

Bachelor of Technology (Computer Science & Engineering)										
Credit-Based Scheme of Studies/Examination										
Semester VII (w.e.f. session 2021-2022)										
S · N o ·	Course Code	Subject	L: T:P	Hours /Week	Cred its	Examination Schedule (Marks)				Durati on of Exam (Hrs)
						Ma jor Test	Mi nor Test	Practi cal	To tal	
1	PE	Elective-IV	3:0: 0	3	3	75	25	0	10 0	3
2	PE	Elective-V	3:0: 0	3	3	75	25	0	10 0	3
3	OE	Open Elective-II	3:0: 0	3	3	75	25	0	10 0	3
4	PROJ-CS-401 A	Project-II	0:0: 12	12	6	0	40	60	10 0	3
5	PE- LA	Elective-IV Lab	0:0: 2	2	1	0	40	60	10 0	3
6	PE- LA	Elective-V Lab	0:0: 2	2	1	0	40	60	10 0	3
Total				21	17	225	115	60	40 0	
7	SIM-401*	Seminar on Summer Internship	2:0: 0	2	0	0	50	0	50	

PE Elective-IV	PE Elective-V
Data Mining: PE-CS-D401A	Soft Computing: PE-CS-D409A
Software Verification and Validation and Testing:: PE-CS-D403A	Neural Networks and Deep Learning: PE-CS-D411A
Information Retrieval: PE-CS-D405A	Object Oriented Software Engineering: PE-CS-D413A
Speech and Natural Processing : PE-CS-D407A	Expert Systems: PE-CS-D415A
OE Elective-II	
Cyber Law and Ethics: OE-CS-401A	
Bioinformatics: OE-CS-403A	
Fiber Optic Communications: OE-CS-405A	
Industrial Electrical Systems: OE-CS-407A	

The course of both PE & OE will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.

***Note:** SIM-401* is a mandatory credit-less course in which the students will be evaluated for Summer Internship undergone after 6th semester and students will be required to get passing marks to qualify.

PE-CS-D401 A	Data Mining						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	To provide the knowledge of data mining and its techniques.						
Course Outcomes (CO)							
CO1	To learn data mining concepts in details.						
CO2	Expose the criteria for data generalization.						
CO3	To explore knowledge of mining associations, correlations and classification.						
CO4	To evaluate various types of data mining.						

Unit I: Basics of Data Mining

Need for data mining, data mining as the evolution of Information technology, data mining as a step in the process of knowledge discovery, Transactional database, Major issues in data mining, data preprocessing, data cleaning, data integration, data reduction, data transformation, data warehousing and Online Analytical Processing (OLAP).

Unit II: Mining Frequent Itemsets with Associations and Correlations

Data cube technology, multidimensional data mining, multi-dimensional data analysis, Mining Frequent Patterns, Associations and Correlations: Basic concepts and methods, market basket analysis example with rule of support and confidence, frequent itemsets, closed itemsets, and association rules, frequent itemset mining methods-Apriori algorithm.

Unit III: Mining Associations and Correlations

Advanced pattern mining, mining multilevel patterns, multi-dimensional patterns, classification: basic concepts, decision tree induction, naive bayesian classification methods, rule based classification, cluster analysis: basic concepts and methods, partitioning methods, hierarchical methods, density based methods, grid based methods.

Unit IV: Data Mining Trends

Mining spatial data, mining spatiotemporal data, mining multimedia data, mining text data, mining web data, stastical data mining, data mining applications-data mining for financial data analysis, intrusion detection and prevention, retail and telecommunication industries, science and engineering, privacy, security and social impacts of data mining, data mining trends.

Suggested Books

- J.Han, M.Kamber, Data Mining: Concepts and Techniques, Academic Press, Morgan Kaufman Publishers, 2015.
- Pieter Adrians, DolfZantinge, Data Mining, Addison Wesley 2013.
- C.S.R. Prabhu, Data Ware housing: Concepts, Techniques, Products and Applications, Prentice Hall of India, 2014.
- Berry and Lin off, Mastering Data Mining: The Art and Science of Customer Relationship Management, John Wiley and Sons, 2012.
- Seidman, Data Mining with Microsoft SQL Server, Prentice Hall of India, 2016.

PE-CS-D403 A	Software Verification and Validation and Testing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3
Program Objective (PO)	The objective of this course is to provide the in-depth coverage of software quality models and software testing strategies. It focuses on test case generation techniques and testing levels. It also focuses on testing different kinds of software.						
Course Outcomes (CO)							
CO1	To develop test cases for any problem						
CO2	To pursue testing on any level of software design by using different testing strategies						
CO3	To learn the test management and testing activities by using different testing methods.						
CO4	To apply testing and quality model of software testing in achieving high-quality software.						

UNIT – I

Introduction: Overview of software evolution, SDLC, Testing Process, Terminologies in Testing: Error, Fault, Failure, Verification, Validation, Definition of software testing, Test Cases, Test Oracles, Testing Process, Limitations of Testing.

UNIT - II

Functional Testing: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.

Structural Testing: Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing.

UNIT - III

Reducing the number of test cases: Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing, and Slice based testing

Testing Activities: Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging, Domain Testing.

UNIT - IV

Overview of SQM: Concepts of Software Quality, Quality Attributes, Software Quality Models: McCall, Boehm, ISO-9000, CMM.

Miscellaneous topics: Stress Testing, Ad hoc testing: Buddy testing, Exploratory testing, Agile and extreme testing.

Suggested Books:

1. Naresh Chauhan “Software Testing Principles and Practices” Oxford Publications, 2012
2. Louise Tamres, “Software Testing”, Pearson Education Asia, 2002
3. Robert V. Binder, “Testing Object-Oriented Systems-Models, Patterns and Tools”, Addison Wesley.
4. William Perry, “Effective Methods for Software Testing”, John Wiley & Sons, New York.
5. Cem Kaner, Jack Falk, Nguyen Quoc, “Testing Computer Software”, Second Edition, Van Nostrand Reinhold, New York.
6. K.K. Aggarwal & Yogesh Singh, “Software Engineering”, 2nd Ed., New Age International Publishers, New Delhi, 2005
7. Boris Beizer, “Software Testing Techniques”, Second Volume, Second Edition, Van Nostrand Reinhold, New York.

PE-CS-D405A	Information Retrieval						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	To provide an overview of Information Retrieval and comprehensive details about various Evaluation methods.						
Course Outcomes (CO)							
CO1	To provide an overview of Information Retrieval process and models.						
CO2	To understand the experimental evaluation of performance metrics.						
CO3	To gain knowledge about various web search engines.						
CO4	To understand the application of appropriate text classification and clustering.						

Unit I

Introduction: Goals and history of IR. The impact of the web on IR. The role of artificial intelligence (AI) in IR. Basic IR models: boolean and vector-space retrieval models; ranked retrieval; text similarity metrics; TF-IDF (term frequency/inverse document frequency) weighting; cosine similarity.

Basic Tokenizing Indexing, and Implementation of Vector space Retrieval: Simple tokenizing, stop word removal, and stemming, inverted indices, efficient processing with sparse vectors, python implementation.

Unit II

Experimental evaluation of IR: performance metrics: recall, precision, and F-measure, evaluations on benchmark text collections.

Query Operations and Languages: Relevance feedback; query expansion; query languages.

Unit III

Text Representation: Word statistics; Zipf's law; porter stemmer; morphology; index term selection; using thesauri, metadata and markup languages (SGML, HTML, XML).

Web Search: search engines; spidering; metacrawlers; directed spidering; link analysis (e.g. hubs and authorities, google pagerank); shopping agents.

Unit IV

Text Categorization and Clustering: Categorization algorithms: naïve bayes; decision trees; and nearest neighbour. Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM). Applications to information filtering; organization; and relevance feedback.

Recommender System: collaborative filtering and content based recommendation of documents and products.

Suggested Books:

- Introduction to Information Retrieval Manning, Raghavan and Schutze, Cambridge University Press, 2008.
- Ricardo Baeza-Yates and Berthier Ribeiro-Neto, Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
- Ricci, F, Rokach, L. Shapira, B.Kantor, Recommender Systems Handbook, First Edition, 2011.
- Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

PE-CS-D407A	Speech and Natural Language Processing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	To provide the understanding of the mathematical and linguistic foundations underlying approaches to the various areas in NLP.						
Course Outcomes (CO)							
CO1	Be familiar with syntax and semantics in NLP.						
CO2	To implement various concepts of knowledge representation using Prolog.						
CO3	To classify different parsing techniques and understand semantic networks.						
CO4	To identify/explain various applications of NLP.						

Unit-I

Speech recognition and speech synthesis: concept overview, key algorithms in the noisy channel paradigm. Fundamental components of Natural Language Processing: Lexicography, syntax, semantics, prosody, phonology, pragmatic analysis, world knowledge. Knowledge Representation schemes: Semantic net, Frames, Conceptual Dependency, Scripts.

Unit-II

Representing knowledge using rules: Logic Programming, Introduction to LISP and Prolog, Rules based deduction systems, General concepts in knowledge acquisition. Syntax Analysis: Formal Languages and grammars, Chomsky Hierarchy, Left- Associative Grammars, ambiguous grammars, resolution of ambiguities.

Unit-III

Computation Linguistics: Recognition and parsing of natural language structures- ATN and RTN, General Techniques of parsing- CKY, Earley and Tomita's algorithm. Semantics: Knowledge representation, semantics networks logic and inference pragmatics, graph models and optimization.

Unit-IV

Applications of NLP: Intelligent work processor, Machine translation, user interfaces, Man-Machine interfaces, natural language querying, tutoring and authoring systems, speech recognition, commercial use of NLP.

Suggested Books:

- Daniel Jurafsky, James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd edition, Pearson Edu., 2013.
- James Allen, "Natural Language Understanding", Pearson Education, Second Edition, 2003.
- Ivan Bratko, "Prolog: Programming for Artificial Intelligence", 3rd Edition, Pearson Education, Fifth Impression 2009.
- G. Gazder, "Natural Language processing in prolog", Addison Wesley, 1989.

PE-CS-D409A	Soft Computing						
Lecture	Tutorial	Practical	Credit	MajorTest	MinorTest	Total	Time
3	0	0	3	75	25	100	3 Hour
Purpose	To familiarize the students with the concepts of soft computing						
Course Outcomes							
CO 1	Identify and describe soft computing techniques and their roles in building intelligent machines						
CO 2	Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.						
CO 3	To learn non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.						
CO 4	Apply genetic algorithms to combinatorial optimization problems.						

Unit I

Introduction: Soft Computing and Neural Networks: Evolution of Computing: Soft Computing Constituents, Soft Vs Hard Computing, From Conventional AI to Computational Intelligence: Machine Learning Basics

Unit II

Fuzzy Logic: Fuzzy Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations. Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

Unit III

Neural Networks: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks, Implementation using Python/ Matlab

Unit IV

Genetic Algorithm (GA): Evolutionary computing, conditions for evolution, Simple Genetic Algorithm (SGA), different types of operators: Selection, Crossover, mutation and replacement, optimization problems and traditional optimization methods, differences between GA & traditional methods, Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.

Suggested Books:

- S. N. Sivanandam & S. N. Deepa, Principles of Soft Computing, Wiley India Pvt. Ltd.
- Goldberg D. E., Genetic Algorithms in Search, Optimization, and Machine Learning, Pearson Education.
- Jang, Sun, Mizutani, Neuro-Fuzzy and Soft computing, Pearson Education.
- Haykin, Neural networks: a comprehensive foundation, Pearson Education.
- George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", Prentice Hall, 1995.

PE-CS-D411A	Neural Networks and Deep Learning						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	To provide knowledge of various artificial neural networks and deep learning algorithms for optimization						
Course Outcomes							
CO 1	To learn the basics of artificial neural networks concepts, various neural networks architecture						
CO 2	To explore knowledge of special types of Artificial neural networks						
CO 3	To understand the basics of Deep learning and its applications						
CO 4	To imprise about the different deep learning algorithms						

Unit-I

Artificial Neural Networks: Human brain, Model of an artificial neuron, Basic concepts of neural networks, fundamentals of biological neural network and artificial neural network, evolution of neural networks, Characteristics of Neural Networks, learning methods-supervised, unsupervised and reinforcement, taxonomy of neural network architectures, terminologies-weights, bias, threshold, learning rate, applications of Neural Networks.

Unit-II

Supervised and Unsupervised Neural Networks: Hebb network theory and training algorithm, perceptron networks architecture and training algorithms, Back Propagation networks architecture and Training Algorithms, Associative Memory network architecture and Training Algorithms, Hopfield networks architecture and Training Algorithms, Counter Propagation networks architecture and Training Algorithms, adaptive resonance theory networks architecture and Training Algorithms.

Unit-III

Advanced neural networks: Kohonan self organising feature, maps architecture and training algorithm, learning vector quantization architecture and training algorithm, boltzman machine, cognitron network, neocognitron network, optical neural networks electro-optical multipliers and holographic correlators.

Unit-IV

Deep learning: Machine learning basics, simple machine learning algorithms-linear regression, underfitting and overfitting challenges in machine learning, supervised learning approach for support vector machine, Deep Forward Networks, Convolutional networks, deep recurrent networks, deep boltzmann machine, applications in speech recognition and natural language processing.

Suggested Books:

- Li Min Fu, "Neural Networks in Computer Intelligence", McGraw-Hill, Inc. 2012.
- S N Sivanandam, "Neural Networks using MATLAB 6.0", TMH, 4th. Reprint 2015.
- S N Sivanandam, "Principles of Soft Computing", 2nd. Edition, Wiley, Reprint 2014.
- Freeman J.A. & D.M. Skapura, "Neural Networks: Algorithms, Applications and Programming Techniques", Addison Wesley, Reading, Mass, 2014.
- Deep Learning (Ian J. Goodfellow, Yoshua Bengio and Aaron Courville), MIT Press, 2016.
- Deep Learning with Python: A Hands-On Introduction by Ketkar, Apress

PE-CS-D413A	Object Oriented Software Engineering						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hour
Purpose	To provide the thorough knowledge to use the concepts and their design attributes for Object Oriented Software Engineering approaches and platforms to solve real time problems.						
Course Outcomes							
CO 1	To learn the basic concepts of object oriented systems and software engineering.						
CO 2	To get exposure of various object modeling methodologies, tools for analyzing and designing software based systems using UML.						
CO 3	To explore problems using Use Cases, analyzing relations, responsibilities and collaborations among classes and their behavior in problem domain.						
CO 4	To evaluate object oriented design processes using models, design patterns, interfaces designs and communication mechanisms for performing required tasks.						

Unit-I

An Overview of Object-Oriented system Development, Objects Basis, Class Hierarchy, Inheritance, Polymorphism, Object Relationships and Associations, Aggregations and Object Containment, Object Persistence, Meta-Classes, Object Oriented Systems Development Life Cycle: Software Development Process, Object Oriented Systems Development: A Use-Case Driven Approach.

Unit-II

Object Oriented Methodologies: Rumbaugh Methodology, Jacobson Methodology, BoochMethodology, Patterns, Frameworks, The Unified approach, Unified Modeling Language (UML)

Unit-III

Object Oriented Analysis Process, Use Case Driven Object Oriented Analysis, Use Case Model, Object Analysis: Classification, Classification Theory, Approaches for identifying classes, Responsibilities and Collaborators, Identifying Object Relationships, Attributes and Methods: Associations, Super-Sub Class relationships, A-Part-of-Relationships-Aggregation, Class Responsibilities, Object Responsibilities.

Unit-IV

Object Oriented Design process and Design Axioms, Corollaries, Design Patterns, Designing Classes: Object Oriented Design Philosophy, UML Object Constraint Language, Designing Classes: The Process, Class Visibility, Refining Attributes, Designing Methods and Protocols, Packages and Managing classes, View Layer: Designing Interface objects, Designing View layer Classes, Macro and Micro Level Interface Design Process.

Suggested Books:

- Ali Bahrami, Object Oriented Systems Development, McGraw Hill Publishing Company Limited, New Delhi, 2013.
- Rumbaugh *et al.*, Object Oriented Modeling and Design, PHI, 2006.
- Robert Laganière and Timothy C. Lethbridge, Object-Oriented Software Engineering: Practical Software Development, McGraw-Hill Publishing Company Limited, New Delhi, Sixth Print 2008.
- Ivar Jacobson, Magnus Christerson, Patrick Jonsson, Gunnar Overgaard, Object-oriented Software Engineering: A Use Case Driven Approach, Pearson Education, New Delhi, Seventh Edition Reprint, 2009.
- David C. Kung, Object-Oriented Software Engineering: An Agile Unified Methodology, McGraw-Hill Publishing Company Limited, New Delhi, 2013

PE-CS-D415A	Expert Systems						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	In this course the student will learn the methodologies used to transfer the knowledge of a human expert into an intelligent program that can be used to solve real-time problems.						
Course Outcomes(CO)							
CO1	Examining the fundamentals and terminologies of expert system.						
CO2	To facilitate students to implement various knowledge representation techniques for acquisition and validate various structures in experts system domain.						
CO3	Signifying AI techniques to solve social, industrial and environmental problems.						
CO4	Application of professional aspects in multi-disciplinary approach to meet global standards towards design, realizing and manufacturing.						

Unit-I

Introduction to Expert Systems: Introduction to Expert Systems, Representation and organization of knowledge, Basics characteristics, Architecture of expert system, types of problems handled by expert systems, case study of PROSPECTOR.

Unit-II

Expert System Tools: Techniques of knowledge representations in expert systems, knowledge engineering, System-building aids, support facilities, stages in the development of expert systems.

Unit-III

Building an Expert System: Expert system development, Selection of tool, Acquiring Knowledge, Building process.

Unit-IV

Problems with Expert Systems: Difficulties, common pitfalls in planning, dealing with domain expert, difficulties during development.

Suggested Books

- Waterman D.A., "A Guide to Expert Systems", Addison Wesley Longman, 1985.
- Hayes-Roth, Lenat and Waterman: Building Expert Systems, Addison Wesley, 1983.
- Weiss S.M. and Kulikowski C.A., "A Practical Guide to Designing Expert Systems", Rowman & Allanheld, New Jersey, 2011.

PE—CS-D401AL	Data Mining Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	2	1	40	60	100	3hrs
Purpose	Learning of data mining tools and extracting knowledge by applying various data mining techniques. Also explore the different validation techniques on the given training data set to get output metrics.						
Course Outcomes(CO)							
CO1	Learning of Data Mining tools.						
CO2	Understanding of various Data Mining Algorithms.						
CO3	Developing the application for association mining, classification and clustering.						
CO4	Providing solutions for real world problems using various data mining techniques.						

List of Practicals

1. Study of WEKA data mining tool.
2. Study of ORANGE and KNIME open source data mining tools.
3. Develop an application to identify underlying relations between different items by extracting
 1. association rule mining.
4. Develop an application for distinguishing the data classes using classification technique.
5. Develop an application for partitioning a set of data objects using clustering technique.
6. Develop an application by implementing Naive Bayes Classifier.
7. Develop an application by implementing Association Mining Rule based Apriori Algorithm.
8. Develop an application for Decision Tree from class-labeled training tuples.
9. Develop a Decision Tree from a given training data set.
10. Develop a Decision Tree with cross validation training data set.
11. Develop a Decision Tree by using prune method and reduced error pruning. Also show the
 2. accuracy for cross validation trained data set.

PE—CS-D403AL	Software Verification and Validation and Testing Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	2	1	40	60	100	3hrs
Purpose	To gain a broad understanding of the discipline of software engineering implementation.						
Course Outcomes(CO)							
CO1	To understand the basic concepts of Software Engineering.						
CO2	To understand the different design techniques.						
CO3	To understand different software development models.						
CO4	To understand different types of Testing.						

List of Practical

1. To identify the role of the software in today's world across a few significant domains related to day to day life.
2. To identify any scenario and identify suitable software development model for the given scenario.
3. To classify the requirement into functional and non-functional requirements and list four functional and non functional requirements for any scenario.
4. Do comparative study of various software development models.
5. Preparation of requirement document for standard application problems in standard format.(e.g Library Management System, Railway Reservation system, Hospital management System, University Admission system)
6. To identify the usage of Regression Testing.
7. To identify the usage of Agile Testing.
8. To understand the importance of SDLC and STLC process.

PE—CS-D405AL	Information Retrieval Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	2	1	40	60	100	3hrs
Purpose	To provide an overview of Information Retrieval and implementation insight about various evaluation methods.						
Course Outcomes(CO)							
CO1	Understanding about Information Retrieval models.						
CO2	Learn experimental evaluation of performance matrices.						
CO3	Learn implementation of web search engines.						
CO4	Learn the implementation of text clustering and classification algorithms.						

List of Practicals

1. Implementation of Simple tokenization and Stop-word removal on a document.
2. Write a program to compute similarity between two text documents.
3. Write a map reduce program to count the number of occurrence of each alphabetic character in a document. The count for each letter should be case-insensitive.
4. Write a program to parse XML text, generate web graph and compute topic specific page rank.
5. Write a program to implement Simple web crawler.
6. Implementation of Naïve Bayes algorithm.
7. Implementation of Decision tree algorithm.
8. Implementation of K-nearest neighbour algorithm.
9. Implementation of K- means algorithm.
10. Evaluate the performance matrix using any algorithm.

PE-CS-D4 07AL	Speech and Natural Processing						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	2	1	40	60	100	3hrs
Purpose	The objective of Natural Language Processing lab is to introduce the students with the basics of NLP which will empower them for developing advanced NLP tools and solving practical problems in the field.						
Course Outcomes(CO)							
CO1	To understand the basic concepts of Speech and Natural Processing.						
CO2	To understand the different word analysis techniques.						
CO3	To understand different Speech and Natural Processing models.						
CO4	To understand different types of chunking.						

List of Practical

1. Word Analysis
2. Word Generation
3. Morphology
4. N-Grams
5. N-Grams Smoothing
6. POS Tagging: Hidden Markov Model
7. POS Tagging: Viterbi Decoding
8. Building POS Tagger
9. Chunking
10. Building Chunker

PE--CS-D409AL	Soft Computing Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	2	1	40	60	100	3hrs
Purpose	Soft Computing achieves practicability, robustness, and low cost solution for complex problems in real world using neural network, fuzzy systems, optimization approaches.						
Course Outcomes(CO)							
CO1	Understand Fuzzy Concepts.						
CO2	Learn Neural Network with back propagation and without back propagation.						
CO3	Learn the operators of Genetic algorithms.						
CO4	Learn the implementation of Optimization algorithms.						

List of Practicals

1. Write a program to implement artificial neural network with back propagation.
2. Write a program to implement artificial neural network without back propagation.
3. Implementation of operations on Fuzzy Sets.
3. Implement Travelling Sales man problem with genetic algorithm..
4. Implement Crisp partitions for real life iris dataset.
5. Write a program to implement Logic gates.
6. Implement SVM classification of Fuzzy Concepts.
7. Implement ABC (Artificial Bee Colony) optimization Technique.
8. Implement DE (Differential Evolution) algorithm.

PE—CS -D411AL	Neural Networks and Deep Learning Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	2	1	40	60	100	3hrs
Purpose	Demonstrate knowledge and apply engineering and management principles to manage projects and in multi-disciplinary environment and use research-based knowledge and research methods including design of experiments, analysis and interpretation of data for valid conclusions.						
Course Outcomes (CO)							
CO1	Apply learning algorithms on perceptron and apply back propagation learning on Neural Network.						
CO2	Apply Feedback NN and plot a Boltzmann machine and associative memory on various application.						
CO3	Apply different types of auto encoders with dimensionality reduction and regularization.						
CO4	Design Convolutional Neural Network and classification using Convolutional Neural Network.						

List of Practicals

1. To Write a program to implement Perceptron.
2. To write a program to implement AND OR gates using Perceptron.
3. To implement Crab Classification using pattern net Objective.
4. To write a program to implement Wine Classification using Back propagation.
5. Write a MatLab Script containing four functions Addition, Subtraction, Multiply and Divide functions.
6. Write a program to implement classification of linearly separable Data with a perceptron.
7. To study ImageNet, GoogleNet, ResNet convolutional Neural Networks.
8. To study Convolutional Neural Network and Recurrent Neural Network.

PE—CS -D413A L	Object Oriented Software Engineering Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	2	1	40	60	100	3hrs
Purpose	Object-Oriented Software Development is an approach/paradigm of developing software by identifying and implementing a set of objects and their interactions to meet the desired objectives. The first step towards this kind of software development is to learn and master the various concepts, tools and techniques that are to be used design and implementation of such systems.						
Course Outcomes (CO)							
CO1	To learn and understand various O-O concepts along with their applicability contexts.						
CO2	To learn various modeling techniques to model different perspectives of object-oriented software design (UML)						
CO3	To learn software development life cycle for Object-Oriented solutions for Real-World Problems.						
CO4	Learn how to test and document software.						

List of Practicals

1. Choose any one project and Write the complete problem statement.
2. Write the software requirement specification document
3. Draw the entity relationship diagram
4. Draw the data flow diagrams at level 0 and level 1
5. Draw use case diagram
6. Draw activity diagram of all use cases.
7. Draw state chart diagram of all use cases
8. Draw sequence diagram of all use cases
9. Draw collaboration diagram of all use cases
10. Assign objects in sequence diagram to classes and make class diagram.

PE—CS-D415AL	Expert System Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	2	1	40	60	100	3hrs
Purpose	In this course the student will learn different techniques of AI and Expert system that can be used to solve real-time problems.						
Course Outcomes(CO)							
CO1	Examining the fundamentals and terminologies of expert system.						
CO2	Study of various trends and issues related to AI and expert system.						
CO3	Implement general problems using AI and expert system techniques.						
CO4	Student will capable to handle real time problems related to AI and expert system.						

List of Practicals

1. Study of Prolog.
2. Write simple fact for the statements using PROLOG.
3. Write predicates One converts centigrade temperatures to
4. Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.
5. Write a program to solve the Monkey Banana problem.
6. WAP to implement factorial, Fibonacci of a given number.
7. Write a program to solve 4-Queen problem.
8. Write a program to solve traveling salesman problem.
9. Write a program to solve water jug problem using LISP
10. Solve any problem using depth first search and best first search.

OE-CS-401A	Cyber Law and Ethics						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	To provide an overview of Cyber Law and also explores technical, legal, and social issues related to cybercrimes, Laws Cyber Ethics						
Course Outcomes (CO)							
CO1	Understand Cyber laws, Cyber space.						
CO2	Describe Information Technology act and Related Legislation.						
CO3	Demonstrate Electronic business and legal issues.						
CO4	Interpret Cyber Ethics, significance and its need.						

Unit I

Cyber Law: Emergence of cyber space, Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

Unit II

Information Technology Act: Overview of IT Act 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public and Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

Unit III

Cyber law and Related Legislation: Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code.

Unit IV

Cyber Ethics: The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block-Chain Ethics.

Suggested Books:

- Cyber Laws: Intellectual property & E Commerce, Security- Kumar K, dominant Publisher
- Cyber Ethics 4.0, Christoph Stuckelberger, Pavan Duggal, by Globethic
- Information Security policy & Implementation Issues, NIIT, PHI
- Legal Dimensions of Cyber Space, Verma S, K, Mittal Raman, Indian Law Institute, New Delhi
- Cyber Crimes and Law Enforcement, Vasu Deva, Commonwealth Publishers, New Delhi, (2003).

OE-CS-403A	Bioinformatics						
Lecture	Tutorial	Practical	Credit	MajorTest	MinorTest	Total	Time
3	0	0	3	75	25	100	3 Hour
Purpose	To familiarize the students with the concepts of bioinformatics.						
Course Outcomes							
CO 1	Explain concepts of bioinformatics and its significance in biological data analysis.						
CO 2	Apply various bioinformatics tools to manage different type of biological data.						
CO 3	Explain computational method and algorithms for biological data interpretation.						
CO 4	Classify different types of biological databases.						

Unit-I

Introduction to Bioinformatics: Introduction, outline of proteins, primary structure: the 20 amino acids – chemical structure & properties; polypeptide geometry: the folding chain, nomenclature, molecular graphics, Structure evolution and mutation genetic information- the triplet code; DNA structure Synthesis of proteins: cell biology background; transcription; RNA polymerase, introns, exons, splicing translation: ribosomes, start/stop codons, post-translational processing

Unit-II

Computing evolution: Phylogenetic Analysis Sequence- based taxonomy: overview and assumptions, from Multiple Alignment to phylogeny Neighbor, Joining Maximum Likelihood Vs. Parsimony, The molecular Clock, Computer Tools for patterns, mapping and phylogenetic analysis, Mathematical tools of proteins and nucleic acids, sequence- Function Relationships Sequence Homology and Conserved Regions , Conserved DNA Sequences.

Unit-III

Bioinformatics tools: Networks- WWW, CERN EMBnet; EMBL Database, SEQNET, GenBank, NLM , etc., Sequence Databases and Sequence Analysis: Genomic , CDNA EMBL database GenBank Protein sequence, Pattern recognition tools Similarity searching, secondary sources, genome databases, Molecular graphics software and other packages, To find sequences based on keywords & phrases, to grab individual sequences or whole groups of Sequences from a database

Unit-IV

Genomics: Introduction , genome scale sequencing , comparative and evolutionary genomics, microarrays, proteomics, pharmacogenomics, Development using computer tools for sequencing projects, PCR and restriction mapping practical and theoretical problems in sequencing. The challenges of whole genome sequencing, web based tools for restriction mapping, new technologies and new bioinformatics tools.

Suggested Books:

- Teresa K. Attwood, David J. Parry-Smith: Introduction to Bioinformatics, 1999, Longman Higher Education.
- S. eddy, a. Krogh, G. Mitchison, Richard Durbin: Biological sequence analysis: probabilistic models of proteins and nucleic acids, 1999, Cambridge University Press.
- Andreas Baxevasis , B.F. Francis Ouellete: Bioinformatics : a practical guide to the analysis of genes and proteins,1998, John Wiley & sons, inc
- James D. Tisdall: Beginning perl for Bioinformatics. 2001. O`reilly & Associates.
- Michael S. Wterman: Mathematical methods for DNA sequences, 1989, CRC Press.

OE-CS-405 A	FIBRE OPTIC COMMUNICATIONS						
Lecture	Tutorial	Practical I	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	To familiarize the students with the concepts of Optical communication covering the contents of optical fibers, losses in fibers, optical sources, detectors etc.						
Course Outcomes							
CO1	Students will be able to understand the structure of fiber and the mechanism of light travelling in the fiber.						
CO2	Students will be able to analyze various losses associated with fibers.						
CO3	Students will learn about the optical sources and optical detectors.						
CO4	Students will be able to understand the various components needed in optical networks						

Unit I

Introduction: Optical Fibers: Structure, Propagation within the fiber, Numerical aperture of fiber, step index and graded index fiber, Modes of propagation in the fiber, Single mode and multi mode fibers. Splices and connectors. Optical Power Launching and Coupling. Fiber-to-fiber joints.

Unit II

Losses in Optical Fiber: Rayleigh Scattering Losses, Absorption Losses, Leaky modes, Mode coupling losses, Bending Losses, Combined Losses in the fiber.

Dispersion Effect: Effect of dispersion on the pulse transmission Intermodal dispersion, Material dispersion, Wave guide dispersion, Polarization Mode Dispersion Total dispersion, Transmission rate. Dispersion Shifted Fibers, Dispersion Compensating Fibers.

Unit III

Light Sources: LEDs, Laser Action in semiconductor Lasers, Semiconductor Lasers for optical communication – Laser modes, Spectral Characteristics, Power Voltage Characteristics, Frequency response.

Detectors: P-I-N Photodiode, APD, Noise Analysis in detectors, Coherent and non-coherent detection, Infrared sensors. Bit error rate.

Unit IV

The Fiber-Optic Communication System: Design considerations of fiber optic systems: Analog and digital modulation. Optical Devices: Optical coupler, space switches, linear divider-combiners, wavelength division multiplexer and demultiplexer, optical amplifier

Optical Networks: Elements and Architecture of Fiber-Optic Network, Optical link network-single hop, multihop, hybrid and photonic networks.

Suggested Books:

- John Power, An Introduction to Fiber optic systems, McGraw Hill International.
- John Gower, Optical communication Systems.
- R. Ramaswamy, Optical Networks, Narosa Publication
- John M. Senior, Optical Fiber Communication
- Gerd Keiser, Optical Fiber Communication

OE-CS-407 A	Industrial Electrical Systems						
Lecture	Tutorial	Practical I	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	To provide the conceptual knowledge of various Industrial Electrical Systems.						
Course Outcomes							
CO1	To study various fundamental concepts of Electrical components.						
CO2	To study and understand the residential and commercial electrical system.						
CO3	To study functions and selection of Industrial Electrical components.						
CO4	To study the basics and role of PLC & SCADA in automation.						

Unit I

Electrical System Components: LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, relays, MPCB, electric shock and electrical safety practices.

Unit II

Residential and Commercial Electrical Systems: types of residential and commercial wiring system, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, protection devices, requirements of commercial installation, earthing of commercial installation, selection and sizing of components.

Unit III

Industrial Electrical Systems: HT connection, industrial substation, transformer selection, power factor correction-kVAR calculation, type of compensation, Introduction to PCC, MCC panels. Specifications of LT breakers. DG systems, UPS system, battery banks, sizing the DG, UPS and battery banks, selection of UPS and battery banks.

Unit IV

Industrial Electrical System Automation: Study of basic PLC, role of automation, advantages of process automation, PLC based control system design, Panel metering and Introduction to SCADA system for distribution automation.

Suggested Books:

- S.L. Uppal and G.C. Garg, "Electrical Wiring, Estimating & Costing", Khanna publishers, 2008.
- K.B. Raina, "Electrical Design, Estimating & Costing", New Age International, 2007.
- S. Singh and R.D. Singh, "Electrical estimating & costing", Dhanpat Rai and Co., 1997. Website for IS standards.
- H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.