**Dr YSR ANU College of Engineering & Technology**

**ACHARYA NAGARJUNA UNIVERSITY**

**SCHEME OF INSTRUCTION AND EXAMINATION, w.e.f. 2019-2022 (R19)**

**COMPUTER SCIENCE & ENGINEERING (CSE)**

**COMPUTER SCIENCE & INFORMATION TECHNOLOGY(CI)**

**IV/IV B.TECH - SEMESTER I (R19 Regulation - Structure & Syllabus)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S.No. | Course Details | Category  | Scheme of Instruction | Scheme of Examination |
| Code | Subject Name |   | Hours in a Week | Marks | Credits |
|   | L | T | P | Internal | External |
| 1 | CSE / CI 411 | Deep Learning | PC | 3 | 0 | 0 | 40 | 60 | 3 |
| 2 | CSE / CI 412 | Design & Analysis of Parallel Algorithms | PC | 3 | 0 | 0 | 40 | 60 | 3 |
| 3 | CSE / CI 413 | Software Project Management | PC | 3 | 0 | 0 | 40 | 60 | 3 |
| 4 | CSE / CI 414 | Professional Elective Course-III | PEC  | 3 | 0 | 0 | 40 | 60 | 3 |
| 5 | CSE / CI 415 | Open Elective/ Job Oriented Course-III | OEC | 3 | 0 | 0 | 40 | 60 | 3 |
| 6 | CSE / CI 416 | Cyber Laws and Ethics | BS | 3 | 0 | 0 | 40 | 60 | 3 |
| 7 | CSE / CI 451 | Advanced Python Programming | Skill Oriented Course | 0 | 0 | 3 | 40 | 60 | 2 |
| 8 | CSE / CI 452 | Industrial / Research Internship(2 months) after 3rd year | MC | 0 | 0 | 3 | 100 | 0 | 2 |
| Total Credits | 22 |

**PROFESSIONAL ELECTIVE COURSE-III**

CSE / CI 414/1. Data Analytics through R Programming

CSE / CI 414/2. Big Data & Hadoop

CSE / CI 414/3. Block Chain Technology

CSE / CI 414/4. Introduction to Data Science

**OPEN ELECTIVE (OEC)/JOB ORIENTED COURSES III(JOEC)**

CSE / CI 415/1. Computer Vision

CSE / CI 415/2. Natural Language Processing

CSE / CI 415/3. Speech & Audio Processing

CSE / CI 415/4. Introduction to Pattern Recognition

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**COMPUTER SCIENCE & ENGINEERING (CSE)**

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**IV/IV B.TECH - SEMESTER II (R19 Regulation - Structure & Syllabus)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S.No. | Course Details | Category  | Scheme of Instruction | Scheme of Examination |
| Code | Subject Name |   | Hours in a Week | Marks | Credits |
|   | L | T | P | Internal | External |
| 1 | CSE / CI 461 | Project work | Project | 0 | 0 | 0 | 50 | 100 | 8 |
| 2 | CSE / CI 462 | Seminar | Seminar | 0 | 0 | 0 | 50 | 0 | 2 |
| 3 | CSE / CI 463 | MOOCs | MOOC | 0 | 0 | 0 | 100 | 0 | 2 |
| Total Credits | 12 |

**CSE / CI 411 Deep Learning**

**Course Objectives:**

* The main objective of this course is to make students comfortable with tools and techniques required in handling large amounts of datasets.
* They will also uncover various deep learning methods in NLP, Neural Networks etc.
* Several libraries and datasets publicly available will be used to illustrate the application of these algorithms.

**UNIT-I**

What is deep learning, Gradient descent, logistic regression, Probability, continuous and discrete distributions; maximum likelihood.

**UNIT-II**

Output Vs hidden layers; linear Vs nonlinear networks; Deep learning strategies II:RLU and dropouts.

**UNIT-III**

How to use the SCC cluster; introduction to Tensor flow.

**UNIT-IV**

Convolutional neural networks, Deep Belief Nets, Recurrent neural networks, Other DNN variants (Kate).

**UNIT-V**

Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate SecondOrder Methods, Optimization Strategies and Meta-Algorithms.

**References:**

1.Ian Goodfellow, YoshuaBengio, Aaron Courville. Deep Learning.

2. Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classication​. Wiley-Interscience. 2nd Edition. 2001.

3. Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4. Academic Press, 2008.

4. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence. 2003.

5. Deep Learning: An MIT Press Book By Ian Goodfellow and Yoshua Bengio and Aaron Courville.

## **Learning Outcomes:**

* 1. Solve problems in linear algebra, probability, optimization, and machine Learning.
	2. Evaluate, in the context of a case study, the advantages and disadvantages of deep learning neural network architectures and other approaches.
	3. Design convolution networks for handwriting and object classification from images or video.
	4. Design recurrent neural networks with attention mechanisms for natural language classification, generation, and translation.
	5. Evaluate the performance of different deep learning models (e.g., with respect to the bias-variance trade-off, overfitting and underfitting, estimation of test error).

CSE / CI 412 **Design & Analysis of Parallel Algorithms LT P C**

 **3 0 0 3**

**Course Objective:**

To expose students to basic techniques of parallel algorithm development and programming on different parallel platform.

**UNIT I**

**INTRODUCTION**
Introduction to Parallel Algorithms – Models of Parallel Computation – Sorting on an EREW SIMD.
PRAM Computer – Relation between PRAM Models – SIMD Algorithms – MIMD Algorithms – Selection – Desirable Properties for Parallel Algorithms - Parallel Algorithm for Selection – Analysis of Parallel Algorithms.

**UNIT II**

 **MERGING, SORTING AND SEARCHING**Merging on the EREW and CREW Models - Fast Merging on EREW - Sorting Networks – Sorting on a Linear Array – Sorting on CRCW, CREW, EREW Models – Searching a Sorted Sequence – Searching a Random Sequence.

**UNIT III**

**MATRIX OPERATIONS**
Matrix Transpositions – Matrix by Matrix Multiplications – Matrix by Vector multiplication.

**GRAPH THEORY PROBLEMS**
Connectivity Matrix – Connected Components – All Pairs Shortest Paths – Minimum Spanning Trees.

**UNIT IV**

**DECISION AND OPTIMIZATION PROBLEMS**

Computing Prefix Sums – Applications - Job Sequencing with Deadlines – Knapsack Problem- The Bit Complexity of Parallel Computations.

**UNIT V**

**THE BIT COMPLEXITY OF PARALLEL COMPUTATIONS:**

Adding Two Integers, Adding N Integers, Multiplying Two Integers, Computing Prefix Sums, Matrix Multiplication, Selection, Sorting.

**REFERENCES:**

1. Selim G. Akl, “The Design and Analysis of Parallel Algorithms”, Prentice Hall, New Jersey, 1989

2. Michael J. Quinn, “Parallel Computing : Theory & Practice”, Tata McGraw Hill Edition, 2003.
3. Justin R. Smith, “The Design and Analysis of Parallel Algorithms”, Oxford University Press, USA , 1993.
4. Joseph JaJa, “Introduction to Parallel Algorithms”, Addison-Wesley, 1992.

**Learning Outcomes:**

1. Define the structure of, and cost models associated with, the PRAM, mesh and hypercube models of parallel computation.
2. Define the metrics of cost, speed-up and efficiency and use these as conceptual tools with which to analyse and discriminate between alternative candidate parallel algorithms for given problems. They will be able to demonstrate, by the use of appropriately chosen examples, the importance of scalability in parallel algorithm design.
3. Explain and, with appropriate use of diagrams, sketch the structure and operation of well known parallel algorithms in a range of application areas, including sorting, matrix and graph based problems.

**CSE / CI 413 Software Project Management LT P C**

 **3 0 0 3**

**COURSE OBJECTIVES:**

 To make the students to understand how to manage people in an organization.

• To understand the Software Project Planning and Evaluation techniques.
• To plan and manage projects at each stage of the software development life cycle (SDLC).
• To learn about the activity planning and risk management principles.
• To manage software projects and control software deliverables.
• To develop skills to manage the various phases involved in project management and people management.
• To deliver successful software projects that support organization‘s strategic goals.

UNIT -I PROJECT EVALUATION AND PROJECT PLANNING

Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT -II PROJECT LIFE CYCLE AND EFFORT ESTIMATION

Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.

UNIT -III ACTIVITY PLANNING AND RISK MANAGEMENT

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

UNIT – IV PROJECT MANAGEMENT AND CONTROL

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

UNIT -V STAFFING IN SOFTWARE PROJECTS

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

**OUTCOMES: At the end of the course, the students should be able to:**

• Understand Project Management principles while developing software.
• Gain extensive knowledge about the basic project management concepts, framework and the process models.
• Obtain adequate knowledge about software process models and software effort estimation techniques.
• Estimate the risks involved in various project activities.
• Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
• Learn staff selection process and the issues related to people management

**TEXT BOOK:**

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

2. Robert K. Wysocki ―Effective Software Project Management‖ – Wiley Publication, 2011

**REFERENCES:**.

1. Walker Royce: ―Software Project Management‖- Addison-Wesley, 1998.
2. Gopalaswamy Ramesh, ―Managing Global Software Projects‖ – McGraw Hill Education (India), Fourteenth Reprint 2013.

 3 Information Technology Project Management: Kathy Schwalbe Thomson Publication.

 4. Information Technology Project Management providing measurable organizational value Jack Marchewka Wiley India.

 5. Applied software project management Stellman & Greene SPD.

 6. Software Engineering Project Management by Richard Thayer, Edward Yourdon WILEY INDIA.

**CSE / CI 414/1 Data Analytics through R Programming L T P C**

 **3 0 0 3**

# Course Objectives:

* + Understand the use of R, Basics of R, Advanced data structures, reading/writing data into R.
	+ Manipulate data using SQL statements and visualization of data using different plots.
	+ Understand the normal, binomial distributions, correlation and covariance, T-test, ANOVA, Manipulation string, and linear models.
	+ Understand the cluster analysis and classification.

# UNIT-I

**Introduction to R -** Why use R?, Obtaining and installing R, The R Environment - Command line interface, RStudio, R Packages - Installing packages, loading packages, Building packages.

**Basics of R** - basic Math, variables, Data types, vectors, calling function, function documentation, missing data. Excel data, reading from databases.

# UNIT-II

**Basic Data Management -** A working example, creating new variables, recoding variables, renaming variables, sorting data, merging data set, sub-setting datasets, Using SQL statement to manipulate data.

# UNIT-III

**Data Management Challenge -** Numerical and character functions, a solution for data management challenge, control flow, User Written functions, pie chart, Histograms, Kernel Density plots, Box plots, dot plots.

# UNIT-IV

**Data Distribution and Regression-** Normal distribution, binomial distribution, summary statistics, correlation and covariance, T-test, ANOVA, paste, sprintf, extracting text, regular expression, Simple linear regression, multiple linear regressions, logistic regression.

# UNIT-V

**Cluster Analysis**- Common steps in cluster analysis, calculating distances, Hierarchical cluster analysis, Partitioning cluster analysis, avoiding nonexistence clusters, Preparing the data, decision trees

# Text books:

1. R for Every One, Advanced analytics and graphics by Jared P Lander, Addison Wisley Data and Analytics series.
2. R in Action, Data Analysis and graphics with R, Robert L Kaacoff, Manning Publisher

# References:

1. Beginning R by Dr.Mark Gardener, Wrox publisher.
2. Associate Analytics Facilitator Guide provided by NASSCOM.

**CSE / CI 414/2 Big Data & Hadoop L T P C**

**3 0 0 3**

# Course Objectives:

* + Understand the Big Data Platform and its Use cases.
	+ Provide an overview of Apache Hadoop.
	+ Provide HDFS Concepts and Interfacing with HDFS.
	+ Apply analytics on Structured, Unstructured Data.

# UNIT-I

**Introduction to Big Data and Hadoop:** Introduction to Big Data, Big Data Analytics, Big Data – Definition, Characteristic Features – Big Data - Applications - Big Data Vs Traditional Data - Risks of Big Data - Structure of Big Data – Challenges of Conventional Systems -History of Hadoop, Apache Hadoop, Analyzing Data with Unix tools, Analyzing Data with Hadoop

# UNIT-II

**Hadoop Framework**: Hadoop – Requirement of Hadoop Framework - Design principle of Hadoop –Comparison with other system - Hadoop Components – Hadoop Daemon’s –Working with HDFS Commands.

# UNIT-III

**HDFS (Hadoop Distributed File System):** The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow

**Hadoop I/O:** Compression, Serialization, Avro and File-Based Data structures.

# UNIT-IV

**Map Reduce:** Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

# UNIT-V

**Hadoop Eco System:Pig :** Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.

**Hive :** Hive Shell, Hive Services, Hive Metastore , Tables, Querying Data and User Defined Functions.

**Hbase :** HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.

# Text books:

1. Tom White “ Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
2. Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley, 2014.
3. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

# References:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
2. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press (2013)
3. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.

**CSE / CI 414/3 Block Chain Technology L T P C**

**3 0 0 3**

**Course Objectives:**

* Develop familiarity of current technologies, tools.
* Impart strong technical understanding of Block Chain technologies.
* Explore the Smart Contracts and Ethereum implementation strategies.
* Introduce the current scenario and practical application areas of Hyper ledger.

**UNIT-I**

**Block Chain 101**- Distributed Systems, History of blockchain, Introduction to blockchain, Types of block chain, CAP theorem and blockchain, benefits and limitations of blockchain,

**Decentralization**- Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Blockchain and full eco system decentralization, Smart contract, Decentralized Organizations, Decentralized autonomous organizations, Decentralized autonomous corporations, Decentralized autonomous societies, Decentralized applications, Platforms for Decentralization.

**UNIT-II**

**Cryptography and Technical Foundations**- Introduction, Cryptographic primitives, Asymmetric Cryptography, Public and Private-keys, Financial -market and trading, Summary.

**Bitcoin**- Bitcoin, Transactions, Blockchain, Bitcoin Payments.

**UNIT-III**

**Smart Contracts**- History, Definition, Ricardian Contracts.

**Ethereum 101**-Introduction, Ethereum blockchain, Elements of the Ethereum block chain, Precompiled contracts, Accounts, Block, Ether, Messages, Mining, Clients and Wallets, Trading and investment, The Yellow paper, The Ethereum Network, Applications developed on Ethereum, Scalability and security issues.

**UNIT-IV**

**Hyper Ledger**- Projects, Hyperledger as a Protocol, Fabric, Hyperledger Fabric, Sawtooth lake, Corda,

**UNIT-V**

**Alternative Block Chain**- Block chains, Platforms.

**Scalability and Other Challenges**- Scalability, Privacy, Security,

**Text books:**

1. Seberrius Jeffery,” Block Chain” 2nd Edition Publishers details 2015

**References:**

1. Narayanan, Bonneau, Felten, Miller and Goldfeder, “Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction”, Princeton University Press.

2. Josh Thompson, ‘Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming’, Create Space Independent Publishing Platform, 2017.

**CSE / CI 414/4 Introduction to data Science L T P C**

**3 0 0 3**

**Course Objectives:**

Will gain knowledge in the basic concepts of Data Analysis

* To acquire skills in data preparatory and preprocessing steps.
* To understand the mathematical skills in statistics.
* To learn the tools and packages in Python for data science.
* To gain understanding in classification and Regression Model.
* To acquire knowledge in data interpretation and visualization techniques.
* To learn the essential concepts of data analytics and data visualization.

**UNIT I**

Data science: definition, Datafication, Exploratory Data Analysis, The Data science process, A data scientist role in this process.

NumPy Basics: The NumPy ndarray: A Multidimensional Array Object, Creating ndarrays ,Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Data Processing Using Arrays, Expressing Conditional Logic as Array Operations, Methods for Boolean Arrays , Sorting , Unique.

**UNIT II**

Getting Started with pandas: Introduction to pandas, Library Architecture, Features, Applications, Data Structures, Series, DataFrame, Index Objects, Essential Functionality Reindexing, Dropping entries from an axis, Indexing, selection, and filtering),Sorting and ranking, Summarizing and Computing Descriptive Statistics, Unique Values, Value Counts, Handling Missing Data, filtering out missing data.

**UNIT III**

Data Loading, Storage, and File Formats : Reading and Writing Data in Text Format, Reading Text Files in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats, JSON Data, XML and HTML: Web Scraping, Binary Data Formats,Using HDF5 Format, Reading Microsoft Excel Files, Interacting with Databases, Storing and Loading Data in MongoDB .

**UNIT IV**

Data Wrangling: Combining and Merging Data Sets, Database style DataFrame Merges, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap , Reshaping and Pivoting, Reshaping with Hierarchical Indexing, Data Transformation, Removing Duplicates, Replacing Values.

**UNIT V**

Plotting and Visualization: A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File,Plotting Functions in pandas, Line Plots, Bar Plots, Histograms and Density Plots, Scatter Plots.

**Text Books:**

1. Wes McKinney, “Python for Data Analysis”,O’REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2012.
2. Rachel Schutt & O’neil, “Doing Data Science”, O’REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.

**Reference Books:**

1. Joel Grus, “Data Science from Scratch: First Principles with Python”, O’Reilly Media, 2015
2. Matt Harrison, “Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2016.

**Course Outcomes:**

Upon successful completion of the course, the student will be able to:

* Apply principles of NumPy and Pandas to the analysis of data.
* Make use of various file formats in loading and storage of data.
* Identify and apply the need and importance of pre-processing techniques.
* Show the results and present them in a pictorial format.

**CSE / CI 415/1 Computer Vision L T P C**

**3 0 0 3**

**Objective:**

* To build an understanding on detailed models of image formation.
* To expose the students to image feature detection and matching.
* To introduce fundamental algorithms for pattern recognition.
* To introduce various classification techniques.
* To expose the students to various structural pattern recognition and feature extraction techniques.

**Unit-1**

Image formation and Image model- Components of a vision system- Cameras- camera model and camera calibration- Radiometry- Light in space- Light in surface - Sources, shadows and shading.

**Unit-2**

Multiple images-The Geometry of multiple views- Stereopsis- Affine structure from motion- Elements of Affine Geometry Affine structure and motion from two images- Affine structure and motion from multiple images- From Affine to Euclidean images.

**Unit-3**

High level vision- Geometric methods- Model based vision- Obtaining hypothesis by pose consistency, pose clustering and using Invariants, Verification.

**Unit-4**

Introduction to pattern and classification, supervised and unsupervised learning, Clustering Vs classification, Bayesian Decision Theory- Minimum error rate classification Classifiers, discriminant functions, decision surfaces- The normal density and discriminant-functions for the Normal density

**Unit-5**

**Linear discriminant based classifiers and tree classifiers:**

Linear discriminant function based classifiers- Perceptron- Minimum Mean Squared Error (MME) method, Support Vector machine, Decision Trees: CART, ID3.

**Unsupervised Methods:** Basics of Clustering; similarity / dissimilarity measures; clustering criteria. Different distance functions and similarity measures, K-means algorithm.

**Recent Advances in Pattern Recognition** Neural network structures for pattern recognition, Pattern classification using Genetic Algorithms.

**Text Books:**

1. Bernd Jahne and Horst HauBecker, Computer vision and Applications, Academic press, 2000.

2. David A. Forsyth & Jean Ponce, Computer vision – A Modern Approach, Prentice Hall, 2002.

**Reference Books:**

1. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

2. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, John Wiley, 2001.

3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, 2004.

4. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.
5. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010.

6. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.

7. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012.

8. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.

9. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer
Vision, Third Edition, Academic Press, 2012.

**Course Outcomes:**

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

* Appreciate the detailed models of image formation.
* Analyse the techniques for image feature detection and matching.
* Apply various algorithms for pattern recognition.
* Examine various clustering algorithms.
* Analyze structural pattern recognition and feature extraction techniques.

CSE / CI 415/2 **Natural Language Processing L T P C**

**3 0 0 3**

**Course Objectives**:

* 1. To understand the underlying concepts and techniques required f or natural language processing.
	2. To create computational models for enabling effective and natural language processing.

**UNIT I**

Overview and language modeling: Overview: Origins and challenges of NLP-Language
and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval.
Language Modeling: Various Grammar- based Language Models-Statistical Language
Model.

**UNIT II**

Word level and syntactic analysis: Word Level Analysis: Regular Expressions-Finite-
State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-
Constituency- Parsing-Probabilistic Parsing.

**UNIT III**

Extracting Relations from Text: From Word Sequences to Dependency Paths:
Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation.

Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles:
Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations.
A Case Study in Natural Language Based Web Search: InFact System Overview, The
GlobalSecurity.orgExperience.

**UNIT IV**

Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis,
and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of
Feedback Systems.

Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to
Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix,
Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of
Experiments.

Automatic Document Separation: A Combination of Probabilistic Classification and
Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation,
Document Separation as a Sequence Mapping Problem, Results.

**UNIT V**

INFORMATION RETRIEVAL AND LEXICAL RESOURCES:

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.

**Text Books:**

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

2. Anne Kao and Stephen R. Poteet (Eds), “Natural LanguageProcessing and Text Mining”, Springer-Verlag London Limited 2007.

# Reference Books:

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: Anintroduction to Natural Language Processing, Computational Linguistics and SpeechRecognition”, 2nd Edition, Prentice Hall, 2008.

2. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin/Cummingspublishing company, 1995.

3. Gerald J. Kowalski and Mark.T. Maybury, “Information Storage and Retrieval systems”, Kluwer academic Publishers, 2000.

# Course Outcomes:

The students should be able to:

* Analyze the natural language text.
* Generate the natural language.
* Do Text mining.
* Apply information retrieval techniques.

CSE / CI 415/3 **SPEECH AND AUDIO PROCESSING L T P C**

**3 0 0 3**

**Course objectives:**

Main objectives can be summarized as follows:

* To understand the basic principles of sound and speech production and perception;
* To understand basic principles of speech regognition,synthesis and dialogue systems;

**UNIT-I**

Introduction- Speech production and modeling - Human Auditory System;General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness.

**UNIT-II**

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters,convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation. Linear Prediction of Speech- Basic concepts of linear prediction;

**UNIT-III**

LinearPrediction Analysis of nonstationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction. Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer,logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

**UNIT-IV**

Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF. Linear Prediction Coding- LPC model of speech production; Structures of LPCencoders and decoders; Voicing detection; Limitations of the LPC model.

**UNIT-V**

Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero-state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP. Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

**Text/Reference Books:**

1. “Digital Speech” by A.M.Kondoz, Second Edition (Wiley Students‟ Edition), 2004.

2. “Speech Coding Algorithms: Foundation and Evolution of Standardized Coders”, W.C. Chu, WileyInter science, 2003.

**Learning outcomes**

Student will be able after finishing the course to describe and explain the basic terms, methods and standards in following areas:

 physiological acoustics, especially the processes of forming and understanding the human speech

 signal digitization and basic signal processing in time and frequency domains

 continues speech recognition

 time and frequency domain text-to-speech synthesis

**CSE / CI 415/4 Introduction to Pattern Recognition L T P C**

**3 0 0 3**

**UNIT I**

**Basics of Probability, Random Processes and Linear Algebra (recap)**: Probability: independence of events, conditional and joint probability, Bayes theorem Random Processes: Stationary and non-stationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra.

**UNIT II**

**Linear Algebra**: Inner product, outer product, inverses, eigen values, eigen vectors, singular values, singular vectors.

**Bayes Decision Theory** : Minimum-error-rate classification. Classifiers, Discriminant functions, Decision surfaces. Normal density and discriminant functions. Discrete features.

 **UNIT III**

**Parameter Estimation Methods** : Maximum-Likelihood estimation :Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and clustering - Criterion functions for clustering. Algorithms for clustering: K-Means, Hierarchical and other methods. Cluster validation. Gaussian mixture models, Expectation-Maximization method for parameter estimation. Maximum entropy estimation. Sequential Pattern Recognition. Hidden Markov Models (HMMs). Discrete HMMs. Continuous HMMs. Nonparametric techniques for density estimation. Parzen-window method. K-Nearest Neighbour method.

**UNIT IV**

**Dimensionality reduction**: Principal component analysis - it relationship to eigen analysis. Fisher discriminant analysis - Generalised eigen analysis. Eigen vectors/Singular vectors as dictionaries. Factor Analysis, Total variability space - a dictionary learning methods. Non negative matrix factorisation - a dictionary learning method.

**Linear discriminant functions** : Gradient descent procedures, Perceptron, Support vector machines - a brief introduction.

**UNIT V**

**Artificial neural networks**: Multilayer perceptron - feedforwark neural network. A brief introduction to deep neural networks, convolutional neural networks, recurrent neural networks.

**Non-metric methods for pattern classification** : Non-numeric data or nominal data. Decision trees: Classification and Regression Trees (CART).

**Reference Books**:

* R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
* S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
* C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

### **Course Outcomes:**

On the successful completion of this course Student are able

* Summarize the various techniques involved in pattern recognition.
* Categorize the various pattern recognition techniques into supervised and unsupervised.
* Illustrate the artificial neural network based pattern recognition.
* Discuss the applications of pattern recognition in various applications.

**CSE / CI 416 Cyber Laws and Ethics**

**Course Objectives**

1. The course objective is to provide the fundamental skill to understand cyber laws.

2. It enable to understand the legal frameworks.

3. It helps the student understand different cyber crimes.

4. It provides overview on Intellectual Property, copy rights, patents rights etc.

5. Given rapid changes in technology and the corresponding changes in crime and the law.

**Unit-1:  Introduction to Cyber Law**

Evolution of computer technology, 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-2:  Information Technology Act**

Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, 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-3:  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, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).

**Unit-4:  Electronic Business and Legal Issues**

Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models- B2B, B2C, E security. Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.

**Unit-5:  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.

**References:**

1. Cyber Laws: Intellectual property & E Commerce, Security- Kumar K, dominant Publisher

2. Cyber Ethics 4.0, Christoph Stuckelberger, Pavan Duggal, by Globethic

3. Computers, Internet and New Technology Laws, Karnika Seth, Lexis Nexis Butterworths Wadhwa Nagpur

#### **LEARNING OUTCOMES:**

The student will:

* Demonstrate an understanding of how ethical issues affect individuals, communities and societies and be able to analyze the consequences of various professional ethical dilemmas.
* Demonstrate awareness and understanding of what is morally/ethically at stake in various situations.
* Apply moral principles and standards of behavior in a workplace setting.
* Identify concepts such as ethics, morals, character, ethical principles and ethical relativism.

**CSE / CI 451 Advanced Python Programming**

1. **CLASS AND OBJECTS:**
2. Create a class ATM and define ATM operations to create account, deposit, check\_balance, withdraw and delete account. Use constructor to initialize members.
3. Make a class Employee with a name and salary. Make a class Manager inherit from Employee. Add an instance variable, named department. Write a method that prints manager's name, department and salary. Make a class Executive inherit from Manager. Write a method that prints the string "Executive" followed by the information stored in the Manager super class object.
4. A hospital wants to create a database regarding its indoor patients. The information to store include a) Name of the patient b) Date of admission c) Disease d) Date of discharge. Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).
5. **NUMPY:**

a. Using Numpy, write a basic array of operations on single array to add x to each element of array and subtract y from each element of array.

 b. Using Numpy, write a program to add, subtract and multiply two matrices.

c. Write a Python program to do the following operations:

 Library: NumPy

1. Create multi-dimensional arrays and find its shape and dimension
2. Create a matrix full of zeros and ones
3. Reshape and flatten data in the array
4. Append data vertically and horizontally
5. Apply indexing and slicing on array
6. Use statistical functions on array - Min, Max, Mean, Median and Standard Deviation
7. Dot and matrix product of two arrays
8. Compute the Eigen values of a matrix
9. Solve a linear matrix equation such as 3 \* x0 + x1 = 9, x0 + 2 \* x1 = 8
10. Compute the multiplicative inverse of a matrix
11. Compute the rank of a matrix
12. Compute the determinant of an array
13. **GUI:**

 a. Design a GUI based calculator to perform arithmetic operations like addition, subtraction, multiplication and division. ( Hint: Expression Calculator using tk)

b. Design a GUI based application to convert temperature from Celsius to Fahrenheit.

c. Write a python program to perform various database operations (create, insert, delete, update).

4. **Pandas Library: Selection**

 a) Write a program that converts Pandas DataFrame and Series into numpy.array.

b) Write a program that demonstrates the column selection, column addition, and column deletion.

c) Write a program that demonstrates the row selection, row addition, and row deletion.

d) Get n-largest and n-smallest values from a particular column in Pandas dataFrame

**5. Pandas Library: Visualization**

a) Write a program which use pandas inbuilt visualization to plot following graphs:

 i. Bar plots ii. Histograms iii. Line plots iv. Scatter plots

b) Write a program to demonstrate use of groupby() method.

c) Write a program to demonstrate pandas Merging, Joining and Concatenating

d) Creating dataframes from csv and excel files.

**4. GRAPHICS**

a. Consider turtle object. Write functions to draw triangle, rectangle, polygon, circle and sphere.

b. Design a Python program using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed.

c. Write a python program to implement the following figures using turtle.



**Reference Books:**

1. Michael H Goldwasser, David Letscher, “Object Oriented Programming in Python”, Prentice Hall, 1st Edition, 2007.

2. Yashavant Kanetkar, Aditya Kanetkar, “Let us Python, BPB publication, 1st Edition, 2019.

3. Ashok Kamthane, Amit Kamthane, “Programming and Problem solving with Python”, McGraw Hill Education (India) Private Limited, 2018.

4. Taneja Sheetal, Kumar Naveen, “Python Programming – A Modular Approach”, Pearson, 2017. 5. R Nageswara Rao, “Core Python Programming”, Dreamtech Press, 2017 Edition.

6. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, “How to Think Like a Computer Scientist: Learning with Python 3”, 3rd Edition, 2015.

7. Paul Barry, “Head First Python a Brain Friendly Guide”, O’Reilly, 2 nd Edition, 2016.

8. Dainel Y.Chen “Pandas for Everyone Python Data Analysis” Pearson Education, 2019.

9. Martin C. Brown (Author), “Python: The Complete Reference” McGraw Hill Education, Fourth edition , 2018.