# Semester -II
# PCC-CSE-201- Systems and Information Security

**Theory:** 3 Hr/Week
**Tutorial:**1 Hr/Week
**Marks:** 100
**Term Work :** 25

**Course Objectives**

1. To learn Fundamental Concepts of Cryptography and Network Security
2. To introduce Definition and Types of Encryption and Decryption Techniques
3. To expose students to Need and use of authentication, Digital Signatures in security.
4. To learn Network Security for IP, E-Mail, Web, intrusion detection systems

**Course Outcomes**

At the end of the course students will be able to

1. Describe basic terminology in cryptography, and classical cryptosystems.
2. Explain modern cryptosystems.
3. Explain security policies such as authentication, integrity and confidentiality.
4. Explain network and Web security protocols.

## Course Contents

**Unit 1. Introduction** **6 Hrs.**

Basic Cryptography and Cipher Techniques Classical crypto system, Stream & block ciphers, Introduction to finite fields, DES, AES, RC5, Differential and Liner Cryptanalysis

**Unit 2. Asymmetric key cryptography** **7 Hrs.**

Introduction to number theory, RSA, key management, Diffi-Hellman key exchange elliptic curve arithmetic, elliptic curve cryptography, Zero knowledge proof systems.

**Unit 3. Authentication:** **6 Hrs.**

Authentication requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Security of Hash Functions and MACS, Digital Signatures, Authentication Protocols, Digital Signature Standard

**Unit 4.** **Network Security:** **7 Hrs.**

Electronic Mail Security - Pretty Good Privacy, S/MIME, IP Security – IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating security Payload

**Unit 5.** **Web Security:** **5 Hrs.**

Web Security Considerations, Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction

**Unit 6.** **System Security:** **5 Hrs**

Malicious Logic and System Security Introduction, computer viruses, worms, Intruders - Intruders, Intruder detection, Password Management, Malicious Software - Viruses and Related Threats, Virus Countermeasures, Firewall - Firewall Design Principles, Trusted systems, recent trends in IP security- case study, legal issues, tools used to detect and prevent attacks

## Reference Books


1 “Cryptography and Network Security Principles and Practices”: Williams Stallings (LPE).

2 "Handbook of Applied Cryptography": Menezes, A. J., P. C. Van Oorschot, and S. A. Vanstone.

3 "Applied Cryptography: Protocols & Algorithms": Schneier, Bruce.

4 IP security-Case study: tools from appropriate white papers or journal papers from internet

# PCC-CSE-202Machine Learning

**Theory:** 3 Hr/Week
**Practical:**2Hrs/Week

**Marks:** 100
**Term Work :** 25

## Course Objectives

1. To understand Human learning aspects and represent using mathematical model
2. To understand primitives in learning process and implement using programming
3. To understand mathematical modeling for solving problems

## Course Outcomes

At the end of the course students will be able to

1. Explain machine learning concepts.
2. Analyse the Machine learning model and apply to solve societal problems
3. Design solution using machine learning techniques.

## Course Contents

**Unit 1.** **Introduction** **05 Hrs.**

Definition, Terminology, Types of learning, Machine Learning Problem categories, Machinelearning architecture, process, Lifecycle, Goals and applications of machine learning, Performance measures, tools and framework, datavisualization.

**Unit 2.** **Regression** **08 Hrs.**

Simple regression – hypothesis, cost function, parameter learning with gradient descent, learningrate, Gradient Descent for linear regression, examples, simple regression in matrix form.Multivariate Linear Regression – multiple features, hypothesis functions, Gradient Descent formultiple variables, Feature scaling, polynomial regression

**Unit 3.** **Classification- logistic regression** **06 Hrs.**

Definition, logistic regression – hypothesis representation, decision boundary, cost function,gradient descent for logistic regression. multiclass classification, Regularization - Overfitting&Underfitting, cost function, Regularized Linear Regression, Regularized Logistic Regression

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| **Unit 4.** | **Artificial Neural Networks**<br>Neurons and biological motivation. Model Representation, Linear threshold units. Perceptrons: representational limitation and gradient descent training. Hypothesis for neuron, cost function,solution of a problem using single neuron.Multiclass classification with neural network. Backpropagation, Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks. | **08 Hrs.** |
| **Unit 5.** | **Classification- Decision trees and Naïve Bayes**<br>Decision trees: definition, terminology, the need, advantages, and limitations. constructing andunderstanding Decision trees, common problems with Decision trees, Decision tree algorithms,random forest, examples. Conditional probability and Naïve Bayes Classifier Instance-basedclassifier – K- Nearest Neighbour Classifier | **08 Hrs.** |
| **Unit 6.** | **Unsupervised learning**<br>Clustering, K Means clustering, Hierarchical clustering, Association Rule Mining | **05Hrs** |

## Reference Books


1. Machine Learning with Python- an approach to applied ML, by AbhishekVijayvargia, BPB publications
2. Practical Machine Learning by SunilaGollapudiPackt Publishing Ltd.
3. Machine Learning by Tom M. Mitchell, McGraw Hill Education; First edition
4. Machine Learning for dummies John Paul Muller, Willey Publication
5. EthemAlpaydin : Introduction to Machine Learning, PHI 2nd Edition-2013

# PCE-CSE-201Data Analytics

**Lectures: 3 hrs / week** **Marks: 100 Marks**

**Practical: 2 hrs/week** **Term Work: 25 Marks**

**Course Objectives:**

1. To study data mining techniques

3. To study the basics of web mining and social network Analysis.

4. Understand the concepts of Big data and challenges in processing Big Data

5. Understand Hadoop architecture and eco-system

**Course Outcomes:**

1. Students will be able to explain fundamentals of Data analysis using data mining, data preparation and exploration, Business Intelligence.

2. Student will be able to explain Classification, clustering with respect to data mining.

3. Student will be able to describe association rule mining, web miningwith respect to data mining.

4. Students will be able to explain fundamentals related to Hadoop and work with Hadoop and work with Hadoop ecosystems such as pig and hive.

5. Student will be able to describe Social Network Analysiswith respect to data analytics.

**Course Content** .

**Unit 1: Business Intelligence Fundamentals (5hrs)**

Components of Decision making process, Business intelligence, Decision Support Systems, Data ware-housing. Data analysis and exploration, Mathematical models for decision making, data preparation, data exploration, Data Mining, Regression and Correlation, Similarity Measures.

**Unit 2: Introduction of Big data and Hadoop Echo system (7hrs)**

Big data definition, Elements of Big data, Big data analytics, Big Data Stack, Virtualization and Big data, virtualization approaches, Hadoop Ecosystem, Hadoop Distributed file system(HDFS, MapReduce, Hadoop YARN, Hbase, Hive, Pig and Pig latin, Sqoop, ZooKeeper, Flume, Oozie

**Unit 3: Classification (7hrs)**

Introduction to Classification, Issues in Classification, Statistical Based Algorithms, Bayesian Classification, Distance Based Algorithms, Simple Approach, K Nearest Neighbors, Decision Tree Based Algorithms, ID3, C4.5, CART, Rule Based Algorithms, Generating Rules from a DT, Generating Rules from Neural Networks.

**Unit 4. Clustering (7hrs)**

Introduction to clustering, Similarity and Distance Measures for clustering, Outliers, Hierarchical Algorithms, Agglomerative Algorithms, Divisive Clustering, Partitional Algorithms, Minimum Spanning Tree, Squared Error Clustering Algorithm, K-Means Clustering, Nearest Neighbor Algorithm, Clustering Large Database, BIRCH, DBSCAN, CURE Algorithm.

**Unit 5. Association Rules (7hrs)**

Introduction toAssociation Rule Mining, Large Item sets, Basic Algorithms, Apriori Algorithm, Sampling Algorithm, Partitioning, Parallel and Distributed Algorithm, Data Parallelism, Task Parallelism, Comparing Approaches, Incremental Rules, Advanced, Association Rule Techniques, Generalized Association Rules, Multiple Level Association Rules,

**Unit 6. Web Mining (7hrs)**

Introduction to Web Mining, Web Content Mining, Web Structure Mining, Web Usage Mining, Preprocessing, Social Network Analysis, Characteristics of Social Networks, Link Mining: Tasks and Challenges, Mining on Social Networks.

**Text Books:**

1. Data Mining Introductory and Advanced Topics - Margaret H. Dunham(Unit 1, 3,4,5,6)
2. Business Intelligence - Data Mining and optimization for Decision Making- Carlo Vercellis- Wiley Publications.(Unit 1)
3. Data Mining: Concepts and Techniques Second Edition- Jiawei Han and MichelineKamber- Morgan, KaufMan Publisher.(Unit 6)
4. Big Data and Analytics- Seema Acharya and SubhashiniChellappan- Wiley Publications(Unit 2)

**Reference Books:**

1. Data Mining Practical Machine Learning Tools and Techniques - Ian H. Witten, Eibe Frank
2. Mastering Data Mining by Michael J.A. Berry & G.S. Linoff (Wiley Student Edition)
3. Big Data (Black Book)- DT Editorial Services- Dreamtech Press

# PCE-CSE-201 Data Warehousing and Data Mining

**Lectures: 3 hr / week** **Marks: 100 Marks**

**Practical: 2 hrs/week** **Term Work: 25 Marks**

**Course Objectives :**

1. To perceive the basic concepts of Data Warehousing, Data mining – its architecture and implementations.
2. To implement and analyze the datawarehousingprocess and data miningalgorithms.
3. To evaluate the different data warehousing anddatamining tools.

**Course Outcomes**:

1. Student will understand fundamentals of data warehousing and data mining.
2. Student will be able to illustrate data warehousing process and data mining algorithms.
3. Student will be able to utilize different data warehousing and data mining tools.

## Course Content

**Unit 1:Data warehousing (DW) Overview and Concepts** **6hrs**

The compelling need for data warehousing:Need for strategic information, failures of past DSS, operational versus DSS, DW-only viable solution.
Data warehouse building blocks: Defining features, DW and data marts, understanding DW architecture, distinguishing characteristics, architectural framework, Technical architecture, architectural types, metadata in DW.

**Unit 2 :Building the Data Warehouse :** **7hrs**

Principles of Dimensional Modeling:From requirements to data design, the star schema, star schema keys, advantages of star schema, star schema examples, snowflake schema.
Data Extraction, Transformation and Loading (ETL):ETL overview, ETL requirements and steps, data extraction, data transformation, data loading, ETL summary.

**Unit 3: Data Mining** **6hrs**

Introduction : Basic data mining tasks, data mining knowlede discovery in databases, data mining issues, data mining metrics, data mining from database perspective, future.
Classification: Issues in classification, stat tical based algorithms, distance ased algorithms, neural network based algorithm

**Unit 4:Clustering** **6hrs**

Introduction, similarity and distance measures, hierarchical algorithms, partition algorithms, clustering large databases

**Unit 5:Association rules** **7hrs**

Introduction, item sets, basic algorithms, parallel and distributed algorithm, comparing approaches, measure the quality of rules

**Unit 6:Web Mining** **6hrs**

Introduction, web content mining, web structure mining, web usage mining

## Textbook:


1. Data Warehousing - Fundamentals for IT Professional: PaulrajPonniah 2nd Edition.Wiley
2. Data Mining - Introductory and Advanced Topics : Dunham, Margaret H, PrenticeHall.


## References:


1. Data Mining - Concepts & Techniques: Jiawei Han &MichelineKamber, MorganKaufmann.
2. Building the Data Warehouse- W. H. Inmon, Wiley Dreamtech India Pvt.Ltd...
3. The Data Warehouse Life cycle Tool kit – RALPH KIMBALL WILEY STUDENTEDITION

# PCE-CSE-201 Business Analytics

**Business Analytics**

**Lectures: 3 hr / week** **Marks: 100 Marks**

**Practical: 2 hrs/week** **Term Work: 25 Marks**

## Course Objectives

1. To learn basic understanding of business analytics and its role within an organization.
2. To provide sound domain knowledge of business analytics and its critical concepts
3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making
4. To explore applications of analytics.

## Course Outcomes

At the end of the course students will be able to

1. Describe basic concepts of business analytics and its role within an organization.
2. Describe types of digital data.
3. Analyse need and features of Business Intelligence.
4. Describe Data integration Technologies.
5. Describe multidimensional models.
6. Describe applications of Business analytics.

## Course Contents

**Unit 1. Introduction** **7 Hrs.**

Introduction to Business Analytics (BA) – Need, Components, Types and Techniques (Descriptive, Predictive and Prescriptive);Business Enterprise Organization, its functions and core business processes, Key Purpose of Using IT in Business; Information Users and Their Requirements. Framework for data-driven decision making.

**Unit 2. Digital data** **7 Hrs.**

Types of Digital Data – Definition, Sources, Storage and Characteristics of Structured, Unstructured and Semi-Structured Data; On Line Analytical Processing (OLAP) versus Online Transaction Processing (OLTP); Data Models for OLTP and OLAP

**Unit 3. Business Intelligence** **7 Hrs.**

Definitions and Examples in Business Intelligence, Data Mining, Big Data, Web and Social Media Analytics, Machine Learning, Data Science, Looking at Data from Various Perspectives of Managing Data; Need, Features and Use of Business Intelligence (BI); BI Component Framework; Business Intelligence versus Business Analytics.

**Unit 4. Basics of Data Integration** **7 Hrs.**

Need for Data warehouse, Definition of data warehouse, Data Mart, Goals of Data warehouse, Data sources, Extract ,Transform, Load, Data Integration and its technologies, Data quality, Data profiling.

**Unit 5. Multidimensional Data Modeling** **5 Hrs.**

Data modeling basics, Types of data model, Data Modelling techniques, Fact table, Dimension Table, Typical Dimensional models, Dimensional Modeling Lifecycle, Designing the dimensional Model.

**Unit 6. Applications of Analytics** **6Hrs**

Analytics in Business Support Functions – Human Capital Analytics, IT Analytics, Sales & Marketing Analytics; Analytics in Industries – Telecom, Retail, Healthcare; Analytical Application Development; Anatomy of Social Media Analytics, anatomy of recommendation system and its components

## Text Books

1 " Fundamentals of Business Analytics" R.N.Prasad and Seema Acharya

Wiley publisher2016.

2 "Business Analytics – The Science of Data-Driven Decision Making" U. Dinesh Kumar, Wiley publisher 2017

**Reference Books**


1 "Business Analytics", Sahil Raj, Cengage Learning.

2 "Business Analytics", James R Evans , Pearson Education Asia, 2nd Edition.

3 "Business Analytics for Managers: Taking Business Intelligence Beyond ", JesperThorlund&Gert H.N. Laursen,Wiley publication


## Practical: Business Analytics

**Term work:25**

**Practical:**2 Hr/Week **Credit:1**

**Practical Work:**

A] Write analysis of Case studies like: GoodLife HealthCare Group, GoodFood Restaurants Inc. TenToTen Retail Stores etc.

B] Students should select Small & Medium Enterprise and perform an exercise for application of the concepts learned under the domain of Business Analytics. Student has to prepare a report and give the presentation in the class.

# PCE-CSE-202 Deep Learning

**Lectures:** 3 hr / week **Marks:** 100 Marks

**Tutorial:**1 Hr/Week **Term Work:** 25 Marks

## Objectives

1. To understand basic concepts of Neural network and deep learning
2. To learn basic building blocks of deep networks
3. To learn major architectures of deep networks
4. To understand different way to tune of major deep networks

## Outcome:

At the end of this course student will be able to

1. Describe basic concepts of neural network and deep learning
2. Explain different architectures of deep learning
3. Describe different optimization techniques in deep learning
4. Design deep neural network according to given problem

### Course Content

**Unit 1: Foundations of Neural Network and Deep Learning (7hrs.)**

Neural Networks: The Biological Neuron, The Perceptron, Multilayer Feed-Forward Networks, Training Neural Networks: Backpropagation Learning, Activation Functions: Linear, Sigmoid, Tanh, Hard Tanh, Softmax, Rectified Linear, Loss Functions: Loss Function Notation, Loss Functions for Regression, Loss Functions for Classification, Loss Functions for Reconstruction, Hyperparameters: Learning Rate, Regularization, Momentum, Sparsity.

**Unit 2: Fundamentals of Deep Learning (6 hrs.)**

Defining Deep Learning: Deep Learning Definition, Common Architectural Principles of Deep Networks: Parameters, Layers, Activation Functions, Loss Functions, Optimization Algorithms, Hyperparameters Summary, Building Blocks of Deep Networks: RBMs, Autoencoders, VariationalAutoencoders.

**Unit 3: Major Architectures of Deep Networks-I (6 hrs.)**

Unsupervised Pre-Trained Networks: Deep Belief Networks, Generative Adversarial Networks, Convolutional Neural Networks (CNNs): Biological Inspiration, Intuition, CNN Architecture Overview, Input Layers, Convolutional Layers, Pooling Layers, Fully Connected Layers, Other Applications of CNNs, CNNs of Note, Summary

**Unit 4: Major Architectures of Deep Networks-II (5 hrs.)**

Recurrent Neural Networks, Modeling the Time Dimension, 3D Volumetric Input, Avoiding Markov Models, General Recurrent Neural Network Architecture, LSTM Networks, Domain-Specific Applications and Blended Networks, Recursive Neural Networks, Network Architecture, Varieties of Recursive Neural Networks, Applications of Recursive Neural Networks

**Unit 5: Tuning Deep Networks-I (8 hrs.)**

Basic Concepts in Tuning Deep Networks: An Intuition for Building Deep Networks, Building the Intuition as a Step-by-Step Process , Matching Input Data and Network Architectures: Summary, Relating Model Goal and Output Layers: Regression Model Output Layer, Classification Model Output Layer, Working with Layer Count, Parameter Count, and Memory: Feed-Forward Multilayer Neural Networks, Controlling Layer and Parameter Counts, Estimating Network Memory Requirements, Weight Initialization Strategies, Using Activation Functions: Summary Table for Activation Functions, Applying Loss Functions, Understanding Learning Rates: Using the Ratio of Updates-to-Parameters, Specific Recommendations for Learning Rates, How Sparsity Affects Learning

**Unit 6: Tuning Deep Networks-II (8 hrs.)**

Applying Methods of Optimization , SGD Best Practices, Using Parallelization and GPUs for Faster Training , Online Learning and Parallel Iterative Algorithms, Parallelizing SGD in DL4J, GPUs, Controlling Epochs and Mini-Batch Size, Understanding Mini-Batch Size Trade-Offs, How to Use Regularization, Priors as Regularizes, Max-Norm Regularization, Dropout, Other Regularization Topics , Working with Class Imbalance, Methods for Sampling Classes, Weighted Loss Functions, Dealing with Overfitting, Using Network Statistics from the Tuning UI, Detecting Poor Weight Initialization, Detecting Nonshuffled Data, Detecting Issues with Regularization

## Text Books:

1. Deep Learning A Practitioner's Approach by Josh Patterson, Adam Gibson, O'Reilly Publication

## Reference Books:

1. Fundamental of Deep Learning: Designing Next Generation of Machine Learning by Nicholas LoCasio, Nikhil Buduma, O'Reilly Publication

# PCE-CSE-202 Computer Vison

**Lectures:** 3 hr / week **Marks:** 100 Marks

**Tutorial:**1Hr/Week **Term Work:** 25 Marks

## Objectives

1. To learn Digital Image Fundamentals
2. To learn Image Enhancement
3. To learn Image Analysis
4. To learn character recognision

## Outcomes

At the end of the course students will be able to

1. Demonstrate understanding of image fundamentals techniques
2. Demonstrate understanding of Image Enhancement techniques
3. Demonstrate understanding of Image Analysis techniques
4. Demonstrateunderstanding of character recognition techniques

## Course Contents

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| **Unit 1.** | Digital Image Fundamentals: - Digital image Representation – Functional Units of an Image processing system. Visual perception – Image Model _ Image sampling and Quantization – grayscale resolution – pixel relationship – image geometry. Image Transforms – Unitary Transform, Discrete Fourier Transform, Cosine Transform, Sine Transform, Hadamard Transform, Slant and KL Transform. | **7 Hrs.** |
| **Unit 2.** | Image Enhancement – Histogram processing – Spatial operations – Image smoothing- Image Sharpening – Color Image Processing methods-Color Image Models | **6 Hrs.** |
| **Unit 3.** | Image restoration and compression Degradation Model – Discrete Formulation – Circulant matrices – Constrained and Unconstrained restoration geometric transformations fundamentals – Compression Models – Error Free Compression – Lossy Compression – International Image Compression Standards | **7 Hrs.** |
| **Unit 4.** | Image Analysis and Computer Vision: Spatial feature Extraction – Transform feature –Edge detection-Boundary Representation-Region Representation-Moment Representation-Structure-Shape Features-Texture-Scene Matching and Detection-Image Segmentation-Classification techniquesMorphology-Interpolation | **7 Hrs.** |
| **Unit 5.** | Sensing 3D shape: how the 3rd dimension changes the problem. Stereo 3D description, 3Dmodel, matching, TINA. Direct 3D sensing-structured | **6 Hrs.** |

light, range finders, range image segmentation

**Unit 6.** Emerging IT applications: Recognition of characters, Fingerprints and faces-Image databases. **7Hrs**

**Reference Books**

1. Fundamentals of Digital Image Processing-A.K.Jain
2. Image Processing and machine vision-Milan Sonka,VaclavHlavae
3. Pattern Recognition Principles-J.T. Tou and R.C.Gonzalez
4. Syntactic Pattern Recognition and applications.-King Sun Fun
5. Computer vision-Fairhurst (PHI).

# PCE-CSE-202 Pattern Recognition

**Lectures:** 3 hr / week **Marks:** 100 Marks

**Tutorial:**1Hr/Week **Term Work:** 25 Marks

**Course Objectives:**

1. To introduce student to various Pattern recognition techniques.
2. To study the Representation and description and feature extraction.
3. To study the principles of decision trees and clustering in pattern recognition.

**Course Outcomes:**

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

1. Develop algorithms for Pattern Recognition.
2. Design the nearest neighbour classifier.
3. Develop and analyse decision tress.

## Course Contents

**Unit 1.** **Introduction:** **7 Hrs**

Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems.

**Unit 2.** **Representation:** **7 Hrs**

Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation.

**Unit 3.** **Nearest Neighbour based classifiers:** **6 Hrs**

Nearest neighbour algorithm, variants of NN algorithms, use ofNN for transaction databases, efficient algorithms, Data reduction, prototype selection.

**Unit 4.** **Bayes classifier:** **6 Hrs**

Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Bayesian belief network.

**Unit 5.** **Decision Trees:** **6 Hrs**

Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over-fitting & Pruning, Examples.

**Unit 6.** **Unsupervised Learning & Clustering:** **7 Hrs**

Introduction, Mixture Densities and Identifiability, Maximum-likelihood Estimates, Unsupervised Bayesian Learning, Data Description and Clustering, Criterion Functions for Clustering,Hierarchical Clustering, On-lineclustering, ComponentAnalysis.

**Reference Books**


1. Pattern Recognition (An Introduction) , V Susheela Devi, M Narsimha Murthy, Universities Press.
2. Pattern Recognition & Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost. PHI
3. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, Wiley, 2000.

# PCE-CSE-203 Parallel and Distributed Computing

**Lectures:** 3 hr / week **Marks:** 100 Marks

**Term Work:** 25 Marks

## Course Objectives

1. To justifytheneedofhighperformanceprovidedbyparallelcomputing.
2. To demonstratequantitativedesignprinciplesofparallelcomputingsystems.
3. To identifychallengesfacedwhiledesigningadistributedsystem.
4. To analysethetrends, communication protocols and algorithmsindistributedsystems.

## Course Outcomes

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

1. Justifytheneedofhighperformanceprovidedbyparallelcomputing.
2. Demonstratequantitativedesignprinciplesofparallelcomputingsystems.
3. Identifychallengesfacedwhiledesigningadistributedsystem.
4. Analysethetrends, communication protocols and algorithmsindistributedsystems.

## Course Contents

**Unit 1. Fundamentals of Parallel Computing:** **7 Hrs.**

Instruction-Level Parallelism: Concepts and Challenges, Basic Compiler Techniques for Exposing ILP, Reducing Branch Costs with Prediction, Scheduling, Overcoming Data Hazards with Dynamic Scheduling, Dynamic Scheduling: Algorithm and Examples, Hardware-Based Speculation, Studies of the Limitations of ILP, Limitations on ILP for Realizable Processors, Hardware versus Software Speculation, ILP Support to Exploit Thread-Level Parallelism

**Unit 2. Data-LevelParallelism** **7 Hrs.**

VectorArchitecture, SIMD Instruction Set Extensions for Multimedia, Graphics Processing Units, CPU/GPU ArchitectureComparison,DetectingandEnhancingLoop-LevelParallelism,DataParallelismand SPMDProgrammingModel,NvidiaGPUCaseStudyandProgrammingModel,Example ofARMHeterogeneousArchitecture.

**Unit 3. Thread-LevelParallelism**

IntroductiontoSharedMemoryArchitectures,Looselyand TightlyCoupledMultiprocessors,CentralizedShared-MemoryArchitectures,SnoopyBusCache Coherence, Performance of Shared-Memory Multiprocessors, Distributed Shared Memory and DirectoryCacheCoherence,BasicsofSynchronization,ModelsofMemoryConsistency. **7 Hrs.**

**Unit 4. Introduction to Distributed Computing**

Motivation,Goals,Advantages,Disadvantages,HardwareConcepts, SoftwareConcepts,DesignIssues,Middleware,OverviewofDistributedSystems **4 Hrs.**

**Unit 5. Communication and Synchronization**

ClientServerModel,MiddlewareandClientServerModel,Relationof NetworkModelswithDistributedSystem(TCP/IP,OSI,ATMetc.),RemoteProcedureCall,Group CommunicationanditsProtocol(IS-IS) **8 Hrs.**

**Synchronization:** ClockSynchronization,LogicalClocks,Lamport'sAlgorithm,GlobalState, VectorAlgorithm,ElectionAlgorithms,MutualExclusionAlgorithms,DeadlocksinDistributed Systems,DeadlockAvoidance,PreventionandDetection

**Unit 6. Distributed Modeling**

Threads,SystemModels,ProcessorAllocation,WorkstationModel,ProcessorPool Model,HybridModel,RealTimeDistributedSystems,TimeTriggeredSystems,EventDriven Systems,DistributedSharedMemory,ConsistencyModels,PageBasedDistributedShared Memory,DistributedFileSystem,Design,Implementation,Trends. Applications. **8 Hrs**

**Reference Books**


1. “ParallelComputerArchitecture”,D.E.Culler,J.P.Singh,andA.Gupta,SecondEdition, MorganKaufmann,2017,ISBN:978
2. “Structured Parallel Programming:PatternsforEfficientComputation”,McCool, Michael D., Arch D. Robison and James Reinders, MorganKaufmann,2012,ISBN:978
3. “*DistributedOperatingSystems*",AndrewS.Tanenbaum,PearsonEducation
4. "DistributedOperatingSystemsConceptsandDesign",PradeepK.Sinha, PHIPublication
5. “DistributedOperatingSystems:ConceptsandPractice”,GalliD.L.,Prentice-Hall.

# PCE-CSE-203 Information Retrieval

**Theory:** 3 Hr/Week **Marks:** 100 Marks

**Term Work :** 25Marks

**Course Objectives**

1. To understand need of Information Retrieval
2. To apply Information Retrieval techniques in Information Search
3. To learn Information Retrieval Modeling and Evaluation
4. To understand preprocessing in IR Systems
5. To implement Text based and Web Based Retrieval Systems

**Course Outcomes**

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

1. fundamentals of IR
2. IR modeling
3. IR Evaluation
4. Text based and Web Based Retrieval Systems

**Course Contents**

**Unit 1. Introduction Information Retrieval** **5 Hrs.**

Information Retrieval in Libraries and Digital Libraries, The IR Problem, The IR System, How the Web Changed Search. User Interfaces for Search, Search Interfaces Today, Visualization in Search Interfaces

**Unit 2. Information Retrieval Modeling** **7 Hrs.**

IR Models: Modeling and Ranking, Characterization of an IR Model, A Taxonomy of IR Models, Classic Information Retrieval:Basic Concepts, The Boolean Model, Term Weighting, TF-IDF Weights, Document Length Normalization, The Vector Model, Set-Based Model, Extended Boolean Model, Generalized Vector Space Model , Latent Semantic Indexing Model, The Hypertext Model, Web based Models, Structured Text Retrieval

**Unit 3. Retrieval Evaluation** **6 Hrs.**

Retrieval Metrics: Precision and Recall, Single Value Summaries: P@n, MAP, MRR, F, UserOriented Measures, DCG: Discounted Cumulated Gain, BPREF: Binary Preferences, Rank Correlation Metrics

**Unit 4. Documents: Languages & Properties** **7 Hrs.**

Metadata, Text Document Format, Markup Languages, RDF: Resource Description Framework, Text Properties, Information Theory, Text

Similarity, Document Preprocessing , Lexical Analysis of the Text , Elimination of Stopwords, Stemming , Keyword Selection, Queries: Languages & Properties, Query Languages: Keyword-Based Querying, Structural Queries, Query Protocols, Query Properties

**Unit 5. Text Classification and Indexing** **6 Hrs.**

A Characterization of Text Classification, Unsupervised Algorithms, Supervised Algorithms, Feature Selection or Dimensionality Reduction, Evaluation Metrics, Inverted Indexes

**Unit 6. Web Retrieval** **5 Hrs**

The Web ,Characteristics , Structure of the Web , Modeling the Web , Link Analysis, Search
Engine Architectures, Search Engine Ranking, Managing Web Data, Search Engine User Interaction, Browsing, Beyond Browsing

**Reference Books**

1. Modern Information Retrieval The Concepts and Technology behind Search by Ricardo Baeza-Yates BerthierRibeiro-Neto Second edition Addison-Wesley 2011
2. Introduction to Information Retrieval by C.D. Manning, P. Raghavan, H. Schütze. Cambridge UP, 2008
3. Search Engines: Information Retrieval in Practice by Bruce Croft, Donald Metzler, Trevor StrohmanPearson 2010

# PCE-CSE-203 Natural Language Processing

**Theory:** 3 Hr/Week **Marks:** 100 Marks

**Term Work :** 25Marks

## Course Objectives

1. To explain the fundamentals concepts of natural language processing.
2. To describe word analysis and language modeling for natural language processing.
3. To explain the various applications of natural language processing.

## Course Outcomes

At the end of the course students will be able to

1. Explain the fundamentals concepts of natural language processing.
2. Describe word analysis and language modeling for natural language processing.
3. Explain the various applications of natural language processing.

## Course Contents

**Unit 1. Introduction to NLP** **6 Hrs.**

Introduction, Motivation, Word tokenization, Word normalization, Wordlevel morphology- morphological analysis and synthesis, Stemming - Porters algorithm,Levenshtein distance measure

**Unit 2. Word Tagging** **6 Hrs.**

Sequence labeling tasks of NLP, POS tagging, POS tag sets, Hidden MarkovModel, Viterbi algorithm, Baum Welch Algorithm

**Unit 3. Language Models** **6 Hrs.**

Introduction to N-gram, Probability estimation for n-gram,Evaluation and perplexity, Smoothing techniques, Named-Entity recognition

**Unit 4. Parsing** **10 Hrs.**

Constituency and dependency parsers, Constituency parser –Syntacticstructure, Parsing methodology, Different parsing algorithms, Parsing in case of ambiguity,Probabilistic parsing, CKY algorithm, Issues in parsing, Dependency parsing-Syntactic structure,Parsing methodology, Transition-Based Dependency Parsing, Graph-Based dependency parsing,Evaluation, Co-reference resolution.

**Unit 5. Word Sense Disambiguation** **6 Hrs.**

Word Senses, Word relations, Word similarity and thesaurus methods, Wordsense disambiguation, Knowledge base and supervised WSD, WordNet , Unsupervised basedWSD.

**Unit 6. Applications of NLP** **6Hrs**

Question/Answering system, Text summarization, SentimentAnalysis, Information extraction

## Reference Books


1 Daniel Jurafsky and James H. Martin, “Speech and Language Processing”, SecondEdition, Prentice Hall, 2008, ISBN: 978-0131873216.

2 Allen James, “Natural Language Understanding”, Second Edition, Benjamin/Cumming, 1994, ISBN: 978-0805303346.

3 Chris Manning and HinrichSchuetze, “Foundations of Statistical Natural Language Processing”, MIT Press, ISBN: 978-0262133609.

4 Journals: Computational Linguistics, Natural Language Engineering, Machine Learning, Machine Translation, Artificial Intelligence

5 “Theory of Computer Science”, E. V. Krishamoorthy.

# PW-CSE-201Seminar –I

**Practical: 4**Hr/Week **Term Work:** 25 Marks

Each student is required to do a seminar presentation on a topic preferably from the area in which a student intends to work for his dissertation during Semester – III and Semester – IV. Preparation and presentation of a seminar is intended to investigate an in-depth review of literature, prepare a critical review and develop confidence to present the material by the student. The seminar shall be evaluated by a Department Committee constituted for this purpose, based on a report submitted by the candidate and a viva-voce conducted at the end of the semester.