Department of Information Technology
M. Tech. Syllabus
To be followed from Academic Year 2020-21

(L-T-P) indicates L-Lecture, T-Tutorial and P-Practical

Program Educational Objectives (PEOs):

PEO1	To provide students strong foundation in mathematics and engineering fundamentals to have carrier in various fields of IT such as Networks and Security, Data Analysis and Management, Web Development etc.
PEO2	To imbibe in them professional and ethical responsibilities towards their profession, society and the environment as well as the respect for diversity.
PEO3	To enable graduates apply necessary techniques, Software and Hardware tools to foster innovation, invention and entrepreneurship.
PEO4	To help students acquire effective oral and written communication and lifelong learning skills to have productive careers in IT industries.
PEO5	To provide opportunity to the students to work effectively as individuals or in teams demonstrating their skills in solving IT related problems.

Program Outcomes (POs):

PO1 (a)	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and specialization to solve complex engineering problems.
PO2 (b)	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using principles of mathematics, natural and engineering sciences.
PO3 (c)	Design/development of solutions: Design and develop solutions by considering the public health and safety, cultural, societal, and environmental considerations to complex multidisciplinary engineering problems.
PO4 (d)	Conduct investigations of complex problems: Use research-based knowledge and methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 (e)	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6 (f)	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7 (g)	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 (h)	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9 (i)	Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10 (j)	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11 (k)	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12 (l)	Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Objectives (PSOs):

PSO1	Foundation of mathematical concepts: To apply mathematical methodologies to crack the real-world problems using appropriate mathematical analysis, data structure and efficient computer algorithms.
PSO2	Knowledge of recent trends: To provide effective and efficient knowledge of recent technologies such as Web Technologies, Data Science, Machine Learning, Artificial Intelligence, Cyber Security, Internet of Things, etc.
PSO3	Project based learning: To provide platform to the students to develop a new and innovative multidisciplinary software development to cater industry needs.

Table of Correlation:

PO/PSO➡ ⬇ PEO	a	b	c	d	e	f	g	h	i	j	k	l	PSO 1	PSO 2	PSO 3
I	✓	✓		✓			✓			✓		✓		✓	
II			✓		✓	✓	✓		✓	✓	✓		✓		✓
III		✓		✓		✓				✓		✓	✓		✓
IV					✓	✓		✓		✓		✓		✓	✓
V	✓	✓	✓	✓	✓				✓	✓				✓	✓

M. Tech. in Information Technology
Proposed CURRICULUM for M.Tech IT 2020--21
(L-T-P) indicates L-Lecture, T-Tutorial and P-Practical

M. Tech. Semester-I					
Course Code	**Subject**	**Scheme of Studies Per Week**			**Credits**
		L	**T**	**P**	
PCC-IT-501	Probability and Statistics for Data Science	3	0	2	4
PCC-IT-502	Machine Learning	3	0	2	4
PCC-IT-503	Advanced Database Management System	3	0	2	4
PEC-IT-5**	Program Elective-I	3	0	2	4
PEC-IT-5**	Program Elective-II	3	0	0	3
MCC-590	Research Methodology and IPR	2	0	0	2
MAC-591	English for Research Paper Writing	2	0	0	0
				Total Credits:	**21**

M. Tech. Semester-II					
Course Code	**Subject**	**Scheme of Studies Per Week**			**Credits**
		L	**T**	**P**	
PCC-IT-511	Deep Learning	3	0	2	4
PCC-IT-512	Data Security	3	0	2	4
PEC-IT-5**	Program Elective-III	3	0	2	4
PEC-IT-5**	Program Elective-IV	3	0	2	4
OEC-8**	Open Elective	3	0	0	3
PRJ-IT-520	Mini Project	0	0	4	2
AUD-9**	Audit Course	2	0	0	0
				Total Credits:	**21**

*** Students should be encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break. All Laboratory courses will have an examination at the end of the respective semester by the expert(s) in the relevant subject.**

CURRICULUM for Second Year

M. Tech. Semester-III					
Course Code	**Subject**	**Scheme of study hours/week**			**Credits**
		L	**T**	**P**	
DIS-IT-601	Dissertation-I / Industrial Project	0	0	28	14
Total Credits:					**14**

M. Tech. Semester-IV					
Course Code	**Subject**	**Scheme of study hours/week**			**Credits**
		L	**T**	**P**	
DIS-IT-602	Dissertation-II / Industrial Project	0	0	28	14
Total Credits:					**14**

The program offers several elective courses, focusing on different aspects of Data Science. A student can choose to do any course from given program elective set.

List of courses for Program Elective-I and Program Elective-II

Elective – I	
PEC-IT-504	Artificial Intelligence
PEC-IT-505	Data structure and Algorithms for Data Science
PEC-IT-506	R Programming
Elective – II	
PEC-IT-507	Data Warehousing and Data Mining
PEC-IT-508	Natural Language Processing
PEC-IT-509	Predictive Data Analytics

List of courses for Program Elective-III and Program Elective-IV

Elective – III	
PEC-IT-513	Data Science for Internet of Things
PEC-IT-514	Python Programming
PEC-IT-515	Information Theory and Coding
Elective – VI	
PEC-IT-516	Image Processing
PEC-IT-517	Big Data Analytics
PEC-IT-518	Pattern Recognition

List of Courses for Open Elective

OEC-801	Business Analytics
OEC-802	Industrial Safety
OEC-803	Operations Research
OEC-804	Cost Management of Engineering Projects
OEC-805	Composite Materials
OEC-806	Waste to Energy

List of Audit Courses

AUD-901	Project Management
AUD-902	Disaster Management
AUD-903	Sanskrit for Technical Knowledge
AUD-904	Value Education
AUD-905	Constitution of India
AUD-906	Pedagogy Studies
AUD-907	Stress Management by Yoga
AUD-908	Personality Development through Life Enlightenment Skills

PCC-IT-501: Probability And Statistics For Data Science

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 1)

Pre-Requisite: Fundamental of Mathematics

COURSE OBJECTIVES:

- To give an exposure of the basic concepts of Probability and Statistical methods and their application.
- To serve as a foundation to analyze problems in Science and Engineering applications through Statistical testing Method.

SYLLABUS:

Unit 1: Probability Concepts: Review of probability concepts - Bayes' Theorem. Random Variable and Distributions: Introduction to random variable – discrete and continuous distribution functions, mathematical expectations – moment generating functions and characteristic functions. Binomial, Poisson, Geometric, Uniform, Exponential, Normal distribution functions (MGF, mean, variance and simple problems) – Chebyshev's theorem.

Unit 2: Discrete Distributions: Bernouli, Binomial, Geometric, Negative Binomial, Poisson, Hypergeometric, Multinomial Distributions, and Continuous Distributions: Uniform, Exponential, Gamma, Normal, Weibull, Beta, and Distribution of function of Random variables.

Unit 3: Sampling mean and variance, Sampling distributions based on normal, Estimation, Properties of point estimators, Confidence interval, Maximum likelihood and Bayes estimators, Prediction intervals.

Unit 4: Hypothesis testing, Single and multiple sample case, Chi-square tests, Goodness of fit test, non-parametric tests, Wilcoxon rank sum and sign rank tests, Kruskal-Wallis test, Friedman f test, Rank correlation coefficient.

Unit 5: Discrete-Time Markov chains: computation of n-step transition probabilities, state classification and limiting probabilities, distribution of time between time changes, M/G/1 queuing system Continuous-Time Markov chains: Birth-Death process (M/M/1 and M/M/m queues), Non-birth-death processes, Petri nets, estimation related to Markov chains.

Unit 6: Correlation and Regression: Correlation, Rank correlation, Regression Analysis, Linear and Nonlinear Regression, Multiple regression, Curve fitting by meth-od of least squares, fitting of straight lines, polynomials, exponential curves.

COURSE OUTCOMES (COS):

- Understand and apply concept and principle of Probability, Statistical methods, Discrete Distribution, Correlation and Regression
- Students will understand thoroughly Basics of Probability distributions, Theory of Estimation and Sampling theory
- They will have knowledge of Various tests of Hypothesis and their Significance, Correlation and Regression and fitting of different types of curves

REFERENCES:

1. *Douglas C. Montgomery and George C.Runger*, "Applied Statistics and Probability for Engineers", (2005) John Wiley and Sons Inc
2. *E. Walpole, R. H. Mayers, S. L. Mayers and K. Ye,* "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, ISBN: 978-8-131-71552-9.
3. *Scheaffer, R.L and McClave, J.T.,* " Statistics for Engineers", Du Burg Press Boston, 1982
4. *J. Ravichandran,* "Probability and Random Processes for Engineers", First Edition, IK International, 2015.
5. *Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye,* "Probability and Statistics for Engineers and Scientists", 8th Edition (2007), Pearson Education Asia.
6. *Bethea R.M and Rhineheart, R.R.,* "Applied Engineering Statistics", Marcel Dekker, 1991.
7. *Chatfeld, C.,* "Statistics for Technology", Chapman and Hall,1976.
8. *Miller J.R., Freund J.E. and Johnson R.,* "Probability and Statistics for Engineers",8th Edition, Pearson, 2010

PCC-IT-502: Machine Learning

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 1)

Pre-Requisite: Linear Algebra and Fundamental of Algorithms

COURSE OBJECTIVES:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To develop skills of using recent machine learning software for solving practical problems

SYLLABUS:

Unit 1: Introduction: History of Machine Learning, Programs vs learning algorithms, Machine Learning definition, Components of a learning, Different Types of Learning

Unit 2: Supervised Learning (Regression/Classification): Distance-based methods, Nearest-Neighbours, Decision Trees, Nave Bayes, Linear models such as Linear Regression, Logistic Regression, Generalized Linear Mode, Support Vector Machines, Nonlinearity and Kernel Methods, Multi-class/Structured Outputs, Ranking.

Unit 3: Unsupervised Learning: Clustering using K-means/Kernel K-means, Dimensionality Reduction using PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative Models such as mixture models and latent factor models.

Unit 4: Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods like Boosting, Bagging, and Random Forests.

Unit 5: Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning.

Unit 6: Scalable Machine Learning (Online and Distributed Learning)- A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference.

Unit 7: Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications.

COURSE OUTCOMES (COS):

- Students will be able to appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning
- Understand the concept behind neural networks for learning non-linear functions.
- Be able to design and implement various machine learning algorithms in a range of real-world applications.

REFERENCES:

1. *Kevin Murphy*, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2. *Trevor Hastie, Robert Tibshirani, Jerome Friedman,* "The Elements of Statistical Learning", Springer 2009 (freely available online).
3. *Christopher Bishop,* "Pattern Recognition and Machine Learning", Springer, 2007.

PCC-IT-503: Advanced Database Management System

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 1)

Pre-Requisite: DBMS Fundamentals

COURSE OBJECTIVES:

- Design databases using data models.
- Query and manage databases.
- Distinguish between centralized and distributed databases.
- Implement applications involving complex transaction processing.
- Do query evaluation and query optimization.

SYLLABUS:

Unit 1: INTRODUCTION - History of Data base Systems. Data base System Applications, data base System VS file System; Data Models: ER Model, relational model, other models; Database Languages: DDL, DML; Introduction to the Relational Model: Integrity constraint over relations, Enforcing integrity constraints, querying relational data, logical data base design; Introduction to Views: Destroying, altering tables and views; Introduction of object database systems: Structured data types, operations on structured data, encapsulation and ADTS, Inheritance.

Unit 2: ORDBMS - Database design for ORDBMS, ORBMS implementation and challenges, OODBMS, comparison of RDBMS, OODBMS and ORDBMS. Introduction to Parallel databases, architectures for parallel databases, Parallel Query Evaluation: Data partitioning and parallelizing sequential operator evaluation code, parallelizing individual operations, and parallel query optimization.

Unit 3: DISTRIBUTED DATABASES - Introduction to distributed databases: Features of distributed databases vs centralized databases, Why distributed databases. DBMS: Levels of transparency, reference architecture for DDB, types of data fragmentation, distribution transparency for read-only and update applications, distributed database access primitives, Integrity constraints in distributed databases.

Unit 4: DISTRIBUTED DATABASE DESIGN - Distributed database design: framework for distributed database design, the design of database fragmentation, allocation of fragments; Distributed

Query processing: Equivalence of transformations for queries, transforming global queries into fragment queries, distributed grouping and aggregation functions, parametric queries.

Unit 5: QUERY OPTIMIZATION - A framework for query optimization, join queries and general queries. non-join queries in a distributed DBMS, joins in a distributed DBMS, cost based query optimization. DBMS Vs IR systems, Introduction to Information retrieval, Indexing for text search, web search engine, managing text in a DBMS, a data model for XML, Querying XML data, and efficient evaluation of XML queries.

COURSE OUTCOMES (COS):

- Students will understand the basics concept of databases and different types of data models and languages and the overall architecture of DBMS
- Understand the basics concept of object database systems.
- Understand the basics concept of ORDBMS, ORBMS and parallel databases
- They will be able to implement the concept of data partioning and parallel query optimization.
- Understand the concept of data fragmentation and data integrity constraints in distributed databases.

REFERENCES:

1. *Silberschatz, Korth,* "Database System Concepts", 6th Edition, TMH, 2010.
2. *Elmasri R, Navathe S B, Somayajulu D V L N, and Gupta S K,* "Fundamentals of Database Systems", 5th Edition, Pearson Education,2009.
3. *C. J. Date,* "Introduction to Database Systems", 8th Edition, Pearson Education, 2009.
4. *Raghuramakrishnan and Johannes Gehrke,* "Database Management Systems", 3rd Edition, TMH, 2006.
5. *S. Ceri and G Pelagatti,* "Distributed databases principles and systems", 1st Edition, TMH, 2008.

PEC-IT-504: Artificial Intelligence

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 1)

COURSE OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.

SYLLABUS:

Unit 1: History And Foundations - History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

Unit 2: Search - Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

Unit 3: Knowledge Representation And Reasoning - Foundations of knowledge representation and

reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

Unit 4: Representing And Reasoning With Uncertain Knowledge - Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

Unit 5: Case Study And Future Applications - Design of a game / Solution for problem in student‟s domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

COURSE OUTCOMES (COS):

- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario.
- Represent uncertainty using probabilistic models.
- Develop a simple game or solution using artificial intelligence techniques.

REFERENCE BOOKS:

1. *George F Luger,* "Artificial Intelligence", Pearson Education Publications
2. *Elaine Rich and Knight,* Artificial Intelligence, Mcgraw-Hill Publications
3. *Patterson,* "Introduction To Artificial Intelligence & Expert Systems", PHI
4. *Weiss.G, "*Multi Agent systems- a modern approach to Distributed Artificial intelligence", MIT Press.
5. *Russell and Norvig, "*Arificial Intelligence: A modern Approach", Printice Hall.

PEC-IT-505: Data Structure And Algorithms For Data Science

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 2)

COURSE OBJECTIVES:

- To provide the knowledge of basic data structures and their implementations.
- To understand importance of data structures in context of writing efficient programs.
- To develop skills to apply appropriate data structures in problem solving.

SYLLABUS:

Unit 1: Built-in Data-structures: Lists**:** Stores indexed elements that are changeable and can contain duplicate items Tuples**:** Stores indexed, unchangeable elements that can have duplicate copies, Dictionaries: Store key-value pairs that are changeable, Sets**:** Contains unordered, unique elements that are mutable.

Unit 2: User-defined Data-structures: Arrays: Similar to Lists, but store single type of elements, Stack**:** Linear LIFO (Last-In-First-Out), Data structure Queues: Linear FIFO (First-In-First-Out) data structure, Trees: Non-Linear data structures having a root and nodes, Linked Lists: Linear data structures that are linked with pointers, Graphs: Store a collection of points or nodes along with edges, Hash Maps: In Python, Hash Maps are the same as Dictionaries.

COURSE OUTCOMES (COS):

- Understand the core, list-like data structures and how they work.
- Understand the core sorting and search algorithms.
- Understand the performance differences between different types of data structures.

PEC-IT-506: R Programming

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 2)

COURSE OBJECTIVES

- Establish an efficient scientific computing environment.
- Identify and use available R packages and associated Open-Source software to meet given scientific objectives.
- Design and write efficient programs using R (and similar high-level languages) to perform routine and specialized data manipulation/management and analysis tasks.
- Document, share, and collaborate on code development using a suite of Open-Source standards and tools.
- Document analytical workflow using R, markdown languages, and version control.

SYLLABUS:

Unit 1 **Introduction:**

Introducing to R – R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorised if-then else – Vector Equality – Vector Element names

Unit 2: **Matrices, Arrays and Lists:**

Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists.

Unit 3: **Data Frames:**

Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Other factors and table related functions - Control statements – Arithmetic and Boolean operators and values – Default values for arguments - Returning Boolean values – functions are objects – Environment and Scope issues – Writing Upstairs - Recursion – Replacement functions – Tools for composing function code – Math and Simulations in R

Unit 4: **OOP:**

S3 Classes – S4 Classes – Managing your objects – Input/Output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three-dimensional plots

Unit 5: Interfacing:

Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear models – Time Series and Auto-correlation – Clustering.

References

1. Beginning R – The Statistical Programming Language, Mark Gardener, Wiley, 2013
2. Introductory R: A Beginner's Guide to Data Visualization, Statistical Analysis and Programming in R, Robert Knell, Amazon Digital South Asia Services Inc, 2013

COURSE OUTCOMES (COS)

CO1: Understand the basics in R programming in terms of constructs, control statements, string functions.
CO2: Understand the use of R for Big Data analytics
CO3: Learn to apply R programming for Text processing.
CO4: Able to appreciate and apply the R programming from a statistical perspective.

PEC-IT-507: Data Warehousing and Data

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 2)

SYLLABUS:

Unit 1: Introduction

Introduction to Data Mining, Importance of Data Mining, Data Mining functionalities, Classification of Data mining systems, Data mining architecture, Major Issues in Data Mining, Data mining metrics, Applications of Data Mining, Social impacts of data, Data Mining from a Database Perspective

Unit 2: Data Pre-processing

Introduction,Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, DataDiscretization.

Unit 3: Classification and Prediction

Basic issues regarding classification and predication, Classification by Decision Tree, Bayesian classification, classification by back propagation, Associative classification, Prediction, Statistical-Based Algorithms, Decision Tree -Based Algorithms, Neural Network -Based Algorithms, Rule-Based Algorithms, Other Classification Methods, Combining Techniques, Classifier Accuracy and Error Measures

Unit 4: Clustering

Similarity and Distance Measures, Hierarchical Algorithms, Partitioned Algorithms, Clustering Large Databases, Clustering with Categorical Attributes

Unit 5: Association Rules

BasicAlgorithms, Advanced Association Rule Techniques, Measuringthe Quality ofRules

Unit 6: Applications and other Data mining techniques

Data Mining Applications, Mining Event Sequences, Visual DM Text Mining, Web Mining, The WEKA data mining Workbench

REFERENCE BOOKS:

1. Data Mining: Concepts and Techniques, J. Han and M. Kamber, Morgan Kaufman, 3/E , 2011
2. Data Warehousing, Data Mining, and OLAP, Alex Berson, Stephen J. Smith,MGH, 1998.

COURSE OUTCOMES:

- Store voluminous data for online processing
- Preprocess the data for mining applications
- Apply the association rules for mining the data
- Design and deploy appropriate classification techniques
- Cluster the high dimensional data for better organization of the data
- Discover the knowledge imbibed in the high dimensional system
- Evolve Multidimensional Intelligent model from typical system
- Evaluate various mining techniques on complex data objects

PEC-IT-508: Natural Language Processing

(Total Credits: 3, Lectures/Week: 3)

COURSE OBJECTIVES:

Unit-1: Introduction to NLP tasks in syntax, semantics, and pragmatics, Applications such as information extraction, the problem of ambiguity. The role of machine learning. Brief history of the field.

Unit-2: N-gram Language Models: The role of language models, Simple N-gram models. Estimating parameters and smoothing. Evaluating language models.

Unit-3: Part of Speech Tagging and Sequence Labelling: Lexical syntax. Hidden Markov Models (Forward and Viterbi algorithms and EM training).

Unit-4: Basic Neural Networks: Basics introduction to perceptron and back propagation, Machine Learning, Pattern Recognition and Machine Learning.

Unit-5: LSTM Recurrent Neural Networks: Introduction to LSTM Networks.

Unit-6: Syntactic parsing: Grammar formalisms and tree banks, Efficient parsing for context-free grammars (CFGs), Statistical parsing and probabilistic CFGs (PCFGs), Lexicalized PCFGs, Neural

shift-reduce dependency parsing.

Unit-7: Semantic Analysis: Lexical semantics and word-sense disambiguation, Compositional semantics, Semantic Role labelling and Semantic Parsing.

Unit-8: Information Extraction (IE): Named entity recognition and relation extraction, IE using sequence labelling.

Unit-9: Machine Translation (MT): Basic issues in MT, Statistical translation, word alignment, phrase-based translation, and synchronous grammars.

REFERENCE BOOKS:

1. Jurafsky and Martin"Speech and Language Processing" Prentice Hall; (January 26, 2000) ISBN: 0130950696
2. Manning and Schutze "Statistical Natural Language Processing" MIT Press; 1st edition (June 18, 1999) ISBN: 0262133601
3. James Allen. *Natural Language Understanding*. The Benajmins/Cummings Publishing Company Inc. 1994. ISBN 0-8053-0334-0.
4. Tom Mitchell. *Machine Learning*. McGraw Hill, 1997. ISBN 0070428077
5. Cover, T. M. and J. A. Thomas: Elements of Information Theory. Wiley. 1991. ISBN 0-471-06259-6.
6. Charniak, E.: Statistical Language Learning. The MIT Press. 1996. ISBN 0-262-53141-0.
7. Jelinek, F.: Statistical Methods for Speech Recognition. The MIT Press. 1998. ISBN 0-262-10066-5.

PEC-IT-509: Predictive Data Analysis

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 1)

Pre-Requisite: DBMS, Fundamental of Machine Learning

COURSE OBJECTIVES:

- Gain understanding of the computational foundations in Big Data Science.
- To develop skills of using recent machine learning software for solving practical problems
- Possess practical skills for handling complex datasets.

SYLLABUS:

Unit 1: Introduction Data Definitions and Analysis Techniques Elements, Variables, and Data categorization Levels of Measurement Data management and indexing , Predictive Analytics which includes Online Marketing and Retail Recommender systems, Personalized shopping on the Internet, Implementing a Recommender System, Collaborative filtering, Content-based filtering, Hybrid recommender systems, Target Marketing, Targeting using predictive modeling, Uplift modeling, Personalization, Online customer experience.

Unit 2: Exploring Data Types and Associated Techniques, Recognizing Data Types, Structured and unstructured data, Static and streamed data, Identifying Data Categories, Attitudinal data, Behavioral data, Demographic data, Generating Predictive Analytics, Data-driven analytics, User-driven analytics, Connecting to Related Disciplines Statistics.

Unit 3: Complexities of Data**,** Finding Value in Data, Delving into data, Data validity, Data variety, Constantly Changing Data, Data velocity, High volume of data, Complexities in Searching Your Data, Keyword-based search, Semantic-based search, Contextual search, Differentiating Business Intelligence from Big-Data Analytics, Exploration of Raw Data, Identifying data attributes, Exploring common data visualizations, Tabular visualizations.

Unit 4: Identifying Similarities in Data, Explaining Data Clustering, Converting Raw Data into a Matrix, Creating a matrix of terms in documents, Term selection, Identifying Groups in Data, K-means clustering algorithm, Clustering by nearest neighbors, Density-based algorithms, Finding Associations in Data Items.

Unit 5: Introducing Data Classification to Business, Exploring the Data-Classification Process, Using Data Classification to Predict the Future.

Unit 6: Visualization of Analytical Results, Visualization as a Predictive Tool, Evaluating the Visualization, Visualizing Model's Analytical Results ,Visualizing hidden groupings in data, Visualizing data classification results, Visualizing outliers in data, Visualization of Decision Trees, Visualizing predictions, Novel Visualization in Predictive Analytics, Data Visualization Tools.

COURSE OUTCOMES (COS):

- Students will understand the concept of data, Data Analytics, Visualization of Analytical skills
- Be able to design and implement various real time data predication in a range of real-world applications.
- Solve the problems using various machine learning techniques.

REFERENCES:

1. Anasse Bari, Mohamed Chaouchi, Tommy Jung, Predictive Analytics For Dummies
2. Dinov, ID. (2018) Data Science and Predictive Analytics: Biomedical and Health Applications using R (Links to an external site.), Springer (ISBN 978-3-319-72346-4).

SEMESTER-II

PCC-IT-511: Deep Learning

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 2)

Pre-Requisites: Machine Learning and AI

COURSE OBJECTIVES:

- Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.

SYLLABUS:

Unit-1 Introduction: Various paradigms of earning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.

Unit-2 Feedforward neural network: Artificial Neural Network, activation function, multi-layer neural network.

Unit-3 Training Neural Network: Risk minimization, loss function, backpropagation, regularization, model selection, and optimization.

Unit-4 Conditional Random Fields: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.

Unit-5 Deep Learning: Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network, stochastic gradient descent, Backpropagation, transferring learning.

Unit-6 Probabilistic Neural Network: Hopfield Net, Boltzman machine, RBMs, Sigmoid net, Autoencoders.

Unit-7 Deep Learning research: Object recognition, sparse coding, computer vision, natural language processing.

Unit-8 Deep Learning Tools: Caffe, Theano, Torch.

REFERENCES:

1. *Goodfellow, I., Bengio,Y., and Courville, A.,* "Deep Learning", MIT Press, 2016.
2. *Bishop C. M.,* "Pattern Recognition and Machine Learning", Springer, 2006.
3. *Yegnanarayana, B.,* "Artificial Neural Networks", PHI Learning Pvt. Ltd, 2009.
4. *Golub, G.,H., and Van Loan,C.,F.,* "Matrix Computations", JHU Press,2013.
5. *Satish Kumar,* "Neural Networks: A Classroom Approach", Tata McGraw-Hill Education, 2004.

COURSE OUTCOMES (COS):

- Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
- Implement deep learning algorithms and solve real-world problems.

PCC-IT-512: Data Security

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 2)

COURSE OBJECTIVES:

1. Explaining the key security requirements aligning with type of threats and vulnerabilities that attack the security of information or database systems.
2. Presenting symmetric and asymmetric cryptographic systems and covering most important parts of cryptology through introducing many cryptography techniques and algorithms.
3. Describing the most important advance encryption theories aligning with the number theories that necessary as requirements.
4. Explaining the hash function as an application of cryptography aligning with the concept of message integrity and digital signature authentication.
5. Understand the issues involved in using asymmetric encryption to distribute symmetric keys.

SYLLABUS:

UNIT 1: An Overview on Security and Data Security

UNIT 2: Symmetric Ciphers: Classical Encryption Techniques (Substitution -1), Classical Encryption Techniques (Substitution -2), Classical Encryption Techniques (Transposition -1), Classical Encryption Techniques (Transposition -2), Block Ciphers, Data Encryption Standard, Block Ciphers, Advance Encryption Standard (Structure), Block Ciphers, Advance Encryption Standard (Transformation Function + Key Expansion), Block Ciphers, Advance Encryption Standard (Implementation of an example), Block Ciphers, Multi Encryption – Triple DES.

UNIT 3: Random bit generation and stream ciphering

UNIT 4: Asymmetric Ciphering: Public Key Cryptography, RSA, Public Key Cryptography, Diffie-Hellman Key Exchange, Elgamal Cryptographic system, Elliptic Curve Cryptography, Diffie-Hellman Key Exchange.

UNIT 5: Digital Signature: Schnorr Digital Signature Schame + NIST DSS, Elliptic Curve Digital Signature Schame, RSA-PSS Digital Signature Scheme.

References:

1. Cryptography and Network Security: Principles and Practice, Global Edition, 7/E, William Stallings, Pearson, ISBN-10: 1292158581 • ISBN-13: 9781292158587
2. Introduction to Cryptography: Principles and Applications. Hans Delfs & Helmut Knebl, Second Edition. (uploaded to the class website)
3. A Graduate Course in Applied Cryptography. Dan Boneh and Victor Shoup. (uploaded to class website)

COURSE OUTCOMES (COs)

- Presenting the most important key security requirements that required for any security systems generally and specifically.
- Utilizing and code developing for encryption algorithms that required to achieve confidentiality key security.
- Building an appropriate encrypting system that designed for specific key size and message length.
- Investigating the suitability of a hash function for verifying the message integrity and digital signature authentication.
- Appreciate the role of distributed symmetric key in improving the asymmetric encryption systems.

PEC-IT-513: Data Science For Internet Of Things

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 2)

COURSE OBJECTIVES:

- To understand the concepts and protocols related to Internet of Things.
- To get an idea where the application areas are available for the Internet of Things to be applied.
- To understand the middleware for Internet of Things; To understand the concepts of Web of Things.
- To understand the concepts of Cloud of Things with emphasis on Mobile cloud computing.
- To understand where the market connected to the network lies.

SYLLABUS:

Unit 1: INTRODUCTION AND BACKGROUND**:** Definition and Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT Protocols, Logical Design of IoT: IoT functional Blocks, IoT Communication Blocks, IoT Communication APIs, IoT Enablish Technologies: WSN, Cloud Computing, Big Data Analysis, Communication Protocols, Embedded Systems.

Unit-2: IOT HARDWARE, DEVICES AND PLATFORMS**:** Basics of Arduino: The Arduino Hardware, The Arduino IDE, Basic Arduino Programming, Basics of Raspberry pi: Introduction to Raspberry Pi, Programming with Raspberry Pi, CDAC IoT devices: Ubimote, Wi-Fi mote, BLE mote, WINGZ gateway, Introduction to IoT Platforms, IoT Sensors and actuators.

Unit-3: IOT ARCHITECTURE AND PROTOCOLS**:** IoT Architecture: Web of Things versus Internet of Things – Two Pillars of the Web – Unified Multitier WoT Architecture, Cloud Providers and Systems, The Cloud of Things Architecture. IoT Protocols: Application Protocols, Service Discovery Protocols, Infrastructure Protocols.

Unit-4: IOT PROGRAMMING**:** Arduino Programming: Serial Communications, getting input from sensors, Visual, Physical and Audio Outputs, Remotely Controlling External Devices, Wireless Communication. Programming with Raspberry Pi: Basics of Python Programming, Python packages of IoT, IoT Programming with CDAC IoT devices.

Unit-5: DOMAIN SPECIFIC IOT: Home automation, Smart cities, Smart Environment, IoT in Energy, Logistics, Agriculture, Industry and Health & Lifestyle secors. Case Studies: A Case study of Internet of Things Using Wireless Sensor Networks and Smartphones, Security Analysis of Internet-of-Things: A Case Study of August Smart Lock, OpenIoT platform.

REFERENCE BOOKS:

1. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.
2. Margolis, Michael. “Arduino Cookbook: Recipes to Begin, Expand, and Enhance Your Projects. " O'Reilly Media, Inc.", 2011.
3. Monk, Simon. Raspberry Pi cookbook: Software and hardware problems and solutions. " O'Reilly Media, Inc.", 2016.
4. The Internet of Things: Applications to the Smart Grid and Building Automation by – Olivier Hersent, Omar Elloumi and David Boswarthick – Wiley Publications -2012.
5. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.
6. David Easley and Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning About a Highly Connected World”, Cambridge University Press, 2010.
7. Al-Fuqaha, Ala, et al. "Internet of things: A survey on enabling technologies, protocols, and applications." IEEE Communications Surveys & Tutorials 17.4 (2015): 2347-2376.
8. Tsitsigkos, Alkiviadis, et al. "A case study of internet of things using wireless sensor networks and smartphones." Proceedings of the Wireless World Research Forum (WWRF) Meeting: Technologies and Visions for a Sustainable Wireless Internet, Athens, Greece. Vol. 2325. 2012.
9. Ye, Mengmei, et al. "Security Analysis of Internet-of-Things: A Case Study of August Smart Lock."

COURSE OUTCOMES (COS):

- Explain the fundamental building blocks of an IoT environment from a logical and physical perspective.
- Experiment with Arduino and Raspberry Pi to choose the appropriate hardware for different IoT projects.
- Summarize various IoT protocols in Application and Network layers by outlining their advantages and disadvantages.
- Develop IoT solutions using Arduino and Raspberry Pi to solve real life problems.
- Survey successful IoT products and solutions to analyze their architecture and technologies.

PCC-IT-514: Python Programming

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 2)

COURSE OBJECTIVES:

- Master the principles of object-oriented programming and the interplay of algorithms and data structures in well-written modular code;
- Solve problems requiring the writing of well-documented programs in the Python language, including use of the logical constructs of that language;
- Demonstrate significant experience with the Python program development environment.
- Understand real time web and app Development

SYLLABUS:

UNIT – I: Introduction: History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input/output, Indentation. Types - Integers, Strings, Booleans;

UNIT – II: Operators and Expressions: Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Data Structures Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.

UNIT – III: Control Flow - if, if-else-else, for, while, break, continue, pass Functions - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

UNIT – IV: Modules: Creating modules, import statement, from import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions Object Oriented Programming OOP in Python: Classes, 'self-variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data Hiding,

UNIT- V: Python Django Framework , REST API, Introduction to Django, Bootstrap, difference between app and project. Migration in detail. Admin in Python.Django Admin in detail with all CRUD operation, testing, Views in Django. URL Routing. Template in Django. Models in Django. Forms in Django. Views in Django., djanog tables, PostGre Sql in detail, sending email, PDF , Reports, Mobile App , deploy application on any cloud (AWS, Azure..) Pandas and Data Frame

REFERENCE BOOKS:

1. *Allen B. Downey* "Think Python: How to Think Like a Computer Scientist", Green Tea Press. (available online under the GNU Free Documentation License) Ian Sommerville, "Software Engineering", 8th Ed. Addison-Wesley.
2. *James Payne,* "Beginning Python®: Using Python 2.6 and Python 3.1", WROX, 2010.
3. *John M. Zelle*, "Python Programming: An Introduction to Computer Science" 2ndEd. by. 2010. Franklin, Beedle and Associates Inc.
4. "Non-Programmer's Tutorial for Python 3". (Wikibooks)
5. *Swaroop C.H.*, "A Byte of Python" by. (availabe free online)
6. *Vamsi Kurama,* "Python Programming: A Modern Approach", Pearson 2.
7. *Mark Lutz,* "Learning Python", Orielly
8. *William Vincent*, " Django for Beginners"
9. *William Vincent, "* Django for Professional"
10. *SamuelDauzon, Aidas B, Arun R., "* Django web development with Python", Packt Publisher
11. "Django by Example", Packt publisher

COURSE OUTCOMES (COS):

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

- Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
- Express different Decision-Making statements and Functions
- Interpret Object oriented programming in Python.
- To design GUI Applications in Python and evaluate different database operations.
- Problem solving and programming capability.
- Web and Mobile app development

PCC-IT-515: Information Theory and Coding

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 2)

COURSE OBJECTIVES:

To understand the theoretical framework upon which error-control codes are built.
To define and apply the basic concepts of information theory (entropy, channel capacity etc.)
To study various data compression methods and describe the most common such methods.
To learn the principles and applications of information theory in communication systems

SYLLABUS:

Unit 1: Information theory: Concept of amount of information, information units Entropy: marginal, conditional, joint and relative entropies, relation among entropies Mutual information, information rate, channel capacity, redundancy and efficiency of channels Discrete channels – Symmetric channels, Binary Symmetric Channel, Binary Erasure Channel, Noise-Free Channel, Channel with independent I/O, Cascaded channels, repetition of symbols, Binary asymmetric channel, Shannon theorem

Unit 2: Source coding – Encoding techniques, Purpose of encoding, Instantaneous codes, Construction of instantaneous codes, Kraft's inequality, Coding efficiency and redundancy, Source coding theorem. Construction of basic source codes – Shannon Fano coding, Shannon Fano Elias coding, Huffman coding, Minimum variance Huffman coding, Adaptive Huffman coding, Arithmetic coding, Dictionary coding – LZ77, LZ78, LZW, ZIP coding Channel coding, Channel coding theorem for DMC

Unit 3: Codes for error detection and correction – Parity check coding, Linear block codes, Error detecting and correcting capabilities, Generator and Parity check matrices, Standard array and Syndrome decoding, Hamming codes Cyclic codes – Generator polynomial, Generator and Parity check matrices, Encoding of cyclic codes, Syndrome computation and error detection, Decoding of cyclic codes, BCH codes, RS codes, Burst error correction

Unit 4: Convolutional codes – Encoding and State, Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes -Viterbi algorithm, Sequential decoding -Stack algorithm. Interleaving techniques – Block and convolutional interleaving, Coding and interleaving applied to CD digital audio system - CIRC encoding and decoding, interpolation and muting. ARQ – Types of ARQ, Performance of ARQ, Probability of error and throughput.

REFERENCE BOOKS:

1. R. Bose, *Information Theory Coding and Cryptography*, Tata McGraw Hill
2. R. J. McEliece, *The Theory of Information and Coding*, Cambridge Uinversity Press
3. T. M. Cover, J. A. Thomas, *Elements of Information Theory*, Wiley
4. R. Togneri, C.J.S deSilva, *Fundamentals of Information Theory and Coding Design*, Taylor and Francis

COURSE OUTCOMES (COs)

CO1: Calculate entropy, joint entropy, relative entropy, conditional entropy, and channel capacity of a system.
CO2: quantify the essence of information in a mathematically sound way.
CO3: explain what the significance of this quantitative measure of information in the communications is systems.
CO4: differentiate between lossy and lossless compression techniques.
CO5: decide an efficient data compression scheme for a given information source.
CO6: explain the impact of feedback and/or many senders or receivers on the communication systems.

PCC-IT-516: Image Processing

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 2)

COURSE OBJECTIVES:

To study the image fundamentals and mathematical transforms necessary for image processing.
To study the image enhancement techniques
To study image restoration procedures.
To study the image compression procedures.

SYLLABUS:

Unit-1 Overview, computer imaging systems, lenses, Image formation and sensing, CVIP lab, Elements of digital image processing: Image model, Sampling and quantization, Relationships between pixels.

Unit-2 Image analysis, pre-processing, Binary image analysis. Image Transforms: Fourier transform, Hough transform.

Unit-3 Image Enhancement: Enhancement by point processing, Spatial filtering, Enhancement in the frequency domain, Color Image Processing

Unit-4 Image Segmentation: Edge detection, Edge detection performance, Discontinuity detection, Thresholding, Region oriented segmentation, Use of motion for segmentation.

Unit-5 Representation and Description: Boundary description, Regional description.

Unit-6 Morphological filtering: Morphological Image Processing, Dilation and Erosion, Opening and Closing, Some basic morphological algorithms.

Unit-7 Feature extraction, shape, histogram, color, spectral, texture, using CVIP tools.
Unit-8 Feature analysis, feature vectors, distance /similarity measures, data pre-processing, Pattern classification.

Textbooks:

1. Digital Image Processing - R.C.Gonzalez & P.Wintz
2. Digital Image Processing - W. K. Pratt
3. Computer Vision - D.H.Ballard & C.M.Brown
4. Fundamentals of Digital Image Processing - A.K. Jain
5. Algorithms for Graphics and Image Processing, Theo Pavlidis, Computer Science
6. Handbook of Pattern Recognition and Image Processing, K.S. Fu and T.Y. Young, Academic Press
7. The Image Processing Handbook, John C. Russ, CRC Press SIUE Library
8. Pattern Recognition - A Statistical Approach - P.A. Devijver and J. Kittler
9. Digital Picture Processing - A. Rosenfeld and A.C. Kak

COURSE OUTCOMES (COs) (CO)

CO1: Review the fundamental concepts of a digital image processing system.
CO2 : Analyze images in the frequency domain using various transforms.
CO3 : Evaluate the techniques for image enhancement and image restoration.
CO4 : Categorize various compression techniques.
CO5: Interpret Image compression standards.
CO6 : Interpret image segmentation and representation techniques.

PCC-IT-517: Big Data Analytics

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 2)

Pre-Requisites Database Management Systems, Hadoop Technology

COURSE OBJECTIVES:

To formulate the difference between Big data and Data Analytics.
To address the phases of Data Analytics life cycle through case study.
To provide the students with the conceptual knowledge of Big Data.
To get familiarized with the analytical methods.
To explore validation and testing methods for decision making.

SYLLABUS:

Unit 1: BIG DATA ECO SYSTEM - Big Data Overview, Data Structures, Analyst Perspective on Data Repositories, State of the Practice in Analytics, Current Analytical Architecture, Drivers of Big Data, Emerging Big Data Ecosystem and a New Approach to Analytics, Key Roles for the New Big Data Ecosystem

Unit 2: DATA ANALYTICS LIFECYCLE - Discovery - Data Preparation, Model Planning, Model Building, Communicate, Results- Operationalize Case Study.

Unit 3: BIG DATA TECHNOLOGIES - Hadoop's Parallel World – Data discovery – Open-source technology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business, Intelligence and Big Data – Crowd Sourcing Analytics – Inter- and Trans-Firewall

Analytics - Information Management.

Unit 4: PROCESSING BIG DATA - Integrating disparate data stores - Mapping data to the programming framework, Connecting and extracting data from storage - Transforming data for processing - Subdividing data in preparation for Hadoop Map Reduce.

Unit 5: ANALYTICAL THEORY AND METHODS- Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Validation and Testing - Diagnostics, Linear Regression - Logistic Regression - Reasons to Choose and Cautions, Decision Trees - Naïve Bayes - Bayes‟ Theorem - Naïve Bayes Classifier - Diagnostics of Classifiers.

Unit 6: ADVANCED ANALYTICS PLATFORM- Real-Time Architecture – Orchestration and Synthesis Using Analytics Engines – Discovery using Data at Rest – Implementation of Big Data Analytics – Big Data Convergence – Analytics Business Maturity Model.

References:

1. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big Data Analytics”, EMC Education Series, John Wiley, ISBN: 978-1-118-87613-8, 2015.
2. Peter Bühlmann, Petros Drineas, Michael Kane, Mark van der Laan, "Handbook of Big Data", CRC Press, 2016.
3. Michael Minelli, Michehe Chambers, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Business”, 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
4. Arvind Sathi, “Big Data Analytics: Disruptive Technologies for Changing the Game”, 1st Edition, IBM Corporation, 2012.
5. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, 1st Edition, Wiley and SAS Business Series, 2012.
6. Tom White, “Hadoop: The Definitive Guide”, 3rd Edition, O’reilly, 2012.

COURSE OUTCOMES (COs) (CO)

CO1: Address the principles of Big Data and its difference to Data Analytics.
CO2: Describe the life cycle phases of Data Analytics through discovery, planning and building.
CO3: Demonstrate the analytical techniques used in decision making.
CO4: Employ tools and technologies to analyze Big data.
CO5: Develop applications using Hadoop.

PCC-IT-518: Pattern Recognition

(Total Credits: 4, Lectures/Week: 3, Practical/Week: 2)

COURSE OBJECTIVES:

1. Understand basic concepts in pattern recognition.
2. Gain knowledge about state-of-the-art algorithms used in pattern recognition research.
3. Understand pattern recognition theories, such as Bayes classifier, linear discriminant analysis.

4. Apply pattern recognition techniques in practical problems.

SYLLABUS:

Overview, Classifier Evaluation, Bayes' Decision Theory
Linear and k-Nearest Neighbour Classifiers
Tree Classifiers and Neural Networks
Support Vector Machines
(Midterm Week) Classifier Combination
Classifier Combination, Continued
Feature Selection
Clustering
Structural and Syntactic Pattern Recognition

REFERENCE BOOKS:

1. Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification", 2/E, Wiley - Interscience, 2000.
2. Christopher M. Bishop: "Pattern Recognition and Machine Learning (Information Science and Statistics)" ,1/E, Springer, January 2008
3. T. Hastie, R. Tibshirani, J. H. Friedman: "The Elements of Statistical Learning",1/E ,Springer, Reprint 3/E, 2003
4. Christopher M. Bishop; "Pattern Recognition and Machine Learning", Springer, 2006
5. Shigeo Abe, "Advances in Pattern Recognition", Springer, 2005

COURSE OUTCOMES (COs) (CO)

CO1: Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.

CO2: Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.

CO3: Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.

CO4: Apply pattern recognition techniques to real-world problems such as document analysis and recognition.

CO5: Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

Open Elective:

OEC-801: **Business Analytics**

(Total Credits: 3, Lectures/Week: 3, Practical/Week: 0)

COURSE OBJECTIVES:

1. Understand the role of business analytics within an organization.
2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
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 become familiar with processes needed to develop, report, and analyze business data.
5. Use decision-making tools/Operations research techniques.
6. Mange business process using analytical and management tools.
7. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

SYLLABUS:

Unit1:
Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics.
Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Unit 2:
Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Unit 3:
Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes.

Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Unit 4:
Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.
Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Unit 5:
Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Unit 6:

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Reference:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

COURSE OUTCOMES (COS)

CO1: Students will demonstrate knowledge of data analytics.

CO2: Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.

CO3: Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.

CO4: Students will demonstrate the ability to translate data into clear, actionable insights.

OEC-801: **Business Analytics**

(Total Credits: 3, Lectures/Week: 3, Practical/Week: 0)

SYLLABUS:

Unit 1: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit 2: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost and its relation with replacement economy, Service life of equipment.

Unit 3: Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit 4: Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit 5: Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing,

cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance.

Unit 6: Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

REFERENCE BOOKS:

1. Maintenance Engineering Handbook, Higgins and Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman and Hall London.

OEC-803: Operations Research

(Total Credits: 3, Lectures/Week: 3, Practical/Week: 0)

COURSE OUTCOMES (COs):

At the end of the course, the student should be able to

- Students should be able to apply the dynamic programming to solve problems of discreet and continuous variables.
- Students should be able to apply the concept of non-linear programming.
- Students should be able to carry out sensitivity analysis.
- Student should be able to model the real world problem and simulate it

SYLLABUS:

Unit 1:
Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit 2
Formulation of a LPP - Graphical solution revised simplex method - duality theory – dual simplex method - sensitivity analysis - parametric programming

Unit 3:
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit 4
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit 5
Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. *H.A. Taha, Operations Research, An Introduction, PHI, 2008*
2. *H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.*
3. *J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008*
4. *Hitler Libermann Operations Research: McGraw Hill Pub. 2009*
5. *Pannerselvam, Operations Research: Prentice Hall of India 2010*
6. *Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010*

OEC-804 : Cost Management of Engineering Projects

(Total Credits: 3, Lectures/Week: 3, Practical/Week: 0)

SYLLABUS:

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. *Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi*
2. *Charles T. Horngren and George Foster, Advanced Management Accounting*
3. *Robert S Kaplan Anthony A. Alkinson, Management and Cost Accounting*
4. *Ashish K. Bhattacharya, Principles and Practices of Cost Accounting A. H. Wheeler publisher*
5. *N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.*

OEC-805 : Composite Materials

(Total Credits: 3, Lectures/Week: 3, Practical/Week: 0)

SYLLABUS:

UNIT–I:
INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.
UNIT – II:
REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.
UNIT – III:
Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.
UNIT–IV:
Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.
UNIT – V:
Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

REFERENCE BOOKS:

1. *Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.*
2. *Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley and Sons, NY, Indian edition, 2007.*

References:

1. *Hand Book of Composite Materials-ed-Lubin.*
2. *Composite Materials – K.K.Chawla.*
3. *Composite Materials Science and Applications – Deborah D.L. Chung.*
4. *Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.*

OEC-806 : Waste to Energy

(Total Credits: 3, Lectures/Week: 3, Practical/Week: 0)

SYLLABUS:

Unit-I: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors
Unit-II: Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.
Unit-III: Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.
Unit-IV: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.
Unit-V: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. *Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.*
2. *Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I and II, Tata McGraw Hill Publishing Co. Ltd., 1983.*
3. *Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.*
4. *Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley and Sons, 199*

Audit Courses:

AUD-901 : **Project Management**

(Total Credits: Audit Course)

COURSE OBJECTIVES:

- Understand the fundamental principles of Project management and also have a good knowledge of responsibilities of project manager and how to handle these.
- To do the Project Scheduling, tracking, Risk analysis, Quality management and Project Cost estimation using different techniques.
- To highlight different techniques for software cost estimation and activity planning.

SYLLABUS:

Unit 1:Project Management: **[06 Hrs]**
Concept of Project Management, Principles of Project Management, Functions of Project Management: Planning, Organizing, Staffing, Directing & Controlling, Project Scope Verification , Functional & Matrix Organization Structure.

Unit 2:Project Network Analysis: [08 Hrs]
Project Network Diagram: Precedence Diagramming Method (PDM), Activity-on-Node (AON) & Arrow Diagramming Method (ADM), Work Breakdown Structure (WBS), Gantt Chart, Milestone Chart, Project Network Analysis (Critical Path Method and PERT), Cost Analysis of Project, Resource Allocation, Resource Smoothening & Leveling, Resource Histograms, Use of Computer Software (PRIMAVERA & MICROSOFT PROJECT) in Project Network Analysis.

Unit 3: Project Network Case Studies: [06 Hrs]
Thermal Power Project, Fertilizer Project, Turnkey Construction Project, Software Creation & Installation Project, Project Related to Mechanical Industry, Projects Related to Electronic & Communication Industry.

Unit 4:Project Economics & Project Value Analysis: [06 Hrs]
Project Formulation, Project Plan, Project Appraisal Techniques: Net Present Value, Internal Rate of Return, Payback Period, Benefit Cost Ratio, Value Engineering job plan, Project Life Cycle Costs.

Unit 5: Project Quality , Risk & Procurement Management: [08 Hrs]
Project Quality Planning, Assurance & Control, Project Quality Management Techniques: Kaizen & Just-in-Time, Total Quality Management, Risk-Management Plan, Uncertainty, Risk Factors and Risk Tolerances, Project Quantitative Risk Analysis (Monte Carlo Analysis & Decision Tree), Project Risk Monitoring & Control, Procurement Management Plan, Project Contract Administration.

Unit 6: Computerized Project Management: [08 Hrs]
Project Information Cell, Management Information System, Software Project Management, Categorization of Software Projects , Project portfolio Management, Software Process and Process Models, Choice of Process Models: Mental Delivery, Rapid Application Development, Agile Methods, Extreme Programming, SCRUM, Software Estimation, Effort and Cost Estimation

Techniques, COSMIC Full Function Points, COCOMO II A Parametric Productivity Model, Project Tracking, Software Configuration Management, Staffing Pattern, Methods of staff selection, The Oldham-Hackman job characteristic model.

References:

1. *Chitkara K.K., Construction Project Management, Tata McGraw Hill Publications.*
2. *Barrie D.S. & Paulson B.C,Professional Construction Management,McGraw Hill.*
3. *R.Flagnan and G.Norman, Risk Managemnt& Construction, Blackwell Scientific Publishers.*
4. *L.W. Zimmwerman and G.D. Hart, Value Engineering, CBS Publishers.*
5. *Robert K. Wysocki "Effective Software Project Management" – Wiley Publication, 2011.*
6. *Walker Royce: "Software Project Management"- Addison-Wesley, 1998.*

COURSE OUTCOMES (COs) (CO)

CO1: Understand the concepts and functions of project management.
CO2: Apply the project plan planning and monitoring techniques.
CO3: Analyze the project value, risk and quality.
CO4: Design and develop projects at each stage of the software development life cycle (SDLC).

MAC-591 : English for Research Paper Writing

(Total Credits: Audit Course)

COURSE OBJECTIVE

- Understand that how to improve your writing skills and level of readability.
- Learn about what to write in each section.
- Understand the skills needed when writing a Title.
- Ensure the good quality of paper at very first-time submission.

SYLLABUS

Unit 1: Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2: Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3: Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit 4: Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Unit 5: Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Unit 6: Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Suggested Studies:

1. *Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)*
2. *Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press*

3. *Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook .*
4. *Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011*

AUD-902: Disaster Management

(Total Credits: Audit Course)

COURSE OBJECTIVE

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

SYLLABUS

Unit 1: IntroductionDisaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Unit 2: Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit 3: Disaster Prone Areas In India Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases and Epidemics.

Unit 4: Disaster Preparedness And Management Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit 5: Risk Assessment Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Unit 6: Disaster Mitigation Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

Suggested Readings:

1. *R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.*
2. *Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.*
3. *Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep andDeep Publication Pvt. Ltd., New Delhi.*

AUD-903: Sanskrit for Technical Knowledge

(Total Credits: Audit Course)

COURSE OBJECTIVES

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
- Learning of Sanskrit to improve brain functioning.
- Learning of Sanskrit to develop the logic in mathematics, science and other subjects enhancing the memory power.
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

SYLLABUS

Unit 1: Alphabets in Sanskrit,

Unit 2: Past/Present/Future Tense

Unit 3: Simple Sentences, Order

Unit 4: Introduction of roots

Unit 5: Technical information about Sanskrit Literature

Unit 6: Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

COURSE OUTCOMES (COS)

- Understanding basic Sanskrit language.
- Ancient Sanskrit literature about science and technology can be understood.
- Being a logical language will help to develop logic in students.

Suggested reading

1. *"Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi*
2. *"Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication*
3. *"India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.*

AUD-904: Value Education

(Total Credits: Audit Course)

COURSE OBJECTIVES

- Understand value of education and self- development.
- Imbibe good values in students.
- Let the students know about the importance of character.

SYLLABUS

Unit 1: Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.

Moral and non- moral valuation. Standards and principles.

Value judgements

Unit 2: Importance of cultivation of values.

Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.

Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

Unit 3: Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.

Punctuality, Love and Kindness.

Avoid fault Thinking.

Free from anger, Dignity of labour.

Unit 4: Universal brotherhood and religious tolerance.

True friendship.

Happiness Vs suffering, love for truth.

Aware of self-destructive habits. Association and Cooperation.

Doing best for saving nature

Unit 5: Character and Competence –Holy books vs Blind faith.

Self-management and Good health.

Science of reincarnation.

Unit 6: Equality, Nonviolence,Humility, Role of Women.

All religions and same message. Mind your Mind, Self-control.

Honesty, Studying effectively

COURSE OUTCOMES (COS)

- Knowledge of self-development.
- Learn the importance of Human values.
- Developing the overall personality.

Suggested reading

1. *Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi*

AUD-904: Constitution of India

(Total Credits: Audit Course)

COURSE OBJECTIVES

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

SYLLABUS

Unit 1: History of Making of the Indian Constitution:

History

Drafting Committee, (Composition and Working)

Unit 2: Philosophy of the Indian Constitution:

Preamble

Salient Features

Unit 3: Contours of Constitutional Rights and Duties:

- Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

Unit 4: Organs of Governance:

- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions

Unit 5: Local Administration:

- District's Administration head: Role and Importance,
- Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
- Pachayati raj: Introduction, PRI: Zila Pachayat.
- Elected officials and their roles, CEO ZilaPachayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials,

- Importance of grass root democracy

Unit 6: Election Commission:

- Election Commission: Role and Functioning.
- Chief Election Commissioner and Election Commissioners.
- State Election Commission: Role and Functioning.
- Institute and Bodies for the welfare of SC/ST/OBC and women.

COURSE OUTCOMES (COS)

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

Suggested reading

1. *The Constitution of India, 1950 (Bare Act), Government Publication.*
2. *Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.*
3. *M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.*
4. *D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.*

AUD-906: Pedagogy Studies

(Total Credits: Audit Course)

COURSE OBJECTIVES

- Review existing evidence on the review topic to inform program design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

SYLLABUS

Unit 1: Introduction and Methodology:

- Aims and rationale, Policy background, Conceptual framework and terminology
- Theories of learning, Curriculum, Teacher education.
- Conceptual framework, Research questions**.**
- Overview of methodology and Searching.

Unit 2:

- Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
- Curriculum, Teacher education.

Unit 3:

- Evidence on the effectiveness of pedagogical practices

- Methodology for the in depth stage: quality assessment of included studies.
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Unit 4:

- Theory of change.
- Strength and nature of the body of evidence for effective pedagogical practices.
- Pedagogic theory and pedagogical approaches.
- Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 5:

- Professional development: alignment with classroom practices and follow-up support
- Peer support
- Support from the head teacher and the community.
- Curriculum and assessment
- Barriers to learning: limited resources and large class sizes

Unit 6: Research gaps and future directions

- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact.

COURSE OUTCOMES (COS)

- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Suggested reading

1. *Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.*
2. *Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.*
3. *Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.*
4. *Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.*
5. *Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.*
6. *Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.*

7. *www.pratham.org/images/resource%20working%20paper%202.pdf.*

AUD-907: Stress Management By Yoga

(Total Credits: Audit Course)

COURSE OBJECTIVES

- To achieve overall health of body and mind.
- To overcome stress.

SYLLABUS

Unit 1: Definitions of Eight parts of yog. (Ashtanga)

Unit 2: Yam and Niyam.

Unit 3: Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

Unit 4: Do`s and Don't's in life.

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit 5: Asan and Pranayam

i) Various yog poses and their benefits for mind and body

Unit 6: Asan and Pranayam

ii) Regularization of breathing techniques and its effects-Types of pranayam

COURSE OUTCOMES (COS)

- Develop healthy mind in a healthy body thus improving social health also.
- Improve efficiency.

Suggested reading

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur.

"Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

AUD-908: Personality Development Through Life Enlightenment Skills

(Total Credits: Audit Course)

COURSE OBJECTIVES

- To learn to achieve the highest goal happily.
- To become a person with stable mind, pleasing personality and determination.
- To awaken wisdom in students.

SYLLABUS

Unit 1: Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride and heroism)
- Verses- 26,28,63,65 (virtue)

Unit 2:

- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

Unit 3: Approach to day to day work and duties.

- Shrimad BhagwadGeeta : Chapter 2-Verses 41, 47,48,

Unit 4:

- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

Unit 5: Statements of basic knowledge.

- Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18

Unit 6:

- Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

COURSE OUTCOMES (COS)

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity.
- Study of Neetishatakam will help in developing versatile personality of students.

Suggested reading

1. *"Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata*
2. *Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath,*
3. *Rashtriya Sanskrit Sansthanam, New Delhi.*

SEMESTER III

DIS-IT-601: Dissertation-I / Industrial Project

(Total Credits: 14)

Dissertation shall consist of:

Research work done by the candidate in the areas related to the chosen specialization, or Comprehensive and critical review of any recent development in the chosen specialization, or Design and/or development of a product related to the program done by the candidate.

Following shall be the guidelines for evaluation of dissertation part I

Dissertation Part I shall consist of the following components (whichever applicable)

- Extensive literature survey
- Data collection from RandD organizations, Industries, etc,
- Study of the viability, applicability and scope of the dissertation
- Detailed Design
- Partial implementation
- A candidate should prepare the following documents for examination
- A term paper in the format of any standard journal based on the work
- A detailed report of the work done by the candidate related to dissertation

Every candidate should present himself (for about 30 min.) before the panel of examiners (which will evaluate the dissertation I for TW and Oral marks) consisting of Head of Department, M. Tech. Coordinator or his nominee, all supervisors.

SEMESTER IV

DIS-IT-602: Dissertation-II / Industrial Project

(Total Credits: 14)

The dissertation shall be assessed internally by a panel of examiners (similar to the one in dissertation part- I) before submission. The candidate shall submit the dissertation in triplicate to the Head of the institution, duly certified that the work has been satisfactorily completed. The Practical examination (viva-voce) shall consist of a defense presented by the candidate or his/her work in the presence of examiners appointed by the Institute one of whom will be the supervisor and the other an external examiner.