BIRLA INSTITUTE OF TECHNOLOGY
MESRA
RANCHI, INDIA

CHOICE BASED CURRICULUM

Computer Science and Engineering

P.G Programme

(M. Tech in Information Technology)

Department of Computer Science & Engineering

Birla Institute of Technology, Mesra, Ranchi - 835215 (India)

Institute Vision

To become a Globally Recognized Academic Institution in consonance with the social, economic and ecological environment, striving continuously for excellence in education, research and technological service to the National needs.

Institute Mission

- To educate students at Undergraduate, Postgraduate Doctoral and Post-Doctoral levels to perform challenging engineering and managerial jobs in industry.
- To provide excellent research and development facilities to take up Ph.D. programmes and research projects.
- To develop effective teaching and learning skills and state of art research potential of the faculty.
- To build national capabilities in technology, education and research in emerging areas.
- To provide excellent technological services to satisfy the requirements of the industry and overall academic needs of society.

Department Vision

The department strives to be recognized for outstanding education and research, leading to excellent professionals and innovators in the field of Computer Science and Engineering, who can positively contribute to the society.

Department Mission

- To impart quality education and equip the students with strong foundation that could make them capable of handling challenges of the new century.
- To maintain state of the art research facilities and facilitate interaction with world's leading universities, industries and research organization for constant improvement in the quality of education and research.

Programme Educational Objectives (PEOs) – Computer Science and Engineering

PEO1: Students are trained in such a way that makes them capable of exploiting and enhancing theoretical and practical knowledge in various domains of information technology.

PEO2: Students are imparted with strong base of knowledge that makes them suitable for industry, teaching and research.

PEO3: Students are trained to develop practical and efficient solutions to the challenges in the growing field of IT industry to gain leadership positions in their organization and/or teams.

PEO4: Students are inculcated with the sensitivity towards ethics, public policies and their responsibilities towards the society to gain trust and respect of others as ethical team members.

PROGRAM OUTCOMES (POs)
M. Tech. in Information Technology

PO1: An ability to independently carry out research /investigation and development work to solve practical problems.

PO2: Ability to write and present a substantial technical report/document.

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO4: In depth understanding of fundamental principles and concepts of various domains of Information Technology.

PO5: Ability for analytical and critical thinking in order toanalyze, design and improve existing tools and techniques.

PO6: Ability to carry on independent research to solve practical problems and have a promising career in academics as well as industry.

COURSE INFORMATION SHEET

Course code: CS501
Course title: MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE
Pre-requisite(s): Discrete Mathematics
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Present basic concepts and techniques of linear algebra, probability, statistics and graph theory
2.	Develop mathematical thinking and problem-solving skill
3.	Provide the foundations of probabilistic and statistical analysis
4.	Explain graphs to formulate computational problems

Course Outcomes

After the completion of this course, students will be able to:

CO1	Demonstrate skills in solving mathematical problems
CO2	Apply knowledge of computing and mathematics appropriate to the discipline
CO3	Analyze problems and identify the computing requirements appropriate to its solution
CO4	Understand basic concepts in probability theory and statistical analysis
CO5	Study the advanced courses in Computer science such as Coding Theory, Artificial Intelligence, Numerical Computation, etc.

SYLLABUS

Module I:
Linear Algebra
Introduction: Matrices and solving set of linear equations, Vector space, Subspace, Linear combination of vectors, Linear dependence and independence of vectors, Bases and dimensions.

(8L)

Module II:
Inner product spaces, Orthogonal vectors and dual vectors, Eigen values and Eigen vectors, Linear programming.

(8L)

Module III:
Probability and Statistics
Frequency distribution and measures of central tendency, mean, median mode, quartiles, measures of dispersions and skewness, standard deviation, mean deviation, coefficient of variation, moments.

(8L)

Module IV:
Probability: definition, Distribution: discrete and continuous, Chi-square test, t-test.

(8L)

Module V:
Graph Theory
Introduction: Graphs and its types, Representation of graphs: Adjacency matrix, Incidence matrix, Adjacency list, Planar graph, Kuratowski's Graphs, Clique and maximum Clique finding algorithms.

(8L)

Books recommended:

TEXT BOOK

1. K. Haffman, and R. Kunze, "Linear Algebra", 2nd Edition, Pearson, 2015.**(T1)**
2. G. Williams, "Linear Algebra with Applications", 4th Edition, John & Bartlett.**(T2)**
3. W. Navidi, "Statistics for Engineers and Scientists", 2nd Edition, TMH, 2008.**(T3)**
4. J.K. Goyal, and J. N. Sharma, "Mathematical Statistics", Krishna Prakashan, 2017**(T4).**

REFERENCE BOOK

1. NarasinghDeo, "Graph Theory with Applications to engineering and Computer Science", Prentice Hall of India, 2001.**(R1)**
2. Douglas B. West, "Introduction to Graph theory", Pearson Education, 2002.**(R2)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:
Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	1
CO2	3	3	1	1	1	1
CO3	2	3	2	1	1	1
CO4	3	2	1	1	1	1
CO5	3	1	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS502
Course title: ADVANCED DATA STRUCTURES
Pre-requisite(s): Data Structures, Algorithm Analysis
Co- requisite(s):
Credits: 3 L: 3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

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

Course Outcomes

After the completion of this course, students are expected to:

CO1	Understand the implementation of symbol table using hashing techniques.
CO2	Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
CO3	Develop algorithms for text processing applications.
CO4	Learn the basic working of advanced heaps.
CO5	Understand the implementation of symbol table using hashing techniques.

SYLLABUS

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

(8L)

Module II:
Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

(8L)

Module III:
Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

(8L)

Module IV:
Heaps: Balanced Search Trees as Heaps, Array-Based Heaps, Heap-Ordered Trees and Half-Ordered Trees, Leftist Heaps, Skew Heaps, Binomial Heaps, Changing Keys in Heaps, Fibonacci Heaps, Heaps of Optimal Complexity, Double-Ended Heap Structures and Multidimensional Heaps, Heap-Related Structures with Constant-Time Updates.

(8L)

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

(8L)

Books recommended:

TEXT BOOK

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++," 2nd Edition, Pearson, 2004.**(T1)**
2. Peter Brass, "Advanced Data Structures," Cambridge University Press, 1stEdition.**(T2)**
3. M T Goodrich, & Roberto Tamassia, "Algorithm Design," John Wiley, 2002.**(T3)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	1	1	1
CO2	2	3	3	1	1	1
CO3	2	3	3	2	1	1
CO4	3	1	1	1	1	1
CO5	3	1	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6
CO3	CD1, CD2, CD3,CD4
CO4	CD1, CD3,CD6
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT501
Course title: INFORMATION THEORY AND CODING
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

After the completion of this course, students will be able to:

1.	To understand the role of information theory for an efficient, error-free and secure delivery of information using binary data streams.
2.	To have a complete understanding of error-control coding.
3.	To understand encoding and decoding of digital data streams.
4.	To introduce methods for the generation of these codes and their decoding techniques.
5.	To have a detailed knowledge of compression and decompression techniques.
6.	To evaluate the performance of various coding techniques over noisy communication channels.

Course Outcomes

After the completion of this course, students will be able to:

CO1	To be able to understand the principles behind an efficient, correct and secure transmission of digital data stream.
CO2	To be familiar with the basics of error-coding techniques.
CO3	To have knowledge about the encoding and decoding of digital data streams.
CO4	Generation of codes and knowledge about compression and decompression techniques.
CO5	To be able to understand the performance requirements of various coding techniques.
CO6	To produce professionals who will be able to conduct research in information theory.

SYLLABUS

Module I:

Source Coding: Introduction to Information Theory, Uncertainty and Information, Average Mutual Information and Entropy, Information Measure for Continuous Random Variables, Source coding theorem, Huffman Coding, Shannon- Fano -Elias Coding, Arithmetic Coding, The Lempel-Ziv Algorithm, Run Length Encoding, and the PCX Format, Rate Distribution Function, Optimum Quantizer Design, Entropy Rate of a Stochastic Process.

(8L)

Module II:

Channel Capacity and Coding: Introduction, Channel Model, Channel Capacity, Channel Coding, Information Capacity Theorem, the Shannon Limit, Channel Capacity for MIMO System, Random Selection of Code. Error Control Coding (Channel Coding).

(8L)

Module III:

Linear Block Codes for Error Correction: Introduction to Error Correction Codes, Basic Definitions, Matrix Description of Linear Block Codes, Equivalent Codes, Parity Check Matrix, Decoding of Linear Block Code, Syndrome Decoding, Error Probability after Coding (Probability of Error Correction), Perfect Codes, Hamming Codes, Low Density Parity Check (LDPC) Codes, Optimal Linear Codes, Maximum Distance Separable (MDS) Codes, Bound on Minimum Distance, Space Time Block Codes.

(8L)

Module IV:

Cyclic Codes: Introduction to the Cyclic Codes, Polynomials, The Division Algorithm for Polynomials, A Method for Generating Cyclic Codes, Matrix Description of Cyclic Codes, Burst Error Correction, Fire Codes, Golay Codes, Cyclic Redundancy Check(CRC) Codes, Circuit Implementation of Cyclic Codes.

(8L)

Module V:

Bose Chaudhuri Hocquenghem (BCH) Codes: introduction to the Codes, Primitive Elements, Minimal Polynomials, Generator Polynomials, in Terms of Minimal Polynomials, Some Examples if BCH Codes, Reed –Solomon Codes, Implementation of Reed –Solomon Encoders and Decoders, Performance of RS Codes Over Real Channels, Nested Codes.

(8L)

Books recommended:

TEXT BOOKS

1. R. Bose, "Information theory Coding and Cryptography," 2nd Edition, McGraw-Hill, 2008.**(T1)**

REFERENCE BOOKS

1. ArijitSaha, Nilotpal Manna, Surajit Mandal, Information Theory, Coding and cryptography, Pearson India, 2013.**(R1)**
2. Cover Thomas and Joy Thomas, Elements of Information Theory, Wiley India Pvt. Ltd. 2nd Edition, 2006.**(R2)**
3. Salvatore Gravano, Introduction to errorControl Codes, Oxford Univ. Press, 2017.**(R3)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	1	1
CO2	3	2	3	3	1	1
CO3	3	3	3	2	1	2
CO4	2	2	3	3	1	2
CO5	2	3	3	2	1	1
CO6	2	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD4
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6
CO5	CD1,CD2, ,CD5,CD7

PROGRAM ELECTIVE – I

COURSE INFORMATION SHEET

Course code: CS506
Course title: MACHINE LEARNING
Pre-requisite(s): Design of Algorithms, Mathematics 2, Artificial Intelligence
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students:

1.	To formulate machine learning problems corresponding to different applications.
2.	To understand various supervised, semi-supervised and unsupervised machine learning algorithms.
3.	To familiarize various machine learning software libraries and data sets publicly available.
4.	To develop machine learning based system for various real-world problems.
5.	To assess how the choice of a machine learning algorithm impacts the accuracy of a system.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Formulate machine learning problems corresponding to different applications: data, model selection, model complexity
CO2	Demonstrate understanding of a range of machine learning algorithms along with their strengths and weaknesses
CO3	Implement machine learning solutions to classification, regression, and clustering problems
CO4	Design and implement various machine learning algorithms in a range of real-world applications
CO5	Evaluate and analyse the performance of a machine learning algorithm or a system based on machine learning algorithm.

SYLLABUS

Module I:
Introduction to Machine Learning
Machine Learning – what and why? Basics of Linear Algebra and Statistics, Overview of target function representations; Linear Regression.

(8L)

Module II:
Supervised Learning
Basics of Feature Selection and Evaluation, Decision Tree, Overfitting and Pruning, Logistic regression, Support Vector Machine and Kernel; Noise, bias-variance trade-off, under-fitting and over-fitting concepts.

(8L)

Module III:
Neural Networks
Perceptrons: representational limitation and gradient descent training. Multilayer networks and backpropagation. Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks.

(8L)

Module IV:
Unsupervised and Semi Supervised Learning
Learning from unclassified data. Clustering. Hierarchical Agglomerative Clustering. k-means partitional clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labeled and unlabled data.

(8L)

Module V:
Ensemble
Committees of multiple hypotheses, bagging, boosting, active learning with ensembles.

(8L)

Books recommended:

TEXT BOOKS

1. Tom Mitchell, "Machine Learning", Latest Edition, Mc-Graw Hill.**(T1)**

REFERENCE BOOKS

1. Shai Shalev-Shwartz, and Shai Ben-David, "Understanding Machine Learning", Cambridge University Press, 2017.**(R1)**
2. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.**(R2)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	1	1
CO2	3	2	3	3	1	1
CO3	3	3	3	2	1	2
CO4	3	3	3	3	2	2
CO5	3	3	3	2	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD4
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT503
Course title: WIRELESS SENSOR NETWORKS
Pre-requisite(s): Basic Networking Fundamentals
Co-requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Familiarize with the principles of sensor nodes, network deployment and architectures.
2.	Know the data transmission and routing protocols. Know the differences among different networks.
3.	Analyze or compare the performance of different routing and MAC protocol
4.	Evaluate the performance of different MAC protocols and clustering algorithm
5.	Compute the throughput and channel utilization for different network scenarios.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Obtain a broad understanding about the network architecture of wireless sensor network.
CO2	Understand all basic characteristics of wireless sensor networks and sensor nodes.
CO3	Understand the principles of data transmission, clustering algorithm and routing protocols.
CO4	Analyze and evaluate different constraint of wireless sensor network, e.g., coverage, power management, security and data collisions.
CO5	Design and development of new sensor network architecture.

SYLLABUS

Module I:
Fundamentals of Sensor Networks
Introduction to wireless sensor networks, Wireless Sensor nodes- Sensing and sensors- challenges and constraints - node architecture-sensing subsystem, processor subsystem communication interfaces- prototypes, Application of Wireless sensors.

(8L)

Module II:
Communication Characteristics and Deployment Mechanisms
Wireless Transmission Technology and Systems-Radio Technology Primer-Available Wireless Technologies - Hardware- Telosb, Micaz motes- Time Synchronization Clock and the Synchronization Problem - Basics of time Synchronization-Time synchronization protocols - Localization- Ranging Techniques- Range based Localization-Range Free Localization- Event driven Localization.

(8L)

Module III:
Mac Layer
Overview-Wireless Mac Protocols-Characteristics of MAC protocols in Sensor networks – Contention free MAC Protocols- characteristics- Traffic Adaptive Medium Access-Y-MAC, Low energy Adaptive Clustering - Contention based MAC Protocols, Power Aware Multi-Access with signalling, Sensor MAC-Timeout MAC-Data gathering MAC.

(8L)

Module IV:
Routing in Wireless Sensor Networks
Design Issues in WSN routing- Data Dissemination and Gathering-Routing Challenges in WSN - Flooding-Flat Based Routing – SAR, Directed Diffusion, Hierarchical Routing- LEACH, PEGASIS - Query Based Routing- Negotiation Based Routing Geographical Based Routing- Transport layer- Transport Protocol Design issues, Performance of Transport Control Protocols.

(8L)

Module V:
Middleware and Security Issues
WSN middleware Principles-Middleware Architecture-Existing middleware - operating systems for wireless sensor networks-performance and traffic management - Fundamentals of network security-challenges and attacks - Protocols and mechanisms for security.

(8L)

Books recommended:

TEXT BOOKS

1. WaltenegusDargie, Christian Poellabauer, “Fundamentals of Wireless Sensor Networks, Theory and Practice”, Wiley Series on wireless Communication and Mobile Computing, 2011.**(T1)**
2. KazemSohraby, Daniel manoli, “Wireless Sensor networks- Technology, Protocols and Applications”, Wiley Inter Science Publications 2010. **(T2)**

REFERENCE BOOKS

1. BhaskarKrishnamachari, “Networking Wireless Sensors”, Cambridge University Press, 2005. **(R1)**

2. C.S Raghavendra, Krishna M.Sivalingam, Taiebznati, "Wireless Sensor Networks", Springer Science 2004.**(R2)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	1
CO2	3	2	1	1	1	1
CO3	3	3	1	1	1	1
CO4	2	3	2	1	1	1
CO5	2	3	3	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS507
Course title: COMPUTABILITY AND COMPLEXITY THEORY
Pre-requisite(s): Automata Theory and Computer algorithms
Co-requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Give introduction to the mathematical foundations of computation including automata
2.	Learn about the issues in finite representations for languages and machines, as well as gain a more formal understanding of algorithms and procedures.
3.	Motivate and expose to the fundamental understanding of computation under resource constraints.
4.	Set a research level exposure to deeper topics in complexity theory.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Relate formal languages and mathematical models of computation
CO2	Attain knowledge about different types of languages and the corresponding machines for computations
CO3	Understand the limitations on what computers can't do, and learn examples of unsolvable problems
CO4	Analyse P, NP, NP-C, NP-Hard, Tractable and Intractable problems
CO5	Explain reduction of problems for easy and hard problems

SYLLABUS

Module I:
Basic background on automata and languages, Types of automata and languages, Turing machines,Encoding and Enumeration of Turing Machines, k-tape Turing machines, non-deterministic Turing machines, Universal Turing machine, Resource bounded computation, Halting problem.

(8L)

Module II:
Context Sensitive Language andChomosky Hierarchy Recursive enumerable languages, Recursive languages, Decidable and recognizable language, Turing-decidable languages, Turing-recognizable languages, Kolmogorov Complexity

(8L)

Module III:
Primitive recursive function, partial recursive function, Recursive and recursive enumeration sets, Programming systems, Unsolvable problems, a non-recursive language and an unsolvable problem, Rice Theorem, More unsolvable problems, PCP

(8L)

Module IV:
Measuring complexity- Big O, small oh and other notations, Analysing algorithms, Time and space complexity of a Turing machine, Complexity analysis of multi-tape TM

(8L)

Module V:
Complexity classes: P, NP, NP-C, NP-Hard problem, PSPACE, NP-complete problems-clique, vertex cover, Hamiltonian cycle, graph colouring problem, graph isomorphism, Reduction from NP-C problem to another problem, Cook-Levin Theorem,Tractable and Intractable problems, Reducing one problem to another problem**,** Additional classes of problems- RP**,** ZPP.

(8L)

Books recommended:

TEXT BOOK

1. Lewis H.R., Papadimitriou C.H.- Elements of the Theory of Computation:, PHI Publ. , 2nd edition, New Delhi. **(T1)**

REFERENCE BOOKS

1. Hopcroft J.E., Motwani R. and Ullman J.D, Introduction to Automata Theory, Languages and Computations, Second Edition, Pearson Education, 2008.**(R1)**
2. John Martin. Introduction to Languages and the Theory of Computation, 3rd ed. McGraw Hill, New York, NY, 2003.**(R2)**
3. Dexter Kozen, Theory of Computation, Springer publication. **(R3)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	1
CO2	3	2	1	1	1	1
CO3	3	3	1	1	1	1
CO4	2	3	2	1	1	1
CO5	2	3	3	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

OPEN ELECTIVE – I

COURSE INFORMATION SHEET

Course code: CS514
Course title: SOFTWARE METRICS
Pre-requisite(s): Software Engineering, Software Testing
Co- requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

After the completion of this course, students will be:

1.	Provide a basic understanding and knowledge of the software metrics.
2.	Understand the importance of Metrics data collection.
3.	Analysis and Metrics for object-oriented systems.
4.	Understand external product attributes, Dynamic Metrics and Resource measurement.

Course Outcomes

After the completion of this course, students will be:

CO1	Able to understand the importance of the software development process.
CO2	Analyze the importance of modelling and modelling language.
C03	Design and develop correct and robust software products.
CO4	Explain the business requirements pertaining to software development.
CO5	Design Metrics for object-oriented systems.

SYLLABUS

ModuleI:
Basics of measurement : Measurement in software engineering Scope of software metrics Representational theory of measurement Measurement and models Measurement scales Meaningfulness in measurement Goal-based framework for software measurement Classifying software measures Determining what to measure Software measurement validation Empirical investigation Types of investigation Planning and conducting investigations.

(8L)

ModuleII:
Measuring size, Aspects of software size Length, functionality and complexity Measuring structure Types of structural measures Control-flow structure Modularity and information flow attributes Data structures.

(8L)

ModuleIII:
Modeling software quality Measuring aspects of software quality Software reliability Basics of software reliability Software reliability problem Parametric reliability growth models Predictive accuracy Recalibration of software-reliability growth predictions Importance of operational environment Wider aspects of software reliability.

(8L)

ModuleIV:
The intent of object-oriented metrics Distinguishing characteristics of object-oriented metrics Various object-oriented metric suites LK suite CK suite and MOOD metrics
Runtime Software Metrics Extent of Class Usage Dynamic Coupling Dynamic Cohesion and Data Structure Metrics.

(8L)

ModuleV:
The intent of component-based metrics, Distinguishing characteristics of comp.
Measuring productivity, teams, tools, and methods.

(8L)

Books recommended:

TEXT BOOK

1. "Software Metrics: A rigorous and Practical Approach" by Norman E. Fenton and Shari Lawrence Pfleeger, International Thomson Computer Press, 2nd Edition, 1997. **(T1)**
2. "Applied Software Measurement" by Capers Jones, McGraw Hill, 2008. **(T2)**

REFERENCE BOOK

1. "Object-Oriented Software Metrics" by Mark Lorenz, Jeff Kidd, Prentice Hall, 1994. **(R1)**
2. "Practical Software Metrics For Project Management And Process Improvement" by Robert B Grady, Hewlett Packard Professional Books, 1st Edition, 2004.**(R2)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	2	2	3	1	1	1
CO3	1	3	3	2	2	2
CO4	3	3	3	2	1	1
CO5	2	1	3	3	3	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS522
Course title: PATTERN RECOGNITION AND APPLICATION
Pre-requisite(s): Linear Algebra, Vector Calculus, Data Structure& Programming
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M.Tech
Semester / Level:I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Be familiar with both the theoretical and practical aspects Pattern Recognition.
2.	Have described the foundation of pattern formation, measurement, and analysis.
3.	Understand the mathematical and computer aspects of while extracting features of an object.
4.	Learn the techniques of clustering and classification for various applications.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Apply their knowledge on Real World Problems while converting these problems to computer compatible problems for Pattern Recognition.
CO2	Solve Decision-making model using Statistical and Mathematical Decision Theory.
CO3	Design clusters for various Pattern using classical and Modern clustering techniques.
CO4	Analyzing various Techniques for Pattern Classification and Clustering.
CO5	Develop Model for Pattern classification through Probabilistic or fuzzy.

SYLLABUS

Module I:
Introduction: Feature Vectors, Classifiers, Supervised, Unsupervised, MATLAB Tools. Classifiers Based on Bayesian Theory, Linear Classifiers, Nonlinear Classifiers.

(8L)

ModuleII:
Feature Selection, Feature Generation I: Data Transformation and Dimensionality Reduction, Feature Generation II.

(8L)

Module III:
Template Matching, Context Dependent Classification, Super vised Learning.

(8L)

Module IV:
Clustering Basic Concepts, sequential Algorithms.

(8L)

ModuleV:
Hierarchical algorithms, Fuzzy clustering, probabilistic clustering, Hard Clustering, Optimization.

(8L)

Books recommended:

TEXT BOOK

1. "Pattern Recognition" by S Theodoridis, K Koutroumbas, Elsevier, 5thEdition, 2015.**(T1)**
2. "Pattern Recognition" by N NarshimaMurty, Springer, University press, 2nd Edition, 2015. **(T2)**

REFERENCE BOOK

1. R.O.Duda et.al,"Pattern Classification", 2ndEdition, John Wiley, New York, 2002. **(R1)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:
Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
CO3	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT518
Course title: INTERNET OF THINGS
Pre-requisite(s):
Co-requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Understand the basic concept and the IoT Paradigm
2.	Know the state of art architecture for IoT applications
3.	Learn the available protocols used for IoT
4.	Design basic IoT Applications.
5.	Evaluate optimal IoT applications.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Identify the IoT Components and its capabilities
CO2	Explain the architectural view of IoT under real world constraints
CO3	Analyse the different Network and link layer protocols
CO4	Evaluate and choose among the transport layer protocols
CO5	Design an IoT application

SYLLABUS

Module I:

IoT-An Architectural Overview

An Architectural Overview Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.

(8L)

ModuleII:

IoT Architecture-State of the Art

State of the art, Reference Model and architecture, IoT Reference Architecture; Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

(8L)

ModuleIII:

Sensor Technology, RFID Technology, WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M CoAP, REST, Zigbee, Bluetooth

(8L)

ModuleIV:

Transport & Session Layer Protocols

Mobile IPv6 technology for IoT, 6LoWPAN,Transport Layer TCP, MPTCP, UDP, DCCP,

Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

(8L)

ModuleV:

Layer Protocols & Security

Introduction, Technical Design constraints. Implementation Examples. Security and Interoperability.

(8L)

Books recommended:

TEXT BOOK

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.**(T1)**
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6". **(T2)**

REFERENCE BOOK

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer. **(R1)**
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI. **(R2)**
3.

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
CO3	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT522
Course title: CYBER SECURITY AND DIGITAL FORENSICS
Pre-requisite(s): Computer Basics, Programming and Problem solving
Co-requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech.
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students:

1.	Know about computer-based crime.
2.	Understand Technical and legal aspects of computer crime investigations
3.	Know the limitations of law and its enforcement agencies.
4.	Learn the procedures of recovering computer evidence and seize process.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Exposure on computer-based crime.
CO2	Technical and legal aspects of computer crime investigations
CO3	Know the limitations of law and its enforcement agencies.
CO4	Learn the procedures of recovering computer evidence and seize process.
CO5	Apply techniques for finding, preserving, presenting, and extracting information from the digital devices.

SYLLABUS

ModuleI:
Introduction: Cyberspace and Criminal Behavior, Traditional problems associated with computer-based crime, e cash problems, Computer Technology and History: Computer Language, Hardware, software, operating system, Internet, Network language.

(8L)

ModuleII:
Early Hackers and Theft Components: Phreakers, Hacking, Commodities, Intellectual property. Contempory computer crime: web based criminal activity, money laundering,

(8L)

Module III:
Identity theft and identity fraud: Typologies of internet theft, virtual identity, credit identity. Prevalence and victimology, physical methods, of identity theft, phishing, spyware, trojans, insurance and loan fraud, immigration fraud. Terrorism and organized crime:Terror online, criminal activities, organized crime as cyber gangs., technology used in organized crime. Data piracy.

(8L)

Module IV:
Avenues for Prosecution and Government efforts: Act, Law enforcement agencies, International efforts, Cyber law and its amendments of current state, other legal considerations.

(8L)

ModuleV:
Forensic Terminologies and Developing forensic capabilities, Searching and seizing computer related evidence, Processing of evidence and report preparation.

(8L)

Books recommended:

TEXT BOOK

1. "Computer Forensics and Cyber Crime" by M.T.Britz, Pearson Education, First Impression, 2012.**(T1)**
2. "Computer Crime and investigation" by E Casey, Springer, 1st Edition, 2001. **(T2)**

REFERENCE BOOK

1. "Computer Crime Investigations and Law" by C Easttom&D.J.Taylor, Carenage Learning. **(R1)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	1	1	2	1
CO2	3	3	3	1	1	1
CO3	3	3	3	2	1	1
CO4	2	3	2	2	2	1
CO5	2	3	2	2	2	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS503
Course title: ADVANCED DATA STRUCTURES LAB
Pre-requisite(s):
Co- requisite(s): Advanced Data Structures
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

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

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand to implement the symbol table using hashing techniques.
CO2	Develop program for AVL, Red-Black trees, B-trees and Splay trees
CO3	Develop program for text processing applications
CO4	Learn the basic working of advanced heaps
CO5	Understand the implementation of symbol table using hashing techniques

SYLLABUS

List of Programs as Assignments:

1. Lab Assignment No: 1

Write a program to implement a dictionary using the following ADTs. We assume all the entries in the dictionary to be distinct integers.

a) Binary Search Tree (BST)
b) Red Black Tree (RBT)

Each ADT should support five operations, void Insert(val), boolean Delete(val), boolean Search(val), void ClearADT() and void DisplayADT(). Both search and delete operations should respond with a boolean value indicating whether the search/delete was successful or not. The objective of this assignment is to compare the performance of BST and RBT ADTs. You have to compute the time taken for completion of operations and study how the running times of ADT operations will vary across the two ADT implementations.

2. Lab Assignment No: 2

Implement data structures to maintain a list of elements. In particular, implement the list as an array and as a linked list. Write a program to remove duplicates from the list. The code for remove duplicates functionality should remain the same across the two implementation of the list.

Implement the following sequence of operations on the skip list:

a) remove() b) insert() c) Search() d) Update()

Assume the coin flips for the first insertion yield two heads followed by tails, and those for the second insertion yield three heads followed by tails.

3. Lab Assignment No: 3

Implement different Hashing functions and Collision Resolution Techniques.

4. Lab Assignment No: 4

Implement Kruskal's algorithm for finding the minimum spanning tree of a given (positively) weighted (undirected) graph G. You must use the Union-Find data structure that implements both "union by rank" and "path compression" heuristics.

5. Lab Assignment No: 5 &6

Implement the following priority queues:

a) Binary Heap b) Binomial Heap c) Fibonacci Heap

Your program should then create an appropriate priority queue object and perform makeHeap() method. After that, you should give the user menu options to insert(key), delete(key), extractMin(), findMin(), decrease(key), increase(key) updateKey(currentKey, newKey), and displayHeap(filename). You may assume that keys will be unique. For displayHeap(filename), you must output the tree structure of the priority queue (including linked list edges in Binomial Heap, etc) as a directed tree in the dot language format1 and store it in a file named filename (given as parameter).

6. Lab Assignment No: 7&8

Implement Text Processing using Huffman Coding.

Implement the compact representation of the suffix trie for the string "minimize minime".

Implement a standard trie for the following set of strings: {abab, baba, ccccc, bbaaaa, caa, bbaacc, cbcc, cbca }.

7. **Lab Assignment No: 9 &10**

One way to mask a message, *M*, using a version of *steganography*, is to insert random characters into *M* at pseudo-random locations so as to expand *M* into a larger string, *C*.

For instance, the message,

ILOVEMOM,

could be expanded into

AMIJLONDPVGEMRPIOM.

It is an example of hiding the string, *M*, in plain sight, since the characters in *M* and *C* are not encrypted. As long as someone knows where the random

Books recommended:

TEXT BOOK

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++," 2nd Edition, Pearson, 2004. **(T1)**
2. Peter Brass, "Advanced Data Structures," Cambridge University Press, 1st Edition. **(T2)**
3. M T Goodrich, & Roberto Tamassia, "Algorithm Design," John Wiley, 2002. **(T3)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets

CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	1	1	1
CO2	3	2	2	1	1	1
CO3	2	3	3	2	1	1
CO4	3	1	1	1	1	1
CO5	3	1	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

PROGRAM ELECTIVE LAB –I

COURSE INFORMATION SHEET

Course code: IT509
Course title: MATLAB PROGRAMMING
Pre-requisite(s):
Co- requisite(s):
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	To familiarize the student in introducing and exploring MATLAB
2.	Develop mathematical thinking and problem-solving skill
3.	To enable the student on how to approach for solving Engineering problems using simulation tools.
4.	To provide a foundation in use of this software for real time app

Course Outcomes

After the completion of this course, students will be able to:

CO1	Express programming & simulation for engineering problems.
CO2	Find importance of this software for Lab Experimentation.
CO3	Analyze problems and write basic mathematical ,electrical ,electronic problems in Matlab
CO4	Implement programming files with GUI Simulink.
CO5	Simulate basic Engineering problems

SYLLABUS

List of Programs as Assignments:

1. Lab Assignment No: 1

Objective: To Understand and Implement Matrix Algebra

1. To create Sparse matrices using the function sparse.
2. To convert a sparse matrix to full matrix.

2. Lab Assignment No: 2

Objective: To Understand and Implement Data Analysis

1. To measure the daily high temperatures in three cities with different color.
2. To solve a different cities temperature do the filter.

3. Lab Assignment No: 3

Objective: To Understand and Implement Data Interpolation

1. To Draw 2-D random data.
2. To Draw Threshold of Human Hearing.

4. Lab Assignment No: 4

Objective: To Understand and Implement Cubic Splines

1. To design Spline differentiation and Integration.
2. To design interpolated Spiral Y=f(X).

5. Lab Assignment No: 5

Objective: To Understand and Implement Fourier Analysis

1.To solve the use of the FFT, consider the problem of estimating the continuous Fourier transform of the signal

$f(t)=2e^{-3t}$ $t \geq 0$, where f(t) is gven by

$F(\omega)=2/(3+j\ \omega)$

2. To design sawtooth Waveform at arbitrary points.

6. Lab Assignment No: 6

Objective: To Understand and Implement Optimization

1. To solve 1-D minimization and maximization.
2. To design Rosenbrock's banana function.

7. Lab Assignment No: 7

Objective: To Understand and Implement Differential Equations

1. Design a van der Pol Solution.
2. To solve Jacobian matrix.

8. Lab Assignment No: 8

Objective: To Understand and Implement Two-Dimensional Graphics

1. To add new plots to an existing plot by using the hold command.
2. To create new Figure windows, use the figure command in the Command window or the **New Figure** selection from the **File** menu in the Command or Figure window.

9. Lab Assignment No: 9

Objective: To Understand and Implement Three- Dimensional Graphics

1. Plot = 2 with 0 5in polar coordinates.
2. Design a Surface plot using the surf function.

10. Lab Assignment No: 10

Objective: To Understand and Implement Images, Movies, and Sound

1. To display 8-bit intensity and RGB images.
2. To convert between indexed images and movie frames.

11. Lab Assignment No: 11

Objective: To Understand and Implement Graphical User Interfaces

1. Using uigetfile to find the startup.m file on the author's computer.
2. Write a program using the function **guidata,** which stores and retrieves data in the GUI figure **'ApplicationData'** property.
3. How to put walls by clicking a mouse button to make an arbitrary maze.
4. Design a GUI System.

Books recommended:

TEXT BOOK

1. Duane Hanselman, bruce Littlefield, Mastering MATLAB 7, Reason edu., 2nd edition, 2008. **(T1)**
2. Sandeep Nagar, Introduction to MATLAB for Engineers and Scientists: Solutions for Numerical Computation and Modeling, A Press, 2017.**(T2)**

REFERENCE BOOK

3. MATLAB Primer by MATHWORKS. **(R1)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	3	3	2	2	1	1
CO3	2	3	2	1	2	1
CO4	3	3	2	2	1	1
CO5	3	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT510
Course title: JAVA PROGRAMMING
Pre-requisite(s):
Co- requisite(s): None
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	To familiarize the student in introducing and exploring JAVA.
2.	Knowledge of the structure and model of the Java programming language.
3.	Use the Java programming language for various programming technologies.
4.	To provide a foundation for Java programming language to solve the given problems.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Write, compile, and execute Java programs that may include basic data types and control flow constructs using J2SE or other Integrated Development Environments (IDEs)
CO2	Write, compile, and execute Java programs manipulating Strings and text documents.
CO3	Write, compile, execute Java programs that include GUIs and event driven programming
CO4	Create Applets and GUI
CO5	Executing Client server and socket programming

SYLLABUS

List of Programs as Assignments:

1. Lab Assignment No: 1

Objective: To Understand and Implement COLLECTION FRAMEWORK

1. To create sparse matrices using the function sparse.
2. To convert a sparse matrix to full matrix.

2. Lab Assignment No: 2

Objective: To Understand and Implement Generic Programming

1. Write the tasks performed by type erasure?
2. Write a generic method to exchange the positions of two different elements in an array?

3. Lab Assignment No: 3

Objective: To Understand and Implement REFLECTION

1. Write a program that finds and displays inheritance hierarchy of a specified class?
2. Write a program that shows all public fields of a specified class?

4. Lab Assignment No: 4

Objective: GUI Development with Swing

1. Working with Text Fields
2. Working with Buttons
3. Working with Lists

4. Working with Scroll Panes

5. Lab Assignment No: 5

Objective: Implementing Robust Geometric Primitives

1. Java Program to Apply Above-Below-on Test to Find the Position of a Point with respect to a Line
2. Java Program to Compute the Area of a Triangle Using Determinants
3. Java Program to Compute the Volume of a Tetrahedron Using Determinants
4. Java Program to Find the Area of any Polygon Using Triangulation

6. Lab Assignment No: 6

Objective: To Understand and Implement examples on "Convex Hull"

1. Java Program to Implement Graham Scan Algorithm to Find the Convex Hull
2. Java Program to Implement Gift Wrapping Algorithm in Two Dimensions
3. Java Program to Implement Jarvis March to Find the Convex Hull

7. Lab Assignment No: 7

Objective: To Understand and Implement examples on "Nearest Neighbor Search"

1. Java Program to Find the Nearest Neighbour Using K-D Tree Search
2. Java Program to Find NearestNeighbour Using Voronoi Diagram

8. Lab Assignment No: 8

Objective: To Understand and Implement Network Programming

1. Working with URLs
2. Socket Server Programming
3. Client Server Programming

9. Lab Assignment No: 9

Objective: To Understand and Implement SOCKET PROGRAMMING

1. Write a java socket program to get the resource http://www.google.com/index.html using HTTP protocol?
2. Write a program how do you get the IP address of a machine from its hostname?

10. Lab Assignment No: 10

Objective: To Understand and Implement Java Web Applications

1. Simple Servlet
2. Java Web Applications - Get Request
3. Java Web Applications - Post Request

11. Lab Assignment No: 11

Objective: To Understand and Implement Advanced Java Input/output (NIO)

1. File Copying With NIO
2. Working with Buffers
3. Working with File Data

Books recommended:

TEXT BOOKS

1. Uttam K Roy, Advanced JAVA Programming, Oxford University Press, 1st Edition , 2015 **(T1)**
2. HeerbertSchildt, Java: A Beginner's Guide, SeventhEdition,Oracle Press, 2014 **(T2)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10

Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	3	3	2	2	1	1
CO3	3	2	2	2	2	1
CO4	3	2	3	2	1	1
CO5	3	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course Code: CS509
Course title: ADVANCED COMPUTER ALGORITHM
Pre-requisite(s): Design and Analysis of Algorithms, Data Structures
Co- requisite(s): None
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 06
Class: M. Tech
Semester / Level: II/05
Branch: Computer Science and Engineering

Course Objectives

After the completion of this course, students will be able to:

1.	Able to create a requirements model using UML class notations and use-cases based on statements of user requirements, and to analyze requirements models given to them for correctness and quality.
2.	Able to create the OO design of a system from the requirements model in terms of a high-level architecture description, and low-level models of structural organization and dynamic behaviour using UML class, object, and sequence diagrams.
3.	Able to comprehend enough Java to see how to create software the implements the OO designs modelled using UML.
4.	Able to comprehend the nature of design patterns by understanding a small number of examples from different pattern categories, and to be able to apply these patterns in creating an OO design.
5.	Given OO design heuristics, patterns or published guidance, evaluate a design for applicability, reasonableness, and relation to other design criteria.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Analyze and compare different approaches of computer algorithm for different practical application.
CO2	Student should understand the concept of NP-hard and NP-complete and reducibility.
CO3	Student should develop basic knowledge of a wide range of advanced algorithm design techniques, approximation algorithms, randomized algorithms and parallel algorithm.
CO4	Student should develop basic advanced algorithm analysis skills for analysing the approximation ratio of approximation algorithms and the probability of randomized algorithms.
CO5	Students should gain a good understanding on a wide range of advanced algorithmic problems, their relations and variants, and application to real-world problems.

SYLLABUS

Module I:
Design Paradigms
Overview of Divide and Conquer, Greedy and Dynamic Programming strategies. Basic search and traversal techniques for graphs, Backtracking, Branch and Bound.

(8L)

Module II :
Theory of NP- Hard and NP-Complete Problems
P, NP and NP-Complete complexity classes; A few NP-Completeness proofs; Other complexity classes.

(8L)

Module III :
ApproximationAlgorithms

Introduction,
Combinatorial Optimization, approximation factor, PTAS, FPTAS, Approximation algorithms for vertex cover, set cover, TSP, knapsack, bin packing, subset-sum problem etc. Analysis of the expected time complexity of the algorithms.

(8L)

Module IV :
Parallel Algorithms
Introduction, Models, speedup and efficiency, Some basic techniques, Examples from graph theory, sorting, Parallel sorting networks. Parallel algorithms and their parallel time and processors complexity.

(8L)

Module V :
Probabilistic Algorithms & Randomized Algorithms
Numerical probabilistic algorithms, Las Vegas and Monte Carlo algorithms, Game-theoretic techniques, Applications on graph problems

(8L)

Text Books:

1. T.H. Cormen, C.E.Leiserson, and R.L. Rivest, "Introduction to Algorithms".
2. G.Brassard, and P.Bratley, "Fundamentals of Algorithmics".
3. Vijay V.Vazirani, "Approximation Algorithms".

Reference Books:

1. D.Harel, "Algorithmics: The spirit of computing".
2. R. Motwani& P. Raghavan, "Randomized Algorithms," Cambridge University Press, 1995.

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2	2	2	1	2
CO2	3	3	3	1	3	1
CO3	2	3	3	3	2	1
CO4	3	3	3	3	1	1
CO5	2	2	3	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets	CO5	CD5

COURSE INFORMATION SHEET

Course Code: IT512
Course title: ADVANCED WEB TECHNOLOGY
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives

This course enables the students:

1.	To appreciate problems of traditional web designing techniques.
2.	To understand the basics of the MVC architecture
3.	To understand ASP.NET's implementation of the MVC model
4.	To understand how to leverage the model for medium to large projects
5.	To optimize the performance and rendering of web sites for different types of clients.

Course Outcomes

After the completion of this course, students will be:

CO1	Able to design models, controllers and views in ASP.NET
CO2	Will be able to establish secure and optimized database connections from the web sites
CO3	Will be able to perform secure and optimized user management and role handling
CO4	Optimize the design aspects of the web sites in a responsive fashion.
CO5	Understand techniques to handle scalability of web sites i.e. using caches

SYLLABUS

Module I:
MVC, Asp.NET MVC, ORMs, Entity Framework, Models, Database Contexts, Adding Controllers, Views, Filtering, Searching related entitites.

(8L)

Module II:
ViewBag, View Model, Complex Filtering, Data Validation, Annotations, Sorting, Paging, Routing Configurations, Many to many relationships with the Entity Framework, Partial Views.

(8L)

Module III:
Authentication, Authorization, ASP.NET Identity, Role Management, User management, Password management.

(8L)

Module IV:
CSS Fundamentals, Selectors, Inheritance, Cascading, Box Model, Advanced CSS, Animations.

(8L)

Module V:
Designing Responsive web sites, Media Queries, Developing for mobiles and Tablets.

(8L)

Text books:
Naylor L., "ASP.NET MVC with Entity Framework and CSS", 1st Edition, Apress, 2017. **.(T1)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	1	1	1
CO2	3	1	1	1	1	1
CO3	3	1	1	2	2	1
CO4	2	3	1	1	1	1
CO5	3	1	1	1	3	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets	CO5	CD5

COURSE INFORMATION SHEET

Course Code: IT513
Course title: BIG DATA ANALYTICS
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives
This course enables the students:

1.	To provide an overview of approaches facilitating data analytics on huge datasets in different domain.
2.	To provide the knowledge on NoSQL and different partitioning method to handle large datasets.
3.	To provide an overview of Apache Hadoop and HDFS Concepts and Interfacing with HDFS
4.	To understand Map Reduce Jobs in Hadoop framework
5.	To provide the knowledge of various Hadoop based tool for processing large datasets.

Course Outcomes
After the completion of this course, students will be able to:

CO1	Describe big data and use cases from selected business domains
CO2	Explain NoSQL big data management
CO3	Install, configure, and run Hadoop and HDFS
CO4	Perform map-reduce analytics using Hadoop
CO5	Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

Syllabus

Module I :

Introduction

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

(8L)

Module II:

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

(8L)

Module III:

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures.

(8L)

Module IV:

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats.

(8L)

Module V:

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration, Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries

(8L)

Text Books:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013. .**(T1)**
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012. .**(T2)**
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012. .**(T3)**

Reference Books:

1. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.**(R1)**
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.**(R2)**
3. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.**(R3)**
4. Alan Gates, "Programming Pig", O'Reilley, 2011.**(R4)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	1	2	1	1	1
CO2	3	2	1	1	1	1
CO3	3	1	1	2	2	2
CO4	2	3	1	1	1	1
CO5	3	1	1	1	3	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets	CO5	CD5

Program Elective II

COURSE INFORMATION SHEET

Course Code: IT508
Course title: CLOUD COMPUTING
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives

This course enables the students to:

1.	Understand about security requirements in cloud.
2.	Learn about infrastructure security at different levels
3.	Know about management standards of cloud security
4.	Develop and Apply trust-based security model to different layers

Course Outcomes

After the completion of this course, students will be able to:

CO1	Identify security aspects of each cloud model
CO2	Implement a public cloud instance using a public cloud service provider
CO3	Apply trust-based security model to different layer
CO4	Develop a risk-management strategy for moving to the Cloud
CO5	Identify various research domain of cloud computing

SYLLABUS

Module I:

Introduction: Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing.

(8L)

Module II:

Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model, Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise.

(8L)

Module III:

Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security Identity and Access Management Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management.

(8L)

Module IV:

Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS, Privacy Issues: Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations.

(8L)

Module V:

Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud, Recent developments in hybrid cloud and cloud security.

(8L)

Text Books:

1. John Rhoton, "Cloud Computing Explained: Implementation Handbook for Enterprises", Publication Date: November 2, 2009. **.(T1)**
2. Tim Mather, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice)", ISBN-10: 0596802765, O'Reilly Media, September 2009. **.(T2)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	3	1	1	1	1
CO2	3	3	3	2	1	1
CO3	3	2	2	1	1	1
CO4	3	2	1	1	1	1
CO5	1	2	3	1	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets	CO5	CD5

COURSE INFORMATION SHEET

Course code:IT516
Course title: DATA MINING AND DATA ANALYSIS
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 L: 3 T: 0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Explain about the necessity of preprocessing and its procedure.
2.	Generate and evaluate Association patterns
3.	Solve problems using various Classifiers
4.	Learn the principles of Data mining techniques and various mining algorithms.
5.	Learn about traditional and modern data driven approach and problem solving techniques for various datasets

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand Data Warehousing and Data Mining and its applications and challenges and Create mini data warehouse.
CO2	Apply the association rules for mining applications.
CO3	Identify appropriate Classification techniques for various problems with high dimensional data.
CO4	Implement appropriate Clustering techniques for various problems with high dimensional data sets.
CO5	Implement various mining techniques on complex data objects.

SYLLABUS

Module I :
Data Analysis foundation, Numeric and Categorical attributes, Dimensionality reduction.

(8L)

Module II:
Data Warehouse: Introduction, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data Warehousing to Data Mining. Data Cube Computation and Data Generalization.

(8L)

Module III:
Frequent Pattern Mining, Summarizing Itemsets, Itemset Mining, Sequence Mining.

(8L)

Module IV:
Classification: Naïve Bayes, KNN, Decision Tree, Classification Performance measures, Classifier evaluation.

(8L)

Module V:
Clustering: K-Means, Agglomerative, Hierarchical, DBSCAN, Spectral and Graph Clustering. Anomaly detection, Statistical, distance and density-based approaches.

(8L)

Text Books:

1. Mohammed J. Zaki, and Wagner Meira Jr., "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge University Press, 2016.**(T1)**
2. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, "Introduction to Data Mining", Pearson, 2014.**(T2)**
3. Jiawei Han, and Micheline Kamber, "Data Mining Concepts & Techniques", 3rd Edition, Publisher Elsevier India Private Limited, 2015.**(T3)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	1	2		3	2
CO2	3	3		2	2	
CO3	2	3	3	2	3	1
CO4		2	3		2	3
CO5	1	2	3	3	2	3

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

COURSE INFORMATION SHEET

Course code: IT518
Course title: INTERNET OF THINGS
Pre-requisite(s):
Co-requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Understand the basic concept and the IoT Paradigm
2.	Know the state of art architecture for IoT applications
3.	Learn the available protocols used for IoT
4.	Design basic IoT Applications.
5.	Evaluate optimal IoT applications.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Identify the IoT Components and its capabilities
CO2	Explain the architectural view of IoT under real world constraints
CO3	Analyse the different Network and link layer protocols
CO4	Evaluate and choose among the transport layer protocols
CO5	Design an IoT application

SYLLABUS

Module I:

IoT-An Architectural Overview

An Architectural Overview Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.

(8L)

ModuleII:

IoT Architecture-State of the Art

State of the art, Reference Model and architecture, IoT Reference Architecture; Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

(8L)

ModuleIII:

Sensor Technology, RFID Technology, WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M CoAP, REST, Zigbee, Bluetooth

(8L)

ModuleIV:

Transport & Session Layer Protocols

Mobile IPv6 technology for IoT, 6LoWPAN,Transport Layer TCP, MPTCP, UDP, DCCP,

Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

(8L)

ModuleV:

Layer Protocols & Security

Introduction, Technical Design constraints. Implementation Examples. Security and Interoperability.

(8L)

Books recommended:

TEXT BOOK

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.**(T1)**
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6". **(T2)**

REFERENCE BOOK

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer. **(R1)**
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI. **(R2)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
CO3	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

Open Elective II

COURSE INFORMATION SHEET

Course code: IT523
Course title: BIOMETRIC SECURITY
Pre-requisite(s):
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives

This course enables the students to:

1.	To understand the brief functioning of biometric system.
2.	To know the different types of biometric and their accuracy.
3.	To increase the likelihood that biometric technologies, when deployed, will be as protective of personal and informational privacy as possible.
4.	To raise awareness of privacy issues for end users and for students.
5.	To increase security of the system as well as data.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
CO2	Identify the sociological and acceptance issues associated with the design and implementation of biometric systems.
CO3	Developing new advanced authentication algorithms.
CO4	Analyze the accurate discrimination between individuals.
CO5	Illustrate the two factor authentication system.

SYLLABUS

Module I:

Biometrics- Introduction- benefits of biometrics over traditional authentication systems - benefits of biometrics in identification systems-selecting a biometric for a system – Applications - Key biometric terms and processes - biometric matching methods -Accuracy in biometric systems.

(8L)

Module II:

Physiological Biometric Technologies: Fingerprints - Technical description –characteristics - Competing technologies - strengths – weaknesses – deployment - Facial scan - Technical description - characteristics - weaknesses-deployment - Iris scan - Technical description – characteristics - strengths – weaknesses – deployment - Retina vascular pattern.

(8L)

Module III :

Technical description – characteristics - strengths – weaknesses – deployment - Hand scan - Technical description-characteristics - strengths – weaknesses deployment – DNA biometrics. Behavioral Biometric Technologies: Handprint Biometrics - DNA Biometrics.

(8L)

Module IV:

signature and handwriting technology - Technical description – classification – keyboard / keystroke dynamics- Voice – data acquisition - feature extraction - characteristics - strengths – weaknesses-deployment.

(8L)

Module V:

Multi biometrics and multi factor biometrics - two-factor authentication with passwords - tickets and tokens – executive decision - implementation plan.

(8L)

TEXT BOOKS :

1. Samir Nanavathi, Michel Thieme, and Raj Nanavathi : "Biometrics -Identity verification in a network", 1st Edition, Wiley Eastern, 2002. **.(T1)**
2. John Chirillo and Scott Blaul : "Implementing Biometric Security", 1st Edition, Wiley Eastern Publication, 2005. **.(T2)**

REFERENCE BOOKS :

1. John Berger: "Biometrics for Network Security", 1st Edition, Prentice Hall, 2004. **.(R1)**

Gaps in the syllabus (to meet Industry/Profession requirements):
POs met through Gaps in the Syllabus:
Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	3	3	3	3	2	1
2	3	3	3	2	1	1
3	3	2	2	3	1	1
4	3	3	2	1	3	1
5	2	1	3	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT504
Course title: APPLIED CRYPTOGRAPHY
Pre-requisite(s):
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives

This course enables the students:

1.	To understand the foundations of cryptographic attacks.
2.	To gain knowledge of encrypting data, and to choose between different algorithms.
3.	Prepare students for research in the area of cryptography and enhance students communication and problem solving skills
4.	To differentiate between the encryption techniques and know their suitability to an application.
5.	To effectively apply their knowledge to the construction of secure cryptosystems.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand the various types of cryptographic protocols and the mathematics behind cryptography.
CO2	Describe the various types of ciphers and hash functions.
CO3	Apply the different cryptographic techniques to solve real life problems.
CO4	Evaluate different techniques as to their suitability to various applications.
CO5	Develop a cryptosystem keeping in view social issues and societal impacts.

SYLLABUS

Module I:

Foundations – Protocol Building Blocks - Basic Protocols - Intermediate Protocols - Advanced Protocols - Zero-Knowledge Proofs - Zero-Knowledge Proofs of Identity -Blind Signatures - Identity-Based Public-Key Cryptography.

(8L)

Module II:

Key Length - Key Management – Public Key Cryptography versus Symmetric Cryptography - Encrypting Communications Channels - Encrypting Data for Storage - Hardware Encryption versus Software Encryption - Compression, Encoding, and Encryption - Detecting Encryption – Hiding and Destroying Information.

(8L)

Module III:

Information Theory - Complexity Theory - Number Theory - Factoring - Prime Number Generation - Discrete Logarithms in a Finite Field - Data Encryption Standard (DES) – Lucifer - Madryga - NewDES - GOST – 3 Way – Crab – RC5 - Double Encryption - Triple Encryption - CDMF Key Shortening - Whitening.

(8L)

Module IV:

Pseudo-Random-Sequence Generators and Stream Ciphers – RC4 - SEAL - Feedback with Carry Shift Registers - Stream Ciphers Using FCSRs - Nonlinear-Feedback Shift Registers - System-Theoretic Approach to Stream-Cipher Design - Complexity-Theoretic Approach to Stream-Cipher Design - N- Hash - MD4 - MD5 - MD2 - Secure Hash Algorithm (SHA) - OneWay Hash Functions Using Symmetric Block Algorithms - Using Public-Key Algorithms - Message Authentication Codes

(8L)

Module V:

RSA - Pohlig-Hellman - McEliece - Elliptic Curve Cryptosystems -Digital Signature Algorithm (DSA) - Gost Digital Signature Algorithm - Discrete Logarithm Signature Schemes - Ongchnorr-Shamir -Cellular Automata - Feige-Fiat-Shamir -Guillou-Quisquater - Diffie-Hellman - Station-to-Station Protocol -Shamir's Three-Pass Protocol - IBM Secret-Key Management Protocol - MITRENET - Kerberos - IBM Common Cryptographic Architecture.

(8L)

TEXT BOOKS:

1. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms, and Source Code in C" John Wiley & Sons, Inc, 2nd Edition, 1996. **(T1)**
2. 2. Wenbo Mao, "Modern Cryptography Theory and Practice", Pearson Education, 2004. **(T2)**
3. Atul Kahate, "Cryptography and Network Security", Tata McGrew Hill, 2003. **(T3)**

REFERENCE BOOKS:

1. William Stallings- Cryptography & Network Security Principles and Practice, Pearson Education. **(R1)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3		3	1	2	
CO2	3	3	3		2	
C03		3	2		1	
CO4			3	2		2
CO5		3		1		1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS605
Course title: HIGH PERFORMANCE COMPUTER ARCHITECTURE
Pre-requisite(s): Computer Architecture/Organization, Operating System, Parallel Computing
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/6
Branch:Information Technology

Course Objectives

This course enables the students to:

1.	To Explain different terminologies in High Performance Computer Architecture.
2.	To introduce basic concepts of High Performance Computer Architecture
3.	Hands on the different parallel architectures in terms of various parameters.
4.	Evaluate performance metrics and scalability and selection criteria for parallelism and different parallel systems and able to modify it.
5.	Provide the students with practice on running complex problem in high performance computing machines.

Course Outcomes

After the completion of this course, students will be:

CO1	Describe different terminologies in High Performance Computer Architecture.
CO2	Demonstrate and Implement the concepts of High Performance Computer Architecture
C03	Compare and differentiate the different parallel architectures in terms of various parameters.
CO4	Evaluate performance metrics and scalability and selection criteria for parallelism and different parallel systems and able to modify it.
CO5	Design effective high-performance systems as per users' criteria with proper justification by self or in a group.

SYLLABUS

Module I:

Parallel Computer Models : The State of Computing, Multiprocessors and Multicomputers, Multivector and SIMD Computers, PRAM and VLSI Models, Architectural Development Tracks.

Program and Network Properties : Conditions for Parallelism, Program Partitioning and Scheduling, Program Flow Mechanism, System Interconnect Architectures.

(8L)

Module II:

Program and Network Properties : Conditions for Parallelism, Program Partitioning and Scheduling, Program Flow Mechanism, System Interconnect Architectures.

Principles of Scalable Performance: Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.

(8L)

Module III:

Processors and Memory Hierarchy: Advanced Processor Technology, Super Scaler and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

Bus, Cache, and Shared Memory: Bus Systems, Cache Memory Organizations, Shared-Memory Organizations, Sequential and Weak Consistency Models, Weak Consistency Models.

(8L)

Module IV:

Pipelining and Superscalar Techniques: Linear Pipeline Processors, Non Linear Pipeline Processor, Instruction Pipeline Design, Arithmetic Pipeline Design, Superscalar Pipeline Design

Multiprocessors and Multicomputers: Multiprocessor System Interconnects, Cache Coherence Synchronization Mechanism, Three Generations of Multicomputers, Message-Passing Mechanisms.

(8L)

Module V:

Multivector and SIMD Computers: Vector Processing Principles, Multivector Multiprocessor, Compound Vector Processing, SIMD Computer Organizations, The Connection Machine CM-5

Scalable, Multithreaded and Data Flow Architecture: Latency-Hiding Techniques, Principle of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures,Data Flow and Hybrid Architectures.

(8L)

TEXT BOOK:

1. Hwang K., Jotwani N., Advanced Computer Architecture, 2nd Edition, Tata Mc-Graw Hill, India, 2010.**(T1)**

REFERENCE BOOK:

1. Stone, H. S., High Performance Computer Architecture, 3rd Edition, Addison Wesley Publishing Company, USA.**(R1)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3			1	2	1
CO2	3	3		1	1	1
C03	3	3	3			1
CO4	2	3			2	1
CO5	2	3	2			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT524
Course title: IMAGE PROCESSING TECHNIQUES
Pre-requisite(s):
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 3
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives
This course enables the students:

1.	Understand the basic concept of Digital Image Processing
2.	To Learn the Fourier Transform & its application
3.	Understand the basic components of filters
4.	Understand the basic concept of Image Compression Fundamentals
5.	Understand the basic concept of Image Segmentation.

Course Outcomes
After the completion of this course, students will be:

CO1	Understand the concept of image formation, digitization, and role human visual system plays in perception of image data and spatial filtering techniques for enhancing the appearance of an image.
CO2	Acquire an appreciation for various frequency based filtering techniques for enhancing the appearance of an image, duly applying them in different applications.
CO3	Discern the difference between noise models, gain an insight into assessing the degradation function and realize different spatial and frequency based filtering techniques for reduction and removal of noise.
CO4	Synthesize a solution to image compression using the concept of information theory and lossless and lossy compression techniques.
CO5	Design and create practical solutions using morphological and image segmentation operators for common image processing problems and assess the results.

Syllabus

Module I:
Introduction to Digital Image Processing, Elements of Visual Perception, Image Sensing & Acquisition, Sampling and Quantization, Basic Relationships between Pixels, Intensity Transformations, Histogram Processing, Spatial Convolution & Correlation, Smoothing Spatial Filters, Sharpening Spatial Filters.

(8L)

Module II:
Introduction to the Fourier Transform, Discrete Fourier Transform, Properties of the Two-Dimensional Fourier Transform, Image Smoothing using Frequency Domain filters, Image Sharpening using Frequency Domain filters, Selective Filtering, Basics of Fast Fourier Transform, Basics of: Walsh- Hadamard Transform; K-L Transform; Discrete Cosine Transform.

(8L)

Module III:
Model of Image Degradation/Restoration Process, Noise Probability Density Functions, Restoration in presence of Noise only, Periodic Noise Reduction using Frequency Domain filtering, Circulant Matrices, Block Circulant Matrices, Unconstrained Restoration, Constrained Restoration, Basics of Inverse Filtering

(8L)

Module IV:
Image Compression Fundamentals – Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Fidelity Criteria, Image Compression Models– Source Encoder and Decoder, Channel Encoder and Decoder, Elements of Information Theory, Error-Free Compression – Variable-Length Coding, Bit-Plane Coding, Lossless Predictive Coding. Lossy Compression – Lossy Predictive Coding, Transform Coding.Color Fundamentals, Color Models, Basics of Full Color Image Processing.

(8L)

Module V:
Morphological Image Processing- Preliminaries, Dilation and Erosion, Opening and Closing, Hit-or-Miss Transformation, Boundary Extraction, Hole Filling, Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning
Image Segmentation- Fundamentals, Point, Line and Edge Detection, Thresholding, Region Based Segmentation, Segmentation based on color.

(8L)

Text books:

1. Rafael. C. Gonzalez & Richard E. Woods- Digital Image Processing, 3/e Pearson Education, New Delhi - 2009.**(T1)**

Reference books:

1. W.K.Pratt-Digital Image Processing, 4/e, John Wiley & sons, Inc. 2006. .**(R1)**
2. M. Sonka et al. Image Processing, Analysis and Machine Vision, 2/e, Thomson, Learning, India Edition, 2007. .**(R2)**
3. Jayaraman, Digital Image Processing, Tata McGraw-Hill Education, 2011.**(R3)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3			1	2	1
CO2	3	3		1	1	1
C03	3	3	3			1
CO4	2	3			2	1
CO5	2	3	2			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS524
Course title: SOFT COMPUTING
Pre-requisite(s):
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 3
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives

After the completion of this course, students will be:

1.	To understand the concepts of soft computing
2.	To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
3.	To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
4.	To provide the mathematical background for carrying out the optimization and familiarizing genetic algorithm for seeking global optimum in self-learning situation.
5.	To develop neural network models.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Solve numericals on Fuzzy sets and Fuzzy Reasoning.
CO2	Develop Fuzzy Inference System (FIS).
CO3	Solve problems on Genetic Algorithms
CO4	Explain concepts of neural networks
CO5	Develop neural networks models for various applications.

SYLLABUS

Module I:

Introduction: Soft Computing vs. hard computing, soft computing paradigms, Basic mathematics of soft computing, learning and statistical approaches to classification and regression.

Fuzzy Logic: Introduction, Fuzzy set theory and operations, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Membership functions, fuzzification and defuzzification.

(8L)

Module II:

Fuzzy Rule Base System: Fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making. **Applications**: Fuzzy logic in modeling and control, image processing

(8L)

Module III:

Neural Networks: Introduction, Biological neural network, learning paradigms. Artificial Neural Network (ANN): Evolution of Basic neuron modeling, Difference between ANN and human brain, McCulloch-Pitts neuron models, Learning paradigms, activation function, Single layer Perceptron, Perceptron learning, Windrow-Hoff/ Delta learning rule, Multilayer Perceptron, Adaline, Madaline, different activation functions, Back propagation network, momentum, limitation, FBFN, Convolution Networks, Kohonen SOM, Hopfield Networks, HebbNet.

(8L)

Module IV:

Genetic Algorithms: Introduction, working principle, Basic operators and Terminologies like individual, gene, encoding, fitness function and reproduction, Genetic modeling: Significance of Genetic operators, Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, GA optimization problems such as TSP (Travelling salesman problem),

Applications:Genetic Algorithm based Back propagation Networks.

(8L)

Module V:

Particle Swarm Optimization: Background, Operations of Particle Swarm Optimization, Basic Flow of Particle Swarm Optimization, Comparison between GA and PSO, Applications of PSO.

Ant Colony Optimization: Ant Colony Optimization Algorithm, Ant System, Ant Colony System, Basic Flow of Ant colony Optimization, Applications of ACO.

(8L)

TEXT BOOKS:

1. S.N. Sivanandam,Principle of Soft Computing, Wiley India. .**(T1)**
2. Simon Haykins ,"Neural Networks :A Comprehensive Foundation, Pearson Education,2002.**(T2)**

3. Timothy J. Ross, “Fuzzy Logic with Engineering Applications.” TMH, New York, 1997. .**(T3)**

REFERENCE BOOKS

1. K.S.Ray ,”Soft Computing and Its application”, Vol 1, Apple Academic Press.2015.**(R1)**
2. K.H.Lee ,”First Course on Fuzzy Theory and App.”, Adv in Soft Computing Spinger.2005.**(R2)**
3. H.Z.Zimmermann ,”Fuzzy Set Theory and its App “ , 4th Ed.Spinger Science,2001.**(R3)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	3	2	3	1	1
CO2	3	2	3	3	1	1
C03	3	3	3	2	1	3
CO4	2	2	3	3	1	2
CO5	2	3	3	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6
CO3	CD1, CD2,
CO4	CD1,CD7
CO5	CD1,CD2,

COURSE INFORMATION SHEET

Course Code: CS512
Course title: ARTIFICIAL INTELLIGENCE
Pre-requisite(s): Design and Analysis of Algorithms, Data Structures
Co- requisite(s): None
Credits:3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives
After the completion of this course, students will be able to:

1.	An ability to apply knowledge of mathematics, science and engineering to both software and hardware design problems.
2.	An ability to design and conduct experiments and to analyze and interpret data related to software and hardware design solutions.
3.	An ability to design a system, component or process to meet desired needs within realistic constraints.
4.	An ability to function on multidisciplinary teams using current computer engineering tools and technologies.
5.	An ability to identify, formulate and solve engineering problems based on a fundamental understanding of concepts of computer engineering topics.

Course Outcomes
After the completion of this course, students will be able to:

CO1	Recall the principles and approaches of artificial intelligence and understand different aspects of Intelligent agent.
CO2	Apply different search techniques for solving real world problems and select the most appropriate solution by comparative evaluation.
CO3	Understanding the various concepts of knowledge representations and demonstrate working. knowledge of reasoning in the presence of incomplete and/or uncertain information.
CO4	To develop a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, Robotics etc.
CO5	Write various types of LISP and PROLOG programs and explore more sophisticated LISP and PROLOG code.

SYLLABUS

Module I :

Introduction: Overview of Artificial Intelligence- Problems of AI, AI Technique, Tic - Tac - Toe Problem.

Intelligent Agents: Agents & Environment, Nature of Environment, Structure of Agents, Goal Based Agents, Utility Based Agents, Learning Agents.

Problem Solving: Problems, Problem Space & Search: Defining The Problem as State Space Search, Production System, Problem Characteristics, Issues in The Design of Search Programs.

(8L)

Module II :

Search Techniques: Solving Problems by Searching, Problem Solving Agents, Searching for Solutions; Uniform Search Strategies: Breadth First Search, Depth First Search, Depth Limited Search, Bi-directional Search, Comparing Uniform Search Strategies.

Heuristic Search Strategies: Greedy Best-First Search, A* Search, Memory Bounded Heuristic Search: Local Search Algorithms & Optimization Problems: Hill Climbing Search, Simulated Annealing Search, Local Beam Search, Genetic Algorithms; Constraint Satisfaction Problems, Local Search for Constraint Satisfaction Problems.

Adversarial Search: Games, Optimal Decisions & Strategies in Games, The Minimax Search Procedure, Alpha-Beta Pruning, Additional Refinements, Iterative Deepening.

(8L)

Module III :

Knowledge & Reasoning: Knowledge Representation Issues, Representation & Mapping, Approaches to Knowledge Representation, Issues in Knowledge Representation.

Using Predicate Logic: Representing Simple Fact in Logic, Representing Instant & ISA Relationship, Computable Functions & Predicates, Resolution, Natural Deduction.

Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning, Matching, Control Knowledge.

(8L)

Module IV :

Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, Bayesian Networks, Dempster -Shafer Theory.

Planning: Overview, Components of A Planning System, Goal Stack Planning, Hierarchical Planning.

Learning: Forms of Learning, Inductive Learning, Explanation Based Learning, Neural Net Learning & Genetic Learning.

(8L)

Module V :

Natural Language Processing: Brief introduction to Syntactic Processing, Semantic Analysis, Discourse & Pragmatic Processing.

Robotics: Introduction, Robot hardware, robotic perception, planning to move, planning uncertain movements, robotic software architecture, application domains.

(8L)

TEXT BOOKS:

1. S. Russel and P. Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Pearson Education. .**(T1)**

2. E. Rich & K. Knight, "Artificial Intelligence", 2/e, TMH, New Delhi, 3rd Edition, TMH.**(T2)**

REFERENCE BOOKS:

1. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI, New Delhi, 2006. .**(R1)**
2. D.W. Rolston, "Principles of AI & Expert System Development", TMH, New Delhi. .**(R2)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets

CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	3	3	3	3	2
CO2	3	3	3	3	3	3
CO3	3	3	3	2	2	3
CO4	3	3	3	2	1	1
CO5	2	2	2	3	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1,
CO3	CD1, CD2, CD3,
CO4	CD1, CD3
CO5	CD1,CD2, CD7

COURSE INFORMATION SHEET

Course code:IT516
Course title: DATA MINING AND DATA ANALYSIS
Pre-requisite(s):
Co- requisite(s): None
Credits:3 L:3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/05
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Explain about the necessity of preprocessing and its procedure.
2.	Generate and evaluate Association patterns
3.	Solve problems using various Classifiers
4.	Learn the principles of Data mining techniques and various mining algorithms.
5.	Learn about traditional and modern data driven approach and problem solving techniques for various datasets

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand Data Warehousing and Data Mining and its applications and challenges and Create mini data warehouse.
CO2	Apply the association rules for mining applications .
CO3	Identify appropriate Classification techniques for various problems with high dimensional data.
CO4	Implement appropriate Clustering techniques for various problems with high dimensional data sets.
CO5	Implement various mining techniques on complex data objects.

SYLLABUS

Module I :
Data Analysis foundation, Numeric and Categorical attributes, Dimensionality reduction.
(8L)

Module II:
Data Warehouse: Introduction, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data Warehousing to Data Mining. Data Cube Computation and Data Generalization.
(8L)

Module III:
Frequent Pattern Mining, Summarizing Itemsets, Itemset Mining, Sequence Mining.
(8L)

Module IV:
Classification: Naïve Bayes, KNN, Decision Tree, Classification Performance measures, Classifier evaluation.
(8L)

Module V:
Clustering: K-Means, Agglomerative, Hierarchical, DBSCAN, Spectral and Graph Clustering. Anomaly detection, Statistical, distance and density-based approaches.
(8L)

Text Books:

1. Mohammed J. Zaki, and Wagner Meira Jr., "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge University Press, 2016.**(T1)**
2. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, "Introduction to Data Mining", Pearson, 2014.**(T2)**
3. Jiawei Han, and Micheline Kamber, "Data Mining Concepts & Techniques", 3rd Edition, Publisher Elsevier India Private Limited, 2015.**(T3)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations
Gaps in the syllabus (to meet Industry/Profession requirements):
POs met through Gaps in the Syllabus:
Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2		3	2
CO2	3	3		2	2	
CO3	2	3	3	2	3	1
CO4		2	3		2	3
CO5	1	2	3	3	2	3

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	Course Delivery methods	Course Outcome	Course Delivery Method
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

COURSE INFORMATION SHEET

Course Code: CS510
Course title: ADVANCED ALGORITHM LAB
Pre-requisite(s): Design and Analysis of Algorithms, Data Structures
Co- requisite(s): None
Credits: 2 L:0 T:0 P: 4
Class schedule per week: 04
Class: M. Tech
Semester / Level: II/05
Branch: Information Technology

Course Objectives

After the completion of this course, students will be able to:

1.	Able to create a requirements model using UML class notations and use-cases based on statements of user requirements, and to analyze requirements models given to them for correctness and quality.
2.	Able to create the OO design of a system from the requirements model in terms of a high-level architecture description, and low-level models of structural organization and dynamic behaviour using UML class, object, and sequence diagrams.
3.	Able to comprehend enough Java to see how to create software the implements the OO designs modelled using UML.
4.	Able to comprehend the nature of design patterns by understanding a small number of examples from different pattern categories, and to be able to apply these patterns in creating an OO design.
5.	Given OO design heuristics, patterns or published guidance, evaluate a design for applicability, reasonableness, and relation to other design criteria.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Able to know the different notions of asymptotic complexity and determine the asymptotic complexity of algorithms including the solving of recurrence relations.
CO2	Able to determine the practical implications of asymptotic notations.
CO3	Able to Implement, analyze, and compare algorithms.
CO4	Able to Know the difference between the dynamic programming concept and a greedy approach.
CO5	Able to know and use basic and advanced graph algorithms including DFS, BFS, and Bellman Ford.

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**
   Programs on Polynomial vs logarithmic running times

2. **Lab Assignment No: 2**
   Programs on Divide-and-conquer algorithms

3. **Lab Assignment No: 3**
   Programs on Greedy and dynamic-programming algorithms

4. **Lab Assignment No: 4**
   Programs on Binary trees
5. **Lab Assignment No: 5**
   Programs on Heaps and priority queues

6. **Lab Assignment No: 7**
   Programs on Binary search trees

7. **Lab Assignment No: 8**
   Programs on Hash tables

8. **Lab Assignment No: 9**
   Programs on Graph traversal

9. **Lab Assignment No: 10**
   Programs on Shortest paths in graphs.

Books recommended:

Text Books:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, MIT Press/McGraw-Hill, 2001. .**(T1)**
2. Sanjoy Dasgupta, Christos H. Papadimitriou and Umesh V. Vazirani, Algorithms, Tata McGraw-Hill, 2008. .**(T2)**
3. Jon Kleinberg and Éva Tardos, Algorithm Design, Pearson, 2005. .**(T3)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2		3	2
CO2	3	3		2	2	
CO3	2	3	3	2	3	1
CO4		2	3		2	3
CO5	1	2	3	3	2	3

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

COURSE INFORMATION SHEET

Course code:IT517
Course title: DATA MINING AND DATA ANALYSIS LAB
Pre-requisite(s):
Co- requisite(s): None
Credits: 2 L: 0 T: 0 P:4
Class schedule per week: 04
Class: M. Tech
Semester / Level: II/05
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Explain about the necessity of preprocessing and its procedure.
2.	Generate and evaluate Association patterns
3.	Solve problems using various Classifiers
4.	Learn the principles of Data mining techniques and various mining algorithms.
5.	Learn about traditional and modern data driven approach and problem solving techniques for various datasets

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand Data Warehousing and Data Mining and its applications and challenges and Create mini data warehouse.
CO2	Apply the association rules for mining applications .
CO3	Identify appropriate Classification techniques for various problems with high dimensional data.
CO4	Implement appropriate Clustering techniques for various problems with high dimensional data sets.
CO5	Implement various mining techniques on complex data objects.

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**
   . Build a Data Warehouseand Explore WEKA tool.

2. **Lab Assignment No: 2**
   . Demonstration of preprocessingon variousdatasets.

3. **Lab Assignment No: 3**

   Q3.Demonstration of Association rule process on dataset using apriori algorithm.

4. **Lab Assignment No: 4**

   Q4.Demonstrate performance of classification on various data sets.

5. **Lab Assignment No: 5**

   Q5. Demonstrate performance ofclustering on various data sets.

6. **Lab Assignment No: 6**

   Q6. Demonstrate performance ofRegression on various data sets

7. **Lab Assignment No: 7**

   Q7. Implement following algorithms for various datasets
   A. Apriori Algorithm.
   B. FP-Growth Algorithm.
   C. K-means clustering.

8. Q8. **Lab Assignment No: 8**

   Implement Bayesian Classification for various datasets

9. **Lab Assignment No: 9**

   Q9 Implement Decision Tree for various datasets.

10. **Lab Assignment No: 10**

    Q10. Implement Support Vector Machines.

11. **Lab Assignment No: 11**

    Q11Applications of classification for web mining.

12. Lab Assignment No: 12

Q12. Case Study on Text Mining or any commercial application

Books recommended:

TEXT BOOKS :

1. Jiawei Han &MichelineKamber - Data Mining Concepts & Techniques Publisher Harcout India. Private Limited. **.(T1)**

REFERENCE BOOKS :

1. G.K. Gupta – Introduction to Data Mining with case Studies, PHI, New Delhi – 2006. **.(R1)**
2. A. Berson& S.J. Smith – Data Warehousing Data Mining, COLAP, TMH, New Delhi – 2004. **.(R2)**
3. H.M. Dunham & S. Sridhar – Data Mining, Pearson Education, New Delhi, 2006. **.(R3)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	3	2	2		1
CO2	3	3	2		1	
CO3	2	3	2	1	1	1
CO4	3				1	1
CO5	3	2	1			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT519
Course title: INTERNET OF THINGS LAB
Pre-requisite(s):
Co-requisite(s):
Credits:2 L:0 T:0 P:4
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/05
Branch: Information Technology

Course Objectives
This course enables the students:

1.	Understand the basic concept and the Iot Paradigm
2.	Know the state of art architecture for IoT applications
3.	Learn the available protocols used for IoT
4.	Design basic IoT Applications.
5.	Evaluate optimal IoT applications.

Course Outcomes
After the completion of this course, students will be:

CO1	Identify the IoT Components and its capabilities
CO2	Explain the architectural view of IoT under real world constraints
C03	Analyse the different Network and link layer protocols
CO4	Evaluate and choose among the transport layer protocols
CO5	Design an IoT application

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**
   Glowing LEDs.
   Toggling LED's.
2. **Lab Assignment No: 2**
   Transmitting a string through UART
   Controlling LEDs blinking pattern through UART.
3. **Lab Assignment No: 3**
   Echo each character typed on HyperTerminal
   Digital IO configuration.
   Timer based LED Toggle.
4. **Lab Assignment No: 4**
   Scanning the available SSID's in the range of Wi-FI Mote.
   Connect to the SSID of choice
5. **Lab Assignment No: 5**
   Demonstration of a peer to peer network topology.
   check the connectivity to any device in the same network.
6. **Lab Assignment No: 6**
   Send hello world to TCP server existing in the same network
   Reading of atmospheric pressure value from pressure sensor.
7. **Lab Assignment No: 7**
   I2C protocol study
   Reading Temperature and Relative Humidity value from the sensor.
   Reading Light intensity value from light sensor.
8. **Lab Assignment No: 8**
   Proximity detection with IR LED.
   Generation of alarm through Buzzer.
9. **Lab Assignment No: 9**
   Timestamp with RTC
   IO Expander.
   Relay control.
10. **Lab Assignment No: 10**
    I2C based 12-channel ADC
    EEPROM read and write
11. **Lab Assignment No: 11**
    Transmitting the measured physical value from the UbiSense Over the Air.

Books recommended:

TEXT BOOK

3. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.**(T1)**

4. Peter Waher, “Learning Internet of Things”, PACKT publishing, BIRMINGHAM – MUMBAI. **(T2)**

REFERENCE BOOK

3. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer. **(R1)**
4. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6”. **(R2)**

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
D4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
C03	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT511
Course title: R PROGRAMMING
Pre-requisite(s):
Co- requisite(s): None
Credits:2 L:0 T:0 P:4
Class schedule per week: 04
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	To familiarize the student in introducing and exploring R
2.	Develop basic thinking for data analysis.
3.	To enable the student on how to approach for statistical Analysis
4.	To provide a foundation in use of this software

Course Outcomes

After the completion of this course, students will be able to:

CO1	Manipulate data within R
CO2	Perform basic data analysis procedures
CO3	Create plots
CO4	Implement programming features like accessing R packages, writing R functions
CO5	Simulation & Profiling with R

SYLLABUS

List of Programs as Assignments:

1. Lab Assignment No: 1

Objective: To Understand and Implement Data Types

1. Data Types - R Objects and Attributes
2. Data Types - Vectors and Lists
3. Data Types - Matrices
4. Data Types - Factors
5. Data Types - Missing Values
6. Data Types - Data Frames
7. Data Types - Names Attribute
8. Data Types - Summary

2. Lab Assignment No: 2

Objective: To Understand and Implement Data Analysis

1. Reading Tabular Data
2. Reading Large Tables
3. Textual Data Formats
4. Connections: Interfaces to the Outside World
5. Subsetting - Basics
6. Subsetting - Lists
7. Subsetting - Matrices
8. Subsetting - Partial Matching
9. Subsetting - Removing Missing Values
10. Vectorized Operations

3. Lab Assignment No: 3

Objective: To Understand and Implement Swirl

1. Workspace and Files
2. Sequences of Numbers
3. Vectors

4. Lab Assignment No: 4

Objective: To Understand and Implement Cubic Splines

1. To design Spline differentiation and Integration.
2. To design interpolated Spiral Y=f(X).

5. Lab Assignment No: 5

Objective: To Understand and Implement Control Structures

1. If-else
2. Control Structures - For loops
3. Control Structures - While loops
4. Control Structures - Repeat, Next, Break

6. Lab Assignment No: 6

Objective: To Understand and Implement Functions

1. Functions (part 2)

2. Scoping Rules - Symbol Binding
3. Scoping Rules - R Scoping Rules
4. Scoping Rules - Optimization Example (OPTIONAL)

7. **Lab Assignment No: 7 &8**

Objective: To Understand and Implement Loop Functions and Debugging

1. Loop Functions - lapply
2. Loop Functions - apply
3. Loop Functions - mapply
4. Loop Functions - tapply
5. Loop Functions – split

8. **Lab Assignment No: 9 & 10**

Objective: To Understand and Implement Two-Dimensional Graphics

1. Generating Random Numbers
2. Simulation - Simulating a Linear Model
3. Simulation - Random Sampling

Books recommended:

TEXT BOOKS

1. Norman Matloff, The Art of R Programming, A Tour of Statistical Software Design 1st Edition, **(T1)**
2. Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, Orielly, 1st Edition. **(T2)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids

CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	3	3	2	2	1	1
CO3	2	2	2	1	1	1
CO4	3	1	1	1	1	1
CO5	3	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: CS601
Course title: GRAPH THEORY
Pre-requisite(s): Discrete Mathematics
Co- requisite(s): None
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: III/6
Branch: Information Technology

Course Objectives

This course enables the students to:

1.	Learn and become comfortable with graphs and its terminologies
2.	Understand applications of graph theory to practical problems and other branches of mathematics
3.	Understand various graphs algorithms along with its analysis.
4.	Practice creative problem solving and improve skills in this area

Course Outcomes

After the completion of this course, students will be able to:

CO1	Attain knowledge about different types of graphs and their applications in real world.
CO2	Perceive the role of cut-set, cut-vertex and fundamental circuits in network flows.
CO3	Create an awareness of planar and dual graph.
CO4	Understand how to represent graphs in computer system
CO5	Apply the concept of graph coloring and partitioning techniques in NP-problems

SYLLABUS

Module I:

Introduction: Graphs and its applications, Finite and infinite graphs, incidence and degree, isolated Vertex, pendant Vertex, and Null graph, paths and circuits, isomorphism, sub graphs, walks, paths, and circuits, connected graphs, disconnected graphs and components, Connectivity checking algorithm, Euler graphs, Operations on graphs, more on Euler graphs, Hamiltonian paths and circuits, Travelling Salesman problem.

(8L)

Module II:

Trees and Fundamental circuits: Trees and its properties, Distance and centers in a tree, Algorithm for checking if a graph is Tree, Partial k-trees, Dynamic Programming in partial k-trees, Spanning trees, Spanning trees in a Weighted graph, Prim's and Kruskal's algorithms

Cut set and cut vertices: Properties of a cut set, Fundamental circuits and cut sets, connectivity and separability, Computing connected components, Menger's theorem, Network flows, 1-Isomorphism, 2-Isomorphism.

(8L)

Module III :

Planar and Dual Graphs: Planar graph, Kuratowski's Graphs, Representations of a planar graph, Detection of planarity, Planar Separator Theorem, Geometric Dual, Combinatorial, Duel, Thickness and crossings, Algorithms for finding Clique and maximum clique**.**

(8L)

Module IV :

Matrix Representation of Graphs: Incidence matrix, Adjacency matrix, Adjacency list, Circuits Matrix, Fundamental Circuit Matrix and Rank of B, Cut-set Matrix, Relationships among A *f*, B*f* and C*f*, path Matrix**.**

(8L)

Module V :

Coloring, Covering and partitioning: Chromatic number, Chromatic partitioning, Chromatics polynomial, Coverings, Four colour problem, Algorithm for graph colouring.

Directed Graphs: Digraphs and its types, Digraphs and binary Relations, Directed paths and connectedness, Euler Digraphs, Trees with Directed Edges, Fundamental Circuits in Di graphs, Matrices A, B and C of Digraphs, Adjacency Matrix of a Digraph, Paired Comparisons and Tournaments, Acyclic Di graphs and De-cyclization**.**

(8L)

Text Books:

1. Narasingh Deo, "Graph Theory with Applications to engineering and Computer Science", Prentice Hall of India, 2001. .**(T1)**

Reference Books:

1. Douglas B. West, "Introduction to Graph theory", Pearson Education, 2002. .**(R1)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	1	1
CO2	3	2	3	3	1	1
CO3	3	3	3	2	1	2
CO4	3	3	3	3	2	2
CO5	3	3	3	2	2	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

COURSE INFORMATION SHEET

Course code: CS607
Course title: INTELLIGENT SYSTEMS
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: III/6
Branch: Information Technology

Course Objectives

This course enables the students to:

1.	Understanding basic concepts and principles through case studies, mathematical analysis and computational implementation.
2.	Application of established engineering methods to complex engineering problem solving.
3.	Fluent application of engineering techniques, tools and resources
4.	In-depth understanding of specialist bodies of knowledge within the engineering discipline.
5.	Capable of constructing intelligent systems (in software) that perform useful engineering tasks

Course Outcomes

After the completion of this course, students will be able to:

CO1	Assemble knowledge of neural networks, fuzzy systems, evolutionary computation as well as some exposure to expert systems
CO2	Demonstrate good knowledge of basic theoretical foundations of the following common intelligent systems methodologies:
CO3	Determine which type of intelligent system methodology would be suitable for a given type of application problem
CO4	Analyse core areas for developing Intelligent systems
CO5	To design and develop an intelligent system for a selected application.

SYLLABUS

Module I:
Biological foundations to intelligent systems I: Artificial neural networks, Back- propagation networks, Radial basis function networks, and recurrent networks.

(8L)

Module II :
Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.

(8L)

Module III:
Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hill- climbing search. Optimization and search such as stochastic annealing and genetic algorithm.

(8L)

Module IV:
Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architecture.

(8L)

Module V:
Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning.

(8L)

Text Books:

1. Luger G.F. and Stubblefield W.A., "Artificial Intelligence: Structures and strategies for Complex Problem Solving", 6th Edition, Addison Wesley, 2008. .**(T1)**

Reference Books:

1. Russell S. and Norvig P., "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice-Hall, 2009. .**(R1)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):
POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	1	1
CO2	3	2	2	2	1	1
CO3	3	3	3	3	1	1
CO4	3	3	2	2	1	1
CO5	2	2	1	1	1	1

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

COURSE INFORMATION SHEET

Course code: CS605
Course title: HIGH PERFORMANCE COMPUTER ARCHITECTURE
Pre-requisite(s): Computer Architecture/Organization, Operating System, Parallel Computing
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class: M. Tech
Class schedule per week: 03
Semester / Level: III/6
Branch: Information Technology

Course Objectives
This course enables the students to:

1.	To Explain different terminologies in High Performance Computer Architecture.
2.	To introduce basic concepts of High Performance Computer Architecture
3.	Hands on the different parallel architectures in terms of various parameters.
4.	Evaluate performance metrics and scalability and selection criteria for parallelism and different parallel systems and able to modify it.
5.	Provide the students with practice on running complex problem in high performance computing machines.

Course Outcomes
After the completion of this course, students will be:

CO1	Describe different terminologies in High Performance Computer Architecture.
CO2	Demonstrate and Implement the concepts of High Performance Computer Architecture
C03	Compare and differentiate the different parallel architectures in terms of various parameters.
CO4	Evaluate performance metrics and scalability and selection criteria for parallelism and different parallel systems and able to modify it.
CO5	Design effective high-performance systems as per users' criteria with proper justification by self or in a group.

SYLLABUS

Module I:

Parallel Computer Models : The State of Computing, Multiprocessors and Multicomputers, Multivector and SIMD Computers, PRAM and VLSI Models, Architectural Development Tracks.

Program and Network Properties : Conditions for Parallelism, Program Partitioning and Scheduling, Program Flow Mechanism, System Interconnect Architectures.

(8L)

Module II:

Program and Network Properties : Conditions for Parallelism, Program Partitioning and Scheduling, Program Flow Mechanism, System Interconnect Architectures.

Principles of Scalable Performance: Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.

(8L)

Module III:

Processors and Memory Hierarchy: Advanced Processor Technology, Super Scaler and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

Bus, Cache, and Shared Memory: Bus Systems, Cache Memory Organizations, Shared-Memory Organizations, Sequential and Weak Consistency Models, Weak Consistency Models.

(8L)

Module IV:

Pipelining and Superscalar Techniques: Linear Pipeline Processors, Non Linear Pipeline Processor, Instruction Pipeline Design, Arithmetic Pipeline Design, Superscalar Pipeline Design

Multiprocessors and Multicomputers: Multiprocessor System Interconnects, Cache Coherence Synchronization Mechanism, Three Generations of Multicomputers, Message-Passing Mechanisms.

(8L)

Module V:

Multivector and SIMD Computers: Vector Processing Principles, Multivector Multiprocessor, Compound Vector Processing, SIMD Computer Organizations, The Connection Machine CM-5

Scalable, Multithreaded and Data Flow Architecture: Latency-Hiding Techniques, Principle of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures,Data Flow and Hybrid Architectures.

(8L)

Text Book:

2. Hwang K., Jotwani N., Advanced Computer Architecture, 2nd Edition, Tata Mc-Graw Hill, India, 2010.**(T1)**

Reference Book:

2. Stone, H. S., High Performance Computer Architecture, 3rd Edition, Addison Wesley Publishing Company, USA.**(R1)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3			1	2	1
CO2	3	3		1	1	1
C03	3	3	3			1
CO4	2	3			2	1
CO5	2	3	2			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT507
Course title: DATA COMMUNICATION AND COMPUTER NETWORKS
Pre-requisite(s):
Co-requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: III/05
Branch: Information Technology

Course Objectives

This course enables the students:

1.	To build an understanding of the fundamental concepts of the data communication model and communications architecture.
2.	To study characteristics of communication mediums and the characteristics of signals propagated through different transmission media, including concepts of transmission impairments.
3.	To understand the basic principles of signal encoding techniques, error-detection, and error-correction techniques.
4.	To understand techniques for flow control and multiplexing for maximum utilization of bandwidths in the data communications process.
5.	To understand the various switching techniques and routing techniques for efficient transmission.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand and be able to explain the principles of a layered protocol architecture; be able to identify and describe the system functions in the correct protocol layer and further describe how the layers interact.
CO2	Understand, explain and calculate digital transmission over different types of communication media.
CO3	Understand, explain and solve mathematical problems for data-link and network protocols.
CO4	Describe the principles of access control to shared media and perform performance calculations.
CO5	Understand and explain the principles and protocols for route calculations and be able to perform such calculations.

SYLLABUS

Module I:

Data Communications and Networking Overview: A Communications Model, Data Communications, Data Communication Networking.

Protocol Architecture: The Need for Protocol Architecture, A Simple Protocol Architecture, OSI, The TCP/IP Protocol Architecture

Data Transmission: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity.

(8L)

Module II:

Guided and Wireless Transmission: Guided Transmission Media, Wireless Transmission, Wireless Propagation, Line-of-Sight Transmission.

Signal Encoding Techniques:

Digital Data Digital Signals, Digital Data Analog Signals, Analog Data Digital Signals, Analog Data Analog Signals.

(8L)

Module III :

Digital Data Communication Techniques: Asynchronous and Synchronous Transmission, Types of Errors, Error Detection, Error Correction, Line Configurations, Interfacing.

Data Link Control: Flow Control, Error Control, High-Level Data Link Control (HDLC).

Multiplexing: Frequency Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing.

(8L)

Module IV :

Circuit Switching and Packet Switching: Switching Networks, Circuit-Switching Networks, Circuit-Switching Concepts, Control Signalling, Soft switch Architecture, Packet-Switching Principles, X.25, and Frame Relay.

(8L)

Module V:

Asynchronous Transfer Model: Protocol Architecture, ATM Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Service Categories, ATM Adaptation Layer.

Routing in Switched Networks: Routing in Circuit-Switching Networks, Routing in Packet-Switching Networks, Least-Cost Algorithms.

(8L)

TEXT BOOKS:

1. W. Stallings, "Data and Computer Communications", 7th Edition, Pearson Edition/ PHI, New Delhi, 2016. .**(T1)**

REFERENCE BOOKS:

1. B. A. Forouzan, "Data Communications and Networking", 4th Edition, TMH, New Delhi 2015. .**(R1)**
2. P.C. Gupta, "Data Communications and Computer Networks", PHI, New Delhi 2006. .**(R2)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	2	2	1	3	2	1
CO3	3	2	2	1	2	1
CO4	3	2	3	2	3	1
CO5	1	1	1	2	2	1

COURSE INFORMATION SHEET

Course code:IT521
Course title: DATA COMMUNICATION AND COMPUTER NETWORKS Lab
Pre-requisite(s):
Co- requisite(s): DATA COMMUNICATION AND COMPUTER NETWORKS
Credits:2 L:0 T:0 P:4
Class schedule per week: 04
Class: M.Tech
Semester / Level: III/05
Branch: Information technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	To familiarize the student in introducing and exploring various Network topologies and networking protocols
2.	To understand the use of client/server architecture in application
3.	To enable the student on how to approach for networking problems using networking simulation tools.
4.	To Design reliable servers using both TCP and UDP sockets
5.	Familiar with network tools and network programming.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Express programming & simulation for networking problems.
CO2	Get a thorough understanding of various aspects of networking devices
CO3	Design and implement simulation of a simple LAN and a WAN that meet a specific set of criteria
CO4	Identify the elements of a communication network
CO5	Simulate various OSI layer protocols using C/C++/ Java

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

Q1. To familiarize with the Lab Network Topology, Locating different interfaces, routers and switches. Studying different pools of IP addresses.
Q2. Implement the data link layer framing methods such as character, character stuffing, and bit stuffing.
Q3. To learn and observe the usage of different networking commands e.g.PING, TRACEROUTE. Learning remote login using telnet session. Measuringtypical average delays between different locations of the network.

2. **Lab Assignment No: 2**

Q1. What is the IP of the machine you are using? Compare it with the IP of your neighbors. Are the IPs of your neighbors same? Why or Why not?

Q2. Ping" is a tool used to determine if a server is responding and to estimate the round trip time of a message sent to that server. Use the ping command for the following URLs and record the success or failure statistics along with the average round trip time.

a) google.com
b) facebook.com
c) bitmesra.ac.in

Q3. Trace the route that is taken when you try to access:
a) google.com
b) facebook.com
c) bitmesra.ac.in

Q4. Network Commands on Linux / Unix

3. **Lab Assignment No: 3**

Q1. Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC 32.

Q2. Implementation of Sub-netting and Super-netting.

Q3. To study different types of transmission media, various topologies, and configure modem of computer HUB and Switches.

4. **Lab Assignment No: 4**

Q1. Write a C/C++ program to determine if the IP address is in Class A, B, C, D, or E.
Q2. Write a C/C++ program to determine if the IP address is in Class A, B, or C.
Q3. Write a C/C++ program to translate dotted decimal IP address into 32 bit address.
Q4. To implement a routing protocol and check its connectivity in a variable length subnet masked network
Q5. Write a C/C++ program to perform bit stuffing and de-stuffing.

5. **Lab Assignment No: 5**

Q1. Implement Dijkstra‘s algorithm to compute the Shortest path through a graph.

Q2. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm

Q3. Take an example subnet of hosts. Obtain broadcast tree for it.

6. **Lab Assignment No: 6**

Q1. Build implementations of the Internet protocols
Q2. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
Q3. Write a code simulating ARP /RARP protocols.

7. **Lab Assignment No: 7**

Q1. Create a socket for HTTP for web page upload and download
Q2. Write a code simulating PING and TRACEROUTE commands.

8. **Lab Assignment No: 8**

Q1. Study and implement model for Socket Programming and Client – Server model.
Q2. Experiments with NS2(or any other simulator) to study behavior (especially performance of) link layer protocols such as Ethernet and 802.11 wireless LAN.

9. **Lab Assignment No: 9**

Q1. Experimental study of application protocols such as HTTP, FTP,SMTP, using network packet sniffers and analyzers such as **Wireshark**. Small exercises in socket programming in C/C++/Java..

10. **Lab Assignment No: 10**

Q1. Take a 64 bit playing text and encrypt the same using DES algorithm.
Q2. Write a program to break the above DES coding
Q3. Using RSA algorithm encrypts a text data and Decrypt the same bjective: To Understand and Implement Data Interpolation

11. **Lab Assignment No: 11**

Q1. Applications using TCP and UDP Sockets like d. DNS e. SNMP f. File Transfer
Q2. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS
Q3. Echo client and echo server b. Chat c. File Transfer

Books recommended:

TEXT BOOKS

1. William Stallings, Data and Computer Communication, Prentice Hall of India. .**(T1)**
2. Behrouz A. Forouzan, Data Communication and Networking, McGraw-Hill. .**(T2)**
3. Andrew S. Tanenbaum, Computer Networks, Prentice Hall. .**(T3)**

REFERENCE BOOKS

4. W. Richard Stevens, TCP/IP Illustrated, Volume 1, Addison-Wesley.**(R1)**
5. Douglas Comer, Internetworking with TCP/IP, Volume 1, Prentice Hall of India. .**(R2)**

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty

2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	3	2	2		1
CO2	3	3	2		1	
CO3	2	3	2	1	1	1
CO4	3				1	1
CO5	3	2	1			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code:IT603
Course title: PYTHON PROGRAMMING LAB
Pre-requisite(s):
Co- requisite(s): None
Credits:2 L:0 T:0 P:4
Class schedule per week: 04
Class:M.Tech
Semester / Level: III/6
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	To introducewith fundamentals and grammar of Python programming.
2.	To understand and be able to use basic programming principles such as data types, variable, conditionals, loops, recursion and function calls.
3.	To learn how to use basic data structures such as List, Dictionary and be able to manipulate text files and images.
4.	To understand the process and skills necessary to effectively attempt a programming problem and implement it with a specific programming language -- Python.
5.	To understand a python program written by someone else and be able to debug and test the same.

Course Outcomes

After the completion of this course, students will be able to:

CO1	To use their problem solving abilities to implement programs in Python.
CO2	To apply Python in software development, testing and systems administration environments.
CO3	To develop Python applications for a variety of uses
CO4	To understand the fact that there is more than one right solution to a problem.
CO5	Work in industry environment with good enough knowledge about Python programming.

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

   Objective: ToImplement basic Python programming.

   Q1. Create a new program called hello world.py. Use this file to write your very First "Hello, world!" program.

   Q2. Write a Python program containing exactly one print statement that produces the following output:

   A
   B
   C
   D
   E
   F

2. **Lab Assignment No: 2**

   Objective: To Understand and Implement the concept of if-else-if statements.

   Q1.Write a Python program that requests five integer values from the user. It then prints one of two things: if any of the values entered are duplicates, it prints "DUPLICATES"; otherwise, it prints "ALL UNIQUE".

   Q2. Write a Python program that allows the user to enter a four-digit binary number and displays its value in base 10. Each binary digit should be entered one per line, starting with the leftmost digit, as shown below.

   Enter leftmost digit: 1
   Enter the next digit: 0
   Enter the next digit: 0
   Enter the next digit: 1
   The value is 9

   Q3.Develop and test a program that prompts the user for their age and determines approximately how many breaths and how many heartbeats the person has had in their life. The average respiration (breath) rate of people changes during different stages of development. Use the breath rates given below for use in your program:

	Breaths per Minute
Infant	30–60
1 –4 years	20–30
5 –14 years	15–25
adult	12–20

   For heart rate, use an average of 67.5 beats per second.

3. **Lab Assignment No: 3**

   Objective: To Understand and Implement the flow control statements.

   Q1. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3,

1/4... 1/10.

Q2.Write a program using a for loop that calculates exponentials. Your program should

ask the user for a base ‘b’ and an exponent ‘exp’, and calculate b^exp.

Q3. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero. What should your program do if the user input a negative number? As a programmer, you should always consider “edge conditions” like these when you program! (Another way to put it- always assume the users of your program will be trying to find a way to break it! If you don’t include a condition that catches negative numbers, what will your program do?)

4. **Lab Assignment No: 4**

Objective: To practice drawing patterns

Q1.Write the program to print the following pattern: ex if the user enters 7, the program would print

```
    *
   **
  ***
 ****
*****
******
*******
******
*****
****
***
**
*
```

Q2.Write a program in python to print the following pattern:

```
          1
         1 1
         121
 1331
        12641
 15101051
1615201561
```

5. **Lab Assignment No: 5**

Objective: To Understand and Implement methods in Python.

Q1.Write a method fact that takes a number from the user and prints its factorial.

Q2. Write a Python function named compare3 that is passed three integers and returns true if the three integers are in order from smallest to largest, otherwise it returns false.

Q3. Write a python function named modCount that is given a positive integer and a second positive integer, m<=n, and returns how many numbers between 1 and n are evenly divisible by m.

6. **Lab Assignment No: 6**

   Objective: To Understand and Implement the concept of Recursion

   Q1. Write a program to read an integer number. Print the reverse of this number using recursion.

   Q2. Write a program that calculates the GCD using recursive functions.

7. **Lab Assignment No: 7**

   Objective: To Understand and Implement Sorting techniques

   Q1.Write a program to sort the list of elements using Insertion sort.

   Q2. Write a program to sort the list of elements using Merge sort.

   Q3.Write a program to multiply the two matrices.

8. **Lab Assignment No: 8**

   Objective: To Understand and Implement the concept of Strings in Python

   Q1. Write a program to check whether string is a palindrome or not.

   Q2. Write a program to implement format method available with string object.

9. **Lab Assignment No: 9**

   Objective: To Understand and Implement Dictionary

   Q1. Program to demonstrate the built in functions within the dictionary.

   Q2. Program to implement dictionary as an associative array

10. **Lab Assignment No: 10**

    Objective: To Understand and Implement File Handling.

    Q1. Program to open the file in the read mode and use of for loop to print each line present in the file.

    Q2. Write a Python program to illustrate Append vs write mode.

    Q3. Write a Program to read and write data from a file.

Books recommended:

TEXT BOOKS

1. Krishna P. R., Object Oriented Programming through JAVA, 1st Edition, Universities Press, 2008. **.(T1)**
2. Patrick Naghton& H. Schildt – The Complete Reference Java 2, Tata McGraw Hill Publication, New Delhi. **.(T2)**
3. Dietel,Dietel - Java How to program , 7th edition; Pearson Education , New Delhi. **.(T3)**

REFERENCE BOOKS

1. C. Horstmann,G. Cornell - Core Java 2 Vol I & Vol II ; Pearson Education , New Delhi. **.(R1)**
2. Balagurusamy -Programming in Java, 2nd Edition; Tata McGraw Hill Publication; New Delhi. **.(R2)**

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes									
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	2	2	1	1	3					
CO2	2	1	1	1	3			3		
CO3	1	2	3	3	3					
CO4		1	1	3	2					1
CO5	1	1	2	2				2		3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code:IT604
Course title: WEB APP DEVELOPMENT LAB
Pre-requisite(s):
Co- requisite(s): None
Credits:2 L:0 T:0 P:4
Class schedule per week: 04
Class: M.Tech
Semester / Level: III/6
Branch: Information Technology
Name of Teacher:

Course Objectives
This course enables the students to:

1.	To get familiar with basics of the Internet Programming.
2.	To acquire knowledge and skills for creation of web site considering both client and server side programming
3.	To gain ability to develop responsive web applications
4.	To explore different web extensions and web services standards

Course Outcomes
After the completion of this course, students will be able to:

CO1	Analyze a web page and identify its elements and attributes.
CO2	Implement interactive web page(s) using HTML, CSS and JavaScript.
CO3	Demonstrate Rich Internet Application.
CO4	Build Dynamic web sites using server side Programming and Database connectivity.

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

   Objective: To Understand and Implement HTML

   Q1. To create a simple html file to demonstrate the use of different tags.

   Q2. To create an html file to link to different html page which contains images, tables, and also link within a page.

   Q3. To create an html page with different types of frames such as floating frame, navigation frame & mixed frame.

   Q4. To create a registration form as mentioned below.

   Create an html page named as “registration.html”

   a) set background colors

   b) use table for alignment

   c) provide font colors & size

2. **Lab Assignment No: 2**

   Objective: To Understand and Implement CSS

   Q1. To create an html file by applying the different styles using inline, external & internal style sheets.

   1. Create a external style sheet named as “external_css.css” and provide some styles for h2, hr, p & a tags.

   2. Create an html file named as “Style_sheet.html”

   a) Include the external style sheet with necessary tag.

   b) Include the internal style sheet for body tags & also use class name, so that the style can be applied for all tags.

   c) Include a tags with inline style sheet.

3. **Lab Assignment No: 3**

   Objective: To Understand and Implement JavaScript

   Q1. To write a Javascript program to define a user defined function for sorting the values in an array.

   Q2. Create an html page named as “exception.html” and do the following.

   1. within the script tag write code to handle exception

   a) define a method RunTest() to get any string values(str) from the user and cll the method Areletters(str).

   b) In Areletters(str) method check whether str contain only alphabets (a-z, AZ), if not throw exception.

   c) Define a exception method Input Exception(str) to handle the exception thrown bythe above method.

   2. Within the body tag define a script tag to call Runtest() method defined.

   Q3. To display the calendar using javascript code by getting the year from the user.

   Q4. To create a html page to display a new image & text when the mouse comes over the existing content in the page.

4. **Lab Assignment No: 4**

   Objective: To Understand and Implement ASP

Q1. To create an ASP file to find the no of hits on the page and to have rotating banner content.

Q2. To create a table of content using ASP program & navigate within the pages.

Q3. Create an ASP file named as request.asp

a) Create a simple form to get the first name & last name and a button submit. When the button is clicked the values in the text box are printed by response object by Request.QueryString

b) Create a hyperlink with some values defined in the tag & display the same using request & response object.

Q4.To display all the content in the database using ASP program.

Lab Assignment No: 5

Objective: To Understand and Implement Java Servlets

Q1. To create a simple servlet program to display the date (using Tomcat server).

Q2. To create a servlet program to retrieve the values entered in the html file (Using NetBeans IDE).

Q3. To display the cookie values that are entered in the html page using servlet program. (using NetBean IDE).

Lab Assignment No: 6

Objective: To Understand and Implement XML

Q1. To create a simple catalog using XML file

Q2. To create external style sheet and using the style sheet in xml file.

Lab Assignment No: 7

Objective: To Understand and Implement PHP

Q1. To create a php program to demonstrate the different file handling methods.

Q2. To create a php program to demonstrate the different predefined function in array, Math, Data & Regular Expression.

Books recommended:

TEXT BOOKS

1. Web Technologies: A Computer Science Perspective , Jeffrey C Jackson , Pearson Education , India.
2. Stephen Wynkoop, Running a perfect website, QUE, 1999

REFERENCE BOOKS

1. Eric Ladd, Jim O' Donnel, Using HTML 4, XML and Java, Prentice Hall of India- QUE, 1999
2. Chris Bates, Web Programming - Building Intranet applications, Wiley Publications, 2004
3. Deitel, Deitel & Nieto, Internet and World Wide Web - How to Program, Pearson Education Asia, 2000

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		3			2	
CO2	1	3	3		1	2
CO3	2		1	2	2	1
CO4	1	3	3		1	

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3
CO2	CD2, CD3,CD6
CO3	CD1, CD2, CD3,CD6
CO4	CD3,CD6,CD7