUP).

Roles, Rights, and Responsibilities: The Rights of Everyone, The Responsibilities of Everyone, The DAD Roles.

UNIT – II: **[10 Periods]**

The Inception Phase: How the Inception Phase Works, Aligning with the Rest of the Enterprise, Securing Funding, Other Inception Activities, When Do You Need an Inception Phase?, Inception Phase Patterns, Inception Phase Anti-Patterns.

Identifying a Project Vision: What's in a Vision?, How Do You Create a Vision?, Capturing Your Project Vision, Bringing Stakeholders to Agreement Around the Vision.

Identifying the Initial Scope: Choosing the Appropriate Level of Initial Detail, Choosing the Right Types of Models, Choosing a Modeling Strategy, Choosing a Work Item Management Strategy.

UNIT – III: **[10 Periods]**

Identifying an Initial Technical Strategy: Choosing the Right Level of Detail, Choosing the Right Types of Models, Choosing a Modeling Strategy, Architecture throughout the Lifecycle.

Initial Release Planning: Who Does the Planning?, Choosing the Right Scope for the Plan, Choosing a General Planning Strategy, Choosing Cadences, Formulating an Initial Schedule, Estimating the Cost and Value, Identifying Risks.

UNIT – IV **[10 Periods]**

The Construction Phase: How the Construction Phase Works, The Typical Rhythm of Construction Iterations, The Risk-Value Lifecycle, When Are You Ready to Deploy? , Construction Patterns, Construction Anti-Patterns.

Initiating a Construction Iteration: Why Agile Planning Is Different, Iteration Planning, Visualizing Your Plan, Look-Ahead Planning and Modeling.

The Transition Phase: How the Transition Phase Works, Planning the Transition Phase, Ensuring Your Production Readiness, Preparing Your Stakeholders for the Release, Deploying the Solution, Transition Phase Patterns, Transition Phase Anti-Patterns.

UNIT – V **[10 Periods]**

Scrum Framework: Scrum Roles, Scrum Activities and Artifacts, Sprints, Daily Scrum.

Sprints: Timeboxed, Short Duration, Consistent Duration, No Goal-Altering Changes, Definition of Done.

Text Books:

1. Scott W. Ambler, Mark Lines, Disciplined Agile Delivery: A Practitioner's Guide to Agile Software Delivery in the Enterprise, IBM Press, 2012 .(UNIT – I to UNIT – IV)
2. K.S. Rubin, Essential Scrum: A Practical Guide to the Most Popular Agile Process, Addison-Wesley, 2012.(UNIT V)

Reference Books:

1. K. Beck, Test Driven Development: By Example, Addison-Wesley, 2002.
2. K. Beck, C. Andres, Extreme Programming Explained: Embrace Change, 2nd Edition, Addison-Wesley, 2004.
3. M. Cohn, Succeeding with Agile: Software Development Using Scrum, Addison-Wesley, 2010.
4. M. Fowler, Catalog of Refactorings, Published online at: http://refactoring.com/catalog/, December 2013 (last visited on: 3 August 2014).
5. K. Schwaber, J. Sutherland, The Scrum Guide, Published online at: https://www.scrum.org/scrum-guide, July 2013 (last visited on: 3 August 2014).

CT 588 – Data Engineering

Lecture: 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. basics of data warehousing and Data mining.
2. association rule mining, and classification techniques.
3. clustering and applications of data mining on complex data objects.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. apply fundamental concepts for the construction of Data Warehouse.
2. familiarize with Data Mining concepts.
3. extract association rules from transactional databases.
4. demonstrate different classification techniques.
5. implement various clustering techniques and and data mining concepts on complex data objects.

UNIT- I: **[12 Periods]**

Data Warehousing and Online Analytical Processing: Data Warehouse: Basic Concepts- Data Warehouse Modeling: Data Cube and OLAP-Data Warehouse Design and Usage- Data Warehouse Implementation.

Data Preprocessing: An overview of Data Preprocessing- Data cleaning- Data Integration- Data Reduction- Data Transformation and Data Discretization.

UNIT- II: **[12 Periods]**

Getting to know Your Data: Data Objects and Attribute Types- Basic Statistical Descriptions of Data- Measuring Data Similarity and Dissimilarity.

Introduction: Why Data Mining- What is Data Mining?-What Kinds of Data can be mined?- What Kinds of Patterns can be mined?- Which Technologies are used?- Major Issues in Data Mining.

UNIT-III: **[15 Periods]**

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts- Frequent Item set Mining Methods: Apriori Algorithm, Generating Association Rules, Improving the efficiency of Apriori, FP Growth Approach for Mining Frequent Item Sets, Mining Frequent Item Sets using Vertical Data Format Method.

Advanced Pattern Mining: Mining Multilevel Associations- Mining Multidimensional Associations- Mining Quantitative Association Rules-Mining Rare Patterns and Negative Patterns- Constrained based Frequent Pattern Mining.

UNIT- IV : **[15 Periods]**

Classification: Basic Concepts- Decision tree induction- Bayes Classification Methods- Rule-Based Classification- Model Evaluation and Selection- Techniques to Improve Classification Accuracy.

Advanced Methods in Classification: Bayesian Belief Networks-Classification by Backpropagation-Classification by Support Vector Machines-Lazy Learners-Other Classification Methods.

UNIT- V: **[12 Periods]**

Cluster Analysis: Introduction to cluster analysis- partitioning methods- Hierarchical methods- Density-Based Methods:DBSCAN-Grid-based Method:STING, Outliers and Outlier Analysis- Outlier Detection Methods.

Data Mining Trends: Mining Sequence Data- Mining Graphs and Networks- Mining Other Kinds of Data- Data Mining Applications.

Text Book:

1. Data Mining Concepts & Techniques, Jiawei Han, MichelineKamber, and Jian Pei, 3/e, Morgan Kaufmann Publishers.

Reference Books:

1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, Addison Wesley.
2. Data Warehouse Toolkit, Ralph Kimball, John Wiley Publishers.

CT 589 – Evolutionary Computation

Lecture: 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. basics of Genetic and Evolutionary Algorithms.
2. different Evolutionary Algorithms.
3. evolutionary Algorithms with Multi Objective Functions.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. identify Algorithms suitable for solving certain Evolutionary computation problems.
2. know the usage of operators in Evolutionary Computation.
3. familiar with various Evolutionary Computation Techniques.
4. apply Evolutionary Computing Techniques for optimization.
5. know the Evolutionary Algorithms with Multi Objective Functions.

UNIT I: **[9 Periods]**

INTRODUCTION: History, Inspiration from biology: Darwinian evolution - Genetics, Need of evolutionary computing.

EVOLUTIONARY ALGORITHM: Components of Evolutionary Algorithms (EA), Working principle of EA, Applications: N-Queens problem - Knapsack problem, Introduction to different branches of evolutionary computation: Genetic algorithm – Evolutionary programming - Evolutionary strategies - Genetic programming.

UNIT II: **[9 Periods]**

VARIANTS OF EVOLUTIONARY COMPUTATION: EA vs traditional methods, Representation, Mutation, Recombination, Population models, Parent selection, Survivor selection.

UNIT III: **[9 Periods]**

EVOLUTIONARY COMBINATORIAL OPTIMIZATION: Local search: Simulated annealing - Tabu search, Hybrid algorithm: Lamarckian evolution - Memetic algorithms, Application: Knapsack problem - Minimum spanning tree problem - Travelling Salesman Problem (TSP).

UNIT IV: **[9 Periods]**

OTHER EVOLUTIONARY TECHNIQUES: Ant Colony Optimization (ACO): Real to artificial ants - ACO algorithm - Convergence proofs, Particle Swarm Optimization (PSO): Principles of bird flocking and fish schooling - PSO algorithm - Variants of PSO, Application: TSP.

UNIT V: **[9 Periods]**

MULTIOBJECTIVE EVOLUTIONARY OPTIMIZATION: Introduction, Pareto optimality, Multi-Objective evolutionary algorithms.

TEXT BOOK:

1. Eiben A E and Smith J E, “Introduction to Evolutionary Computing”, Springer, New York, 2008.

REFERENCES:

1. Frank Neumann and Carsten Witt, “Bio-inspired Computation in Combinatorial Optimization”, Springer, New York, 2010.
2. Marco Dorigo and Thomas Stutzle, “Ant Colony Optimization”, Prentice Hall, New Delhi, 2005.
3. Jun Sun, Choi-Hong Lai and Xiao-Jun Wu, “Particle Swarm Optimisation: Classical and Quantum Perspectives”, Taylor and Francis, USA, 2012.
4. Carlos A CoelloCoello, Gary B Lamont and David A Van Veldhuizen, “Evolutionary Algorithms for Solving Multi-Objective Problems”, Springer, New York, 2007.
5. David B Fogel, “Evolutionary Computation”, IEEE Press, New York, 2000.

CT 590 – Cyber Security

Lecture: 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. Cyber security policies and Evolutions, Cyber security objectives and decision makers.
2. Cyber governance issues and conflict issues
3. Cyber management and Infrastructure issues.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. Know polices, laws & regulations and counter measures.
2. Know the concepts of security management goals, security frameworks and security policy objectives.
3. Analyze copyright & Trademarks, Email and Messaging.
4. Analyze user issues and conflict issues.
5. Analyze risk management in various sectors and Infrastructure issues.

UNIT – I: **[10 Periods]**

Cyber Security Introduction: Cyber Security, Cyber Security policy, Domains of Cyber Security Policy: Laws and Regulations, Enterprise Policy, Technology Operations, Technology Configuration, Strategy Versus Policy.

Cyber Security Evolution: Productivity, Internet, e-commerce, Counter Measures, Challenges.

UNIT – II: **[10 Periods]**

Cyber Security Objectives: Cyber Security Metrics, Security Management Goals, Counting Vulnerabilities, Security Frameworks, Security Policy Objectives.

Guidance for Decision Makers: Tone at the Top, Policy as a Project.

UNIT – III: **[10 Periods]**

Cyber Security Management: Arriving at Goals, Cyber Security Documentation, Catalog Format, Cyber Security Policy Taxonomy.

Cyber Governance Issues: Net Neutrality, Internet Names and Numbers, Copyright and Trademarks, Email and Messaging.

UNIT – IV: **[10 Periods]**

Cyber User Issues: Malvertising, Impersonation, Appropriate Use, Cyber Crime, Geo location, Privacy.

Cyber Conflict Issues: Intellectual property Theft, Cyber Espionage, Cyber Sabotage, Cyber Welfare.

UNIT – V: **[10 Periods]**

Cyber Management Issues: Fiduciary Responsibility, Risk Management, Professional Certification, Supply Chain, Security Principles, Research and Development.

Cyber Infrastructure Issue: Banking and finance, Health care, Industrial Control systems.

Text Books:

1. Jennifer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs, Jeffrey Schmidt, Joseph Weiss “Cyber Security Policy Guidebook” John Wiley & Sons 2012.

References:

1. Rick Howard “Cyber Security Essentials” Auerbach Publications 2011.
2. Richard A. Clarke, Robert Knake “Cyberwar: The Next Threat to National Security & What to Do About It” Ecco 2010.
3. Dan Shoemaker Cyber security The Essential Body of Knowledge, 1st ed. Cengage Learning 2011.
4. Augastine, Paul T.,” Cyber Crimes and Legal Issues”, Crecent Publishing Corporation, 2007.

CT 591 – Fuzzy Set Theory and Applications

Lecture: 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. basics of the fuzzy sets.
2. extension principles and relations on fuzzy sets.
3. applications of the fuzzy set theory.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. know the basic operations of the fuzzy sets.
2. know various types of fuzzy sets.
3. familiarize with the principles of the fuzzy sets, relations and fuzzy graphs.
4. acquainted with functions on fuzzy sets and modeling of uncertainty.
5. familiarize with applications of fuzzy sets and expert systems.

UNIT-I: **[12 Periods]**

Introduction to Fuzzy Sets: Crispness, Vagueness, Fuzziness, Uncertainty, Fuzzy Set Theory,Fuzzy Mathematics.

Fuzzy Sets-Basic Definitions: Basic Definitions, Basic Set-Theoretic Operations for Fuzzy Sets.

UNIT-II: **[12 Periods]**

Extensions: Types of Fuzzy Sets Further Operations on Fuzzy Sets**,** Algebraic Operations**,** Set-Theoretic Operations**,** Criteria for Selecting Appropriate Aggregation Operators.

Fuzzy Measures and Measures of Fuzziness: Fuzzy Measures, Measures of Fuzziness.

UNIT-III: **[12 Periods]**

The Extension Principle and Applications, The Extension Principle, Operations for Type 2 Fuzzy Sets, Algebraic Operations with Fuzzy Numbers, Special Extended Operations, Extended Operations for LR-Representation of Fuzzy Sets.

Fuzzy Relations and Fuzzy Graphs, Fuzzy Relations on Sets and Fuzzy Sets, Compositions of Fuzzy Relations, Properties of the Min-Max Composition, Fuzzy Graphs, Special Fuzzy Relations.

UNIT-IV: **[12 Periods]**

Fuzzy Analysis, Fuzzy Functions on Fuzzy Sets, Extrema of Fuzzy Functions, Integration of Fuzzy Functions, Integration of a Fuzzy Function over a Crisp Interval ,Integration of a (Crisp) Real-Valued Function over a Fuzzy Interval, Fuzzy Differentiation.

Uncertainty Modelling: Application-oriented Modelling of Uncertainty, Causes of Uncertainty, Type of Available Information, Uncertainty Methods, Uncertainty Theories as Transformers of Information, Matching Uncertainty Theory and Uncertain Phenomena.

UNIT-V: **[12 Periods]**

Fuzzy Logic and Approximate Reasoning: Linguistic Variables, Fuzzy Logic, Approximate and Plausible Reasoning, Fuzzy Languages.

Fuzzy Sets and Expert Systems: Introduction to Expert Systems, Uncertainty Modeling in Expert Systems, Applications.

Text Book:

1. H.-J. Zimmermann,"Fuzzy Set Theory-and Its Applications", Fourth Edition, Springer Science+Business Media, LLC.

Reference Books:

1. Kwang H.Lee, "First course on Fuzzy Theory and Applications", Springer, 2005.
2. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic -Theory and Applications", Prentice Hall.

CT 592 – Natural Language Processing

Lecture: 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. concepts and techniques for natural language processing.
2. syntax and semantics in NLP.
3. computational models for natural language processing.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. determine the structural components of sentences for a given Grammar.
2. represent context-independent meaning of a sentence.
3. know semantic interpretation of the sentence.
4. identify the ambiguity and possible interpretations of a sentence.
5. generate contextual representation.

UNIT-I: **[9 Periods]**

INTRODUCTION TO NATURAL LANGUAGE UNDERSTANDING: Applications of Natural Language Understanding, Evaluating language Understanding Systems, The Different levels of Language Analysis.

GRAMMARS AND PARSING: Grammars and Sentence Structure, Top- down parser, Bottom up chart parser, Transition network grammars, Top-down chart parsing, finite state models and Morphological processing.

UNIT-II: **[9 Periods]**

FEATURES AND AUGMENTED GRAMMARS: Feature Systems and Augmented Grammars ,Morphological Analysis and the Lexicon, A Simple Grammar Using Features, Parsing with Features, Augmented Transition Networks.

GRAMMARS FOR NATURAL LANGUAGE: Auxiliary Verbs and Verb Phrases, Movement Phenomenon In Language, Handling Questions in Context-Free Grammars.

UNIT-III: **[9 Periods]**

TOWARD EFFICIENT PARSING: Human preferences in parsing, Encoding Uncertainty-Shift-Reduce Parsers, A Deterministic Parser.

AMBIGUITY RESOLUTION: Statistical Methods: Part of Speech tagging, Obtaining lexical probabilities, Probabilistic Context-Free Grammars, Best-First Parsing.

UNIT-IV: **[9 Periods]**

SEMANTICS AND LOGICAL FORM: Semantics and Logical Form Word Senses and Ambiguity, The Basic Logical Form Language, Encoding Ambiguity in the Logical Form, Verbs and States in Logical Form.

LINKING SYNTAX AND SEMANTICS: Semantic Interpretation and Compositionality, A Simple grammar and Lexicon with Semantic Interpretation, Prepositional Phrases and Verb Phrases.

Unit-V: **[9 Periods]**

AMBIGUITY RESOLUTION: Selectional Restrictions, Semantic Filtering Using Selectional Restrictions, Statistical Word Sense Disambiguation. Scoping and the Interpretation of Noun Phrases: Scoping Phenomena, Definite Descriptions and Scoping.

USING WORLD KNOWLEDGE: Using world knowledge: Establishing Coherence, Matching against Expectations, Reference and Matching Expectations, Using Knowledge About Action and Casuality, Scripts: Understanding Stereotypical Situations

Text Book:

1. James Allen, Natural Language Understanding, Second Edition, Pearson Education.

Reference Books:

1. Daniel Jurafsky, James H.Martin, Speech and Language Processing.
2. Christopher Manning, HinrichSchutze, “Foundations of Statistical Natural Language Processing”, MIT Press.
3. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Second Edition, Tata McGraw Hill.
4. www.pcai.com/web/ai_info/natural_lang_proc.html.
5. www.pcai.com/web/ai_info/natural_long_proc.html.
6. https://en.wikipedia.org/wiki/natural_language_processing.

CT 593 – Software Architecture

Lecture: 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand

1. software architectural requirements and drivers.
2. architectural styles and views.
3. architectures for emerging technologies.

Course Learning Outcomes: After successful completion of this course, student will be able to 1. develop software architecture for business cycle.

2. identify key architectural quality.
3. use Architectural Description Language.
4. reuse Architectural styles and views in an organization.
5. reuse Architectural assets – community wise .

UNIT-I: **[10 Periods]**

The Architecture Business Cycle: Where d Architectures Come From?, Software Processes and the Architecture Business Cycle, What makes a "Good Architecture"

What is Software Architecture?: What Software Architecture is and What it Isn't, Architecture Styles, Reference Models, and Reference Architectures, Why is Software Architecture Important? Architectural Structures.

UNIT – II: **[10 Periods]**

Quality Attributes: Architectures and Quality Attributes, Architectural Means for Achieving Qualities.

Moving From Qualities to Architecture: Architectural Styles: Introducing Architectural Styles, Organizing Architectural Styles, Refinements of Styles, Using Styles in System Design.

UNIT – III: [10 Periods] Architecture Description Languages: Architecture Description Languages Today, Capturing Architectural Information in an ADL, How Do ADLs Help System Development?, Choosing and ADL.

Architecture-Based Development: Forming the Team Structure, Creating a Skeletal System, Exploiting Patterns in Software Architecture.

UNIT – IV: **[10 Periods]**

Product Lines: Reusing Architectural Assets within an Organization: Creating Products and Evolving a Product Line, Organizational Implications of a Product Line, Component-Based Systems.

UNIT –V: **[10 Periods]**

Community wide Reuse of Architecture assets: Reference Architectures, Open Systems, The Process of Engineering an Open System, Standards.

Text Books:

1. Len Bass, Paul Clements, and Rick Kazman, “Software Architecture in Practices”, Addison-Wesley, 2003.

Reference Books:

1. Paul Clements, Felix Bachmann, Len Bass, David Garlan, James Ivers, Reed Little, Paulo Merson, Robert Nord, and Judith Stafford, “Documenting Software Architectures. Views and Beyond”, 2nd Edition, Addison-Wesley, 2010.
2. Paul Clements, Rick Kazman, and Mark Klein, “Evaluating software architectures: Methods and case studies. Addison-Wesley, 2001.
3. Anthony J Lattanze, “Architecting Software Intensive System. A Practitioner's Guide”, CRC Press, 2010.

CT 594 – Semantic Web

Lecture: 4 Periods/Week **Internal: 40 Marks**
Practical: -- **External: 60 Marks**
Credits: 4

Course Learning Objectives: At the end of the Course Students will understand concepts of

1. Traditional and Semantic Web.
2. Web Ontology Language and Inference rules.
3. Ontology's and Semantic Web search engine and services.

Course Learning Outcomes: After successful completion of this course, student will be able to

1. familiarize with Semantic Web technologies.
2. write Resource Document Format for Semantic Web-systems.
3. analyze Semantic web structures by using Ontology Web Language and Inference rules.
4. use Ontologies in Semantic Web-system.
5. develop Semantic Web applications.

UNIT I: **[10 Periods]**

The Semantic Web: Vision, Semantic Web Technologies, A Layered Approach

The world of the semantic web: WWW-meta data-Search engine-Search engine for traditional web-Semantic web-Search engine for semantic web-Traditional web to semantic web.

UNIT II: **[10 Periods]**

Describing Web Resources: RDF, Basic Ideas, XML Based Syntax RDF Schema **RDF and RDF**

Schema in RDF Schema: Basic Ideas, The Language, An Axiomatic Semantics for RDF and RDF Schema, A Direct Inference System for RDF and RDFS, Querying in RQL.

UNIT III: **[10 Periods]**

Web Ontology Language OWL: The OWL Language, OWL in OWL, Future Extension

Logic and Inference-Rules: Monotonic Rules- syntax, semantics, Rule Markup in XML, Non monotonic Rules- syntax, semantics, Rule Markup in XML

UNIT IV: **[10 Periods]**

Ontology Engineering: Constructing Ontologies Manually, Reusing Existing Ontologies,

Using Semiautomatic Methods: OnToKnowledge Semantic Web Architecture, Application project

UNIT V: SEMANTIC WEB SERVICES **[10 Periods]**

Swoogle: Swoogle, FOAF, Semantic markup Issues, prototype system, Design of Semantic web search engine, prototype system-case study.

Semantic Web Services: Semantic web services, OWL-S, Upper ontology, WSDL-S, OWL-S to UDDI mapping, Design of the search engine, implementations

Text Books:

1. Antoniou Grigoris , Groth Paul, Harmelen Frank Van, Hoekstra Rinke, “A Semantic Web Primer” , 3ed , PHI pub.(Unit-I to IV)
2. Liyang Yu, “Semantic Web and Semantic Web Services”, CRC 2007(Unit-I & V).

Reference Books:

1. Karin K Brietman, Marco Antonio Casanova, Walter Truszkowski, “Semantic Web – Concepts”, Technologies and Applications. Springer 2007.
2. Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph, ”Foundations of Semantic Web Technologies”, CRC Press.

CT 551 – Advanced Programming Lab

Lecture: -- **Internal: 40 Marks**
Practical: 3 Periods/Week **External: 60 Marks**
Credits: 2

CT 552 – Data Base Technologies Lab

Lecture: -- **Internal: 40 Marks**
Practical: 3 Periods/Week **External: 60 Marks**
Credits: 2

CT 561 – Machine Learning Lab

Lecture: -- **Internal: 40 Marks**
Practical: 3 Periods/Week **External: 60 Marks**
Credits: 2

CT 562 – Industry Related Lab

Lecture: -- **Internal: 40 Marks**
Practical: 3 Periods/Week **External: 60 Marks**
Credits: 2

NOTE: Laboratory work will be based on concerned subject syllabus with minimum 10 experiments to be incorporated. The self-study contents will be declared at the commencement of semester. Around 50% of the Questions will be asked from self study contents.