SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING: TIRUPATI
DEPARTMENT OF COMPUTER SCINCE ENGINEERING
Postgraduate Programme
Scheme of Instruction for Choice Based Credit System
(With effect from 2018 – 2019 admitted batch)
Total credits (2 year course): 68

SEMESTER I

Course Code	Course Title	L	T	P	Credits	Internal	End Semester	Total
Program Core-I		3			3	40	60	100
MAPC 01	Mathematical Foundation of Computer Science							
Program Core-II		3			3	40	60	100
COPC 02	Advanced Data Structures	3			3	40	60	100
Program Elective – I(Any one of the following)		3			3	40	60	100
COPE 11	Machine Learning							
COPE 12	Introduction to Intelligent Systems							
Program Elective – II(Any one of the following)		3			3	40	60	100
COPE 21	Distributed Database Systems							
COPE 22	Data Science							
Audit Course – I		2	0	2	2	40	60	100
PGPC 01	Research Methodology and IPR							
COCP 01	Core-I Lab: Advanced Data StructuresLab			4	2	40	60	100
COEP 01	Elective-I Lab (Based on Elective): Machine Learning/ Introduction to Intelligent Systems/ Distributed Database Systems/ Data Science Lab			4	2	40	60	100
Audit Course – II(Any one of the following)		2			0	40	60	100
PGPA 11	English for Research Paper Writing							
PGPA 12	Disaster Management							
PGPA 13	Sanskrit for Technical Knowledge							
PGPA 14	Value Education							

Total					18			700

SEMESTER II

Course Code	Course Title	L	T	P	Credits	Internal	End Semester	Total
Program Core-III		3			3	40	60	100
COPC 03	Advanced Algorithms							
Program Core-IV		3			3	40	60	100
COPC 04	Soft Computing							
Program Elective – III(Any one of the following)		3			3	40	60	100
COPE 31	Data Preparation and Analysis							
COPE 32	Computer Vision							
Program Elective – IV(Any one of the following)		3			3	40	60	100
COPE 41	GPU Computing							
COPE 42	Digital Forensics							
COCP02	Core-II Lab (Based on Core)::Advanced Algorithms/ Soft Computing Lab			4	2	40	60	100
COEP02	Elective-II Lab (Based on Elective): Data Preparation and Analysis/ Computer Vision/ GPU Computing/ Digital Forensics Lab			4	2	40	60	100
Audit Course – III(Any one of the following)		2	0	0	0	40	60	100
PGPA 21	Constitution of India							
PGPA 22	Pedagogy Studies							
PGPA 23	Stress Management by Yoga							
PGPA 24	Personality Development through Life Enlightenment Skills							
COMP 01	Mini Project			4	2	40	60	100
					18			600

SEMESTER III

Course Code	Course Title	L	T	P	Credits	Internal	End Semester	Total
Program Elective – V(Any one of the following)		3			3	40	60	100
COPE 51	Compilers for HPC							
COPE 52	Optimization Techniques							
Open Elective – III(Any one of the following)		3	0	0	3	40	60	100
PGOE 11	Business Analytics							
PGOE 12	Industrial Safety							
PGOE 13	Operations Research							
PGOE 14	Cost Management of Engineering Projects							
PGOE 15	Composite Materials							
PGOE16	Waste to Energy							
COPD01	Major Project : Phase – I Dissertation			20	10	100		100
Total					16			300

SEMESTER IV

		Lecture	Tutorial	Practical	Credits
COPD 02	Major Project : Phase – II Dissertation			32	16
	Total				16

Instruction Hours/Week : 32(P) Credits : 16

Sessional Marks : 50 End Semester Examinations Marks : 50

SEMESTER I

MAPC01

Mathematical Foundation of Computer Science

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

Unit I
Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem,Probabilistic inequalities, Markov chains

Unit II
Random samples, sampling distributions of estimators**,** Methods of Moments and Maximum Likelihood**,**

Unit III
Statistical inference**,** Introduction to multivariate statistical models: regression and classification problems, principal components analysis**,** The problem of overfitting model assessment.

Unit IV
Graph Theory: Isomorphism, Planar graphs, graph colouring, hamilton circuits and euler cycles.

Unit V
Permutations and Combinations with and without repetition.Specialized techniques to solve combinatorial enumeration problems

References:

1. John Vince, Foundation Mathematics for Computer Science, Springer.
2. K. Trivedi.Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.
3. M. Mitzenmacher and E. Upfal.Probability and Computing: Randomized Algorithms and Probabilistic Analysis.
4. Alan Tucker, Applied Combinatorics, Wiley

Course Outcomes

- To understand the basic notions of discrete and continuous probability.

- To understand the methods of statistical inference, and the role that sampling distributions play in those methods.

- To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.

COPC02

Advanced Data Structures

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

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

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

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

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

Unit V
Computational **Geometry:** One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees.

References:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson.

2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley.

Curse Outcomes

- Understand the implementation of symbol table using hashing techniques.
- Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
- Develop algorithms for text processing applications.
- Identify suitable data structures and develop algorithms for computational geometry problems.

COPE11

Machine learning

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

Unit I

Supervised Learning (Regression/Classification)
Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes Linear models: Linear Regression, Logistic Regression, Generalized Linear Models Support Vector Machines, Nonlinearity and Kernel Methods Beyond Binary Classification: Multi-class/Structured Outputs, Ranking

Unit II

Unsupervised Learning
Clustering: K-means/Kernel K-means
Dimensionality Reduction: PCA and kernel PCA
Matrix Factorization and Matrix Completion
Generative Models (mixture models and latent factor models)

Unit III

Evaluating Machine Learning algorithms and Model Selection,Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests

Unit IV

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning 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 IV
Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT 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)

Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007

Course Outcomes

- Extract features that can be used for a particular machine learning approach in various IOT applications.

- To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.

- To mathematically analyse various machine learning approaches and paradigms

COPE12

Introduction to Intelligent Systems

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

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

Unit II
Biological foundations to intelligent systems II: Fuzzy logic, knowledgemRepresentation and inference mechanism, genetic algorithm, and fuzzy neural networks.

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

Unit IV
Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual

graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard
architectures.

Unit V

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning.Recent trends in Fuzzy logic, Knowledge Representation

References:

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

2. Russell S. and Norvig P. (2009). Artificial Intelligence: A Modern Approach. Prentice-Hall, 3rd edition.

Corse Outcomes

- Able to Demonstrate knowledge of the fundamental principles of intelligent systems and would be able to analyse and compare the relative merits of a variety of AI problem solving techniques.

COPE21

Distributed Database Systems

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

Unit I

Introduction: Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts Distributed Database Systems Atchtecture: Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues

Unit II

Distributed Database Design: Alternative design strategies; Distributed esign issues; Fragmentation; Data allocation
Semantics Data Control: View management; Data security; Semantic Integrity Control
Query Processing Issues: Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data

Unit III

Distributed Query Optimization: Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms

Transaction Management: The transaction concept; Goals of transaction management; Characteristics of
transactions; Taxonomy of transaction models

Concurrency Contrl: Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management

Unit IV

Reliability: Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols

Parallel Database Systems: Parallel architectures; parallel query processing and optimization; load balancing

Unit V

Advanced Topics;

Mobile Databases, Distributed Object Management, Multi-databases

References

1. Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991.
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

Course Outcomes

- Design trends in distributed systems.
- Apply network virtualization.
- Apply remote method invocation and objects.

COPE22

Data Science

Instruction Hours/Week : 3(L) Credits : 3

Sessional Marks : 40 End Semester Examinations Marks : 60

Unit-I

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

Unit-II

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources

Unit-III

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance,Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

Unit-IV

Data visualisation:Introduction, Types of data visualisation,Data for visualisation:Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

Unit-V

Applications of Data Science,Technologies for visualisation, Bokeh (Python)\ Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

References:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.

2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.

Corse Outcomes

- Explain how data is collected, managed and stored for data science;
- Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists;
- Implement data collection and management scripts using MongoDB

PGPC 01

Research Methodology and IPR

Instruction Hours/week : 2(L) **Credits : 2**
Sessional Marks : 40 **Semester-end Examination : 60**

UNIT I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT II

Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT III

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT IV

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT. Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. 1.Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science
2. & engineering students'"
3. 2.Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
4. 3.Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"
5. 4.Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
6. 5.Mayall , "Industrial Design", McGraw Hill, 1992.
7. 6.Niebel , "Product Design", McGraw Hill, 1974.
8. 7.Asimov , "Introduction to Design", Prentice Hall, 1962.
9. 8.Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New
10. Technological Age", 2016.
11. 9.T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Course Outcomes:

- understand research problem formulation.
- analyze research related information
- follow research ethics
- understand that today's world is controlled by Computer, Information Technology, but
- tomorrow world will be ruled by ideas, concept, and creativity.
- understand that when IPR would take such important place in growth of individuals &
- nation, it is needless to emphasis the need of information about Intellectual Property Right
- to be promoted among students in general & engineering in particular.
- 6.understand that IPR protection provides an incentive to inventors for further research work and
- investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

PGPA11

ENGLISH FOR RESEARCH PAPER WRITING

Instruction Hours/week : 2(L) Credits : 2
Sessional Marks : 100 Semester-end Examination : -

UNIT I

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT II

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

UNIT III

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 IV

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 V

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

References :

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

Course outcomes

- understand how to improve writing skills and level of readability
- learn about what to write in each section
- understand the skills needed when writing a Title

PGPA12

DISASTER MANAGEMENT

Instruction Hours/week : 2(L) Credits : 2
Sessional Marks : 100 Semester-end Examination : -

UNIT I
Introduction
Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; natural and Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT II
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, Manmade disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III
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 IV
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 V
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.

References:

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 &Deep Publication Pvt. Ltd., New Delhi.

Course outcomes

- 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 the 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

PGPA 13

SANSKRIT FOR TECHNICAL KNOWLEDGE

Instruction Hours/week : 2(L) Credits : 2
Sessional Marks : 100 Semester-end Examination : -

UNIT I
Alphabets in Sanskrit, Past/Present/Future Tense

UNIT II
Simple Sentences Order

UNIT III
Introduction of roots

UNIT IV
Technical information about Sanskrit Literature

UNIT V
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

References:

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.

Course Outcomes:

At the end of the course, students will be able to
1. understand basic Sanskrit language
2. understand the Ancient Sanskrit literature about science & technology
3. help to develop logic, being a logical language

PGPA14

VALUE EDUCATION

Instruction Hours/week : 2(L) Credits : 2
Sessional Marks : 100 Semester-end Examination : -

UNIT I
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 II
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 III
Personality - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness, Avoid fault Thinking. Free from anger, Dignity of labour.

UNIT IV
Behavior Development, 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 V

Character and Competence, Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence ,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

References:

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

Course outcomes:

At the end of the course, students will be able to
1.acquire the knowledge of self-development
2.learn the importance of Human values
3.develop the overall personality

COCP01

Core-I Lab

Advanced Dats Structures Lab

Instruction Hours/Week : 4(P) Credits : 2
Sessional Marks : 40 End Semester Examinations Marks : 60

The concepts of Core courses should be practiced using Java/Python
Hashing functions
Boyer-Moore Algorithm
Knuth-Morris-Pratt Algorithm
Huffman Coding Algorithm
One Dimensional Range Searching
Two
Dimensional Range Searching
Lab Outcomes
Hashing functions
Boyer-Moore Algorithm
Knuth-Morris-Pratt Algorithm
Huffman Coding Algorithm
One Dimensional Range Searching
Two
Dimensional Range Searching

COEP01

Elective-I Lab(Based on Elective):
Instruction Hours/Week : 4(P) Credits : 2

Sessional Marks : 40 End Semester Examinations Marks : 60

The concepts of Elective courses should be practiced using Java/Python

Machine Learning Lab

1. Implement Nearest-Neighbours
2. Implement Naive Bayes Linear models
3. Implement K-means/Kernel K-means
4. Implement Bayesian Learning
5. Implement IOT applications

Lab Outcomes

On successful completion of this course the students will be able to learn

- Nearest-Neighbours
- Naive Bayes Linear models
- K-means/Kernel K-means
- Bayesian Learning
- IOT applications

Intelligent Systems Lab

1. Implement Neural network
2. Implement genetic algorithm
3. Implement fuzzy neural networks
4. Implement frames
5. Implement scripts,
6. Implement statistical learning

Course Outcomes

On successful completion of this course the students will be able to learn

1. genetic algorithm
2. fuzzy neural networks
3. frames
4. scripts,
5. statistical learning

Distributed Database Systems Lab

1. Implement View management
2. Implement Data security
3. Implement Semantic Integrity
4. Implement Distributed query optimization algorithms
5. Implement Operations transaction management
6. Implement Distributed query processing
7. Implement parallel query processing

Course Outcomes

On successful completion of this course the students will be able to learn

- View management
- Data security
- Semantic Integrity
- Distributed query optimization algorithms
- Operations transaction management
- Distributed query processing
- parallel query processing

Data Science Lab

1. Implement Data storage in Oracle/XML
2. Implement data visualization
3. Implement Basic machine learning algorithms
4. Implement various data collection and analysis techniques
5. Implement visualization techniques

Course Outcomes

On successful completion of this course the students will be able to learn

- Data storage in Oracle/XML
- data visualization
- Basic machine learning algorithms
- in various data collection and analysis techniques
- visualization techniques

SEMESTER II

COPC03

Advanced Algorithms

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

Unit I
Sorting**:** Review of various sorting algorithms, topological sorting **Graph:** Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

Unit II
Matroids**:** Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.
Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path

Unit III9
Flow-Networks**:** Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.
Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition

Unit IV
Shortest Path in Graphs**:** Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming
Modulo Representation of integers/polynomials: Chinese Theorem, Conversion between base-representation and modulo-representation Extension to polynomials. Application: Interpolation problem

Unit V
Discrete Fourier Transform (DFT**):** In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm
Linear Programming: Geometry of the feasibility region and Simplex algorithm **NP-completeness:** Examples, proof of NP-hardness and NP-completeness.

References

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.

2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman."Algorithm Design" by Kleinberg and Tardos

Course Outcomes

- Analyze the complexity/performance of different algorithms.
- Determine the appropriate data structure for solving a particular set of problems.
- Categorize the different problems in various classes according to their complexity.

COPC04

Soft Computing

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

Unit I
INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics

Unit II
FUZZY LOGIC: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making

Unit II
NEURAL NETWORKS: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural Networks

Unit IV
GENETIC ALGORITHMS: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition

Unit V
Matlab/Python Lib: Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic

References

1. Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro:Fuzzy and Soft Computing , Prentice:Hall of India, 2003.

2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications , Prentice Hall, 1995.

3. MATLAB Toolkit Manual

Course Outcomes

- Identify and describe soft computing techniques and their roles in building intelligent machines
- Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
- Apply genetic algorithms to combinatorial optimization problems.
- Evaluate and compare solutions by various soft computing approaches for a given problem

COPE31

Data Preparation and Analysis/Big Data Analysis

Instruction Hours/Week : 3(L) Credits : 3

Sessional Marks : 40 End Semester Examinations Marks : 60

Unit I

Data Gathering and Preparation: Data formats, parsing and transformation, Scalability and real-time issues

Unit II

Data Cleaning: Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation

Unit III

Exploratory Analysis: Descriptive and comparative statistics, Clustering and association, Hypothesis
generation

Unit IV

Visualization: Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity

Unit V

Regression and correlation analysis

References:

1. Making sense of Data : A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt

Course Outcomes

- Able to extract the data for performing the Analysis.

COPE32

Computer Vision

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

Unit I
Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis

Unit II
Edge detection, Edge detection performance, Hough transform, corner detection

Unit III
Segmentation, Morphological filtering, Fourier transform

Unit IV
Feature extraction, shape, histogram, color, spectral, texture, using CVIPtools, Feature analysis, feature vectors, distance /similarity measures, data pre-Processing

Unit V
Pattern Analysis:
Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised
Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods.

References:

1. Computer Vision: Algorithms and Applications by Richard Szeliski.

2. Deep Learning, by Goodfellow, Bengio, and Courville.

3. Dictionary of Computer Vision and Image Processing, by Fisher et al.

Course Outcomes

- Developed the practical skills necessary to build computer vision applications.
- To have gained exposure to object and scene recognition and categorization from images

COPE41

GPU Computing

Instruction Hours/Week : 3(L) Credits : 3

Sessional Marks : 40 End Semester Examinations Marks : 60

Unit I

Introduction: History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA OpenCL / OpenACC,
Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps / Wavefronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D / 3D thread mapping, Device properties, Simple Programs

Unit II

Memory: Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories

Unit III

Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU
Functions: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.

Unit IV

Support: Debugging GPU Programs. Profiling, Profile tools, Performance aspects
Streams: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based-Synchronization - Overlapping data transfer and kernel execution, pitfalls.

Unit V

Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning
Advanced topics: Dynamic parallelism, Unified Virtual Memory, Multi-GPU

processing, Peer access, Heterogeneous processing

References:

1. Programming Massively Parallel Processors: A Hands-on Approach; David Kirk, Wen-mei Hwu;Morgan Kaufman; 2010 (ISBN: 978-0123814722)

2. CUDA Programming: A Developer's Guide to Parallel Computing with GPUs; Shane Cook;Morgan Kaufman; 2012 (ISBN: 978-0124159334)

Course Outcomes

- Students would learn concepts in parallel programming, implementation of programs on GPUs, debugging and profiling parallel programs.

COPE42

Digital Forensics

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

Unit I

Digital Forensics Science: Forensics science, computer forensics, and digitalforensics.
Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics

Unit II

Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

Unit III

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

Unit IV

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

Unit V

Mobile Forensics: mobile forensics techniques, mobile forensics tools.
Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008. Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

References:

1. John Sammons, The Basics of Digital Forensics, Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications

Course Outcomes

- Computer forensics and digital detective and various processes, policies and procedures
- E-discovery, guidelines and standards, E-evidence, tools and environment.
- Email and web forensics and network forensics

PGPA 21

CONSTITUTION OF INDIA

Instruction Hours/week : 2(L) Credits : 2
Sessional Marks : 100 Semester-end Examination : -

UNIT I

History and philosophy of the Indian Constitution
History -Drafting Committee, (Composition & Working) - Preamble - Salient Features

UNIT II

Contours of Constitutional Rights & 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 III

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 IV

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: ZilaPachayat. 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 V

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.

References:

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.

Course Outcomes:

- the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- 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.
- the passage of the Hindu Code Bill of 1956.

PGPA 22

PEDAGOGY STUDIES

Instruction Hours/week : 2(L) Credits : 2
Sessional Marks : 100 Semester-end Examination : -

UNIT I

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 II

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

UNIT III

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? 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 IV

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 V

Research gaps and future directions:
Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

References:

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.

Course Outcomes:

- the pedagogical practices being used by teachers in formal and informal classrooms in developing countries.
- the evidence on the effectiveness of these pedagogical practices
- learns how teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.

PGPA 23

STRESS MANAGEMENT BY YOGA

Instruction Hours/week : 2(L) Credits : 2
Sessional Marks : 100 Semester-end Examination : -

UNIT I
Definitions of Eight parts of yog. (Ashtanga)

UNIT II
Yam - Ahinsa, satya, astheya, bramhacharya and aparigraha

UNIT III
Niyam - Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT IV
Asan - Various yog poses and their benefits for mind & body

UNIT V
Pranayam - Regularization of breathing techniques and its effects-Types of pranayam 8

References:
1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

Course Outcomes:

- develop healthy mind in a healthy body thus improving social health also
- improve efficiency

PGPA 24

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Instruction Hours/week : 2(L) Credits : 2
Sessional Marks : 100 Semester-end Examination : -

UNIT I

Neetisatakam-Holistic development of personality
Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) - Verses- 26,28,63,65 (virtue)

UNIT II

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

UNIT III

Approach to day to day work and duties.
Shrimad BhagwadGeeta : Chapter 2-Verses 41, 47,48- Chapter 3-Verses 13, 21, 27, 35 - Chapter 6-Verses 5,13,17, 23, 35 - Chapter 18-Verses 45, 46, 48.

UNIT IV

Statements of basic knowledge.
Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68 - Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT V

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.

References :

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

Course Outcomes :

- develop personality and achieve the highest goal in life
- lead the nation and mankind to peace and prosperity
- help in developing versatile personality.

COCP02

Core-II Lab(Based on Core)
:Advanced Algorithms/ Soft Computing Lab

Instruction Hours/Week : 4(P) Credits : 2
Sessional Marks : 40 End Semester Examinations Marks : 60

The concepts of Core courses should be practiced using Java/Python

1. BFS travel salesman problem
2. DFS travel salesman problem
3. Ford-Fulkerson Method
4. Strassen's algorithm
5. Dijkasra's
6. Floyd-Warshall algorithm
7. NP-Complete problems

Lab Outcomes

On successful completion of this course the students will be able to learn

- BFS travel salesman problem
- DFS travel salesman problem
- Ford-Fulkerson Method
- Strassen's algorithm
- Dijkasra's
- Floyd-Warshall algorithm
- NP-Complete problems

COEP02

Elective-II Lab (Based on Elective)

Instruction Hours/Week : 4(L) Credits : 2
Sessional Marks : 40 End Semester Examinations Marks : 60

The concepts of Elective courses should be practiced using Java/Python

Data Preparation and Analysis Lab

1. Implement Data Gathering and stroring
2. Implement Data formats, parsing using Python
3. Implement Heterogeneous and missing data
4. Implement Regression analysis
5. Implement correlation analysis
6. Implement Visualization

Lab Outcomes

On successful completion of this course the students will be able to learn

- Data Gathering and stroring
- Data formats, parsing using Python
- Heterogeneous and missing data
- Regression analysis
- correlation analysis
- Visualization

Computer Vision Lab

1. Implement Image formation and sensing
2. Implement Image analysis
3. Implement Edge detection
4. Implement Corner detection
5. Implement Segmentation
6. Implement Feature extraction
7. Implement Feature analysis

Lab Outcomes

On successful completion of this course the students will be able to learn

- Image formation and sensing
- Image analysis
- Edge detection
- Corner detection
- Segmentation
- Feature extraction
- Feature analysis

GPU Computing Lab

1. Implement Threads
2. Implement Simulation of dynamic allocation
3. Implement Synchronization
4. Implement Asynchronization
5. Implement Graph algorithms

Lab Outcomes

On successful completion of this course the students will be able to learn

- Threads
- Simulation of dynamic allocation
- Syncronization
- Asyncrinization
- Graph algorithms

Digital Forensics Lab

1. Implement methods to search

2. Implement investigative process, analysis
3. Implement criminal investigation.
4. Implement forensic analysis
5. Use open-source security tools
6. Use mobile forensics tools

Lab Outcomes

On successful completion of this course the students will be able to learn

- methods to search
- investigative process, analysis
- criminal investigation.
- forensic analysis
- open-source security tools
- mobile forensics tools

COMP 01

Mini Project

nstruction Hours/Week : 6(L) Credits : 3

Sessional Marks : 40 End Semester Examinations Marks : 60

The object of mini Project is to enable the student to take up investigative study in the broad field of Computer Science and Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

- Survey and study of published literature on the assigned topic;
- Working out a preliminary Approach to the Problem relating to the assigned topic;
- Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
- Preparing a Written Report on the Study conducted for presentation to the Department;
- Final Seminar, as oral Presentation before a departmental committee.

SEMESTER III

COPE51

Compilers for HPC

Instruction Hours/Week : 3(L) Credits : 3

Sessional Marks : 40 End Semester Examinations Marks : 60

Unit-I

High Performance Systems, Structure of a Compiler, Programming Language Features, Languages for High Performance.

Unit-II

Data Dependence: Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph.Scalar Analysis with Factored Use-Def Chains: Constructing Factored Use- Def Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, Data Dependence for Scalars. Data
Dependence Analysis for Arrays.

Unit-III

Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls, Inter-procedural Analysis. Loop Restructuring: Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-procedural Transformations. Optimizing for Locality: Single Reference to Each Array, Multiple References,Genera l Tiling, Fission and Fusion for Locality.

Unit-IV

Concurrency Analysis: Concurrency from Sequential Loops, Concurrency from Parallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers. **Vector Analysis:** Vector Code, Vector Code from Sequential Loops, Vector Code from For all Loops, Nested Loops, Round off Error, Exceptions, and Debuggers, Multi-vector Computers.

Unit-V

Message-Passing Machines: SIMD Machines, MIMD Machines, Data Layout, Parallel Code for Array Assignment, Remote Data Access, Automatic Data Layout, Multiple Array Assignments, Other Topics.

Scalable Shared-Memory Machines: Global Cache Coherence, Local Cache Coherence, Latency Tolerant Machines.

References:

1. Michael Wolfe, High-Performance Compilers for Parallel Computing, Pearson

Course Outcomes

- Familiar with the structure of compiler.

- Parallel loops, data dependency and exception handling and debugging in compiler.

COPE52

Optimization Techniques

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

Unit I
Engineering application of Optimization, Formulation of design problems as mathematical programming problems.

Unit II
General Structure of Optimization Algorithms, Constraints, The Feasible Region.

Unit II
Branches of Mathematical Programming: Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming, Semi Definite Programming.

Unit IV
Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc.

Unit V
Real life Problems and their mathematical formulation as standard programming problems.

References

1. Laurence A. Wolsey (1998). Integer programming. Wiley. ISBN 978-0-471-28366-9.
2. Practical Optimization Algorithms and Engineering Applications Andreas Antoniou.
3. An Introduction to Optimization Edwin K., P. Chong & Stanislaw h. Zak.
4. Dimitris Bertsimas; Robert Weismantel (2005). Optimization over integers. Dynamic Ideas. ISBN 978-0-9759146-2-5.
5. John K. Karlof (2006). Integer programming: theory and practice.CRC Press. ISBN 978-0-8493-1914-3.
6. H. Paul Williams (2009). Logic and Integer Programming. Springer. ISBN 978-0-387-92279-9.

7. Michael Jünger; Thomas M. Liebling; Denis Naddef; George Nemhauser; William R. Pulleyblank; Gerhard Reinelt; Giovanni Rinaldi; Laurence A. Wolsey, eds. (2009). 50 Years of Integer Programming 1958-2008: From the Early Years to the State-of-the- Art. Springer. ISBN 978-3-540-68274-5.

8. Der-San Chen; Robert G. Batson; Yu Dang (2010). Applied Integer Programming: Modeling and Solution. John Wiley and Sons. ISBN 978-0-470-37306-4.

Course Outcomes

- Formulate optimization problems.
- Understand and apply the concept of optimality criteria for various types of optimization problems.
- Solve various constrained and unconstrained problems in Single variable as well as multivariable.
- Apply the methods of optimization in real life situation

PGOE 11

Business Analytics

Instruction Hours/week : 3(L) Credits : 3
Sessional Marks : 40 Semester-end Examination : 60

UNIT I

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, 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 II

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 III

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 IV

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 V

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

References:

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:

- the knowledge of data analytics.
- the ability of think critically in making decisions based on data
- and deep analytics.
- the ability to use technical skills in predicative and prescriptive
- modeling to support business decision-making.
- **t**he ability to translate data into clear, actionable insights.

PGOE 12

Industrial Safety

Instruction Hours/week : 3(L) Credits : 3
Sessional Marks : 40 Semester-end Examination : 60

UNIT I

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 II

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 & its relation with replacement economy, Service life of equipment.

Unit-III

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 IV

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 achine 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 V

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. 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

References:

1. Maintenance Engineering Handbook, Higgins & 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 & Hall London.

Course outcomes:

- understand the preventive steps for industrial safety
- apply the corrosion prevention methods
- find the causes and tracking of faults in machine tools and equipment
- understand the periodic and preventive maintenance of mechanical and electrical equipment

PGOE 13

Operations Research

Instruction Hours/week : 3(L) Credits : 3
Sessional Marks : 40 Semester-end Examination : 60

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Course Outcomes:

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

PGOE 14

Cost Management of Engineering Projects

Instruction Hours/week : 3(L) Credits : 3
Sessional Marks : 40 Semester-end Examination : 60

UNIT I

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.

UNIT II

Project: meaning, Different types, why to manage, cost overruns centers, 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.

UNIT III

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,

UNIT IV

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.

UNIT V

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 & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Course outcomes:

- understand the cost concepts in decision - making
- commission, execute and manage Engineering projects
- apply the quality management techniques in the execution of projects
- apply the quantitative techniques for cost management of projects

PGOE 15

Composite Materials

Instruction Hours/week : 3(L) Credits : 3
Sessional Marks : 40 Semester-end Examination : 60

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.

References:

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 & Sons, NY, Indian edition, 2007.
3. Hand Book of Composite Materials-ed-Lubin.
4. Composite Materials – K.K.Chawla.
5. Composite Materials Science and Applications – Deborah D.L. Chung.

6. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

Course outcomes:

- demonstrate the characteristics of composite materials and composite performance
- understand the use of fibres as reinforcement
- understand the manufacturing process of metal and polymer matrix composites
- demonstrate the failure criteria

PGOE 16

Energy Generation from Wastes

Instruction Hours/week : 3(L) Credits : 3
Sessional Marks : 40 Semester-end Examination : 60

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 & 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 &Sons, 1996.

Course outcomes :

- 1.demonstrate the energy generation from wastes
- understand the biomass pyrolysis and gasification
- design, construct and operate biomass combustors
- develop bio-energy system

COMP 01

Major Project : Phase – I Dissertation

Instruction Hours/Week : 20(P) Credits : 10
Marks : 100

The object of Major Project Phase I Dissertation Work & Dissertation is to enable the student to extend further the investigative study , either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student in R&D work and technical leadership. The assignment to normally include:

- In depth study of the topic assigned in the light of the Report prepared ;
- Review and finalization of the Approach to the Problem relating to the assigned topic;
- Preparing an Action Plan for conducting the investigation, including team work;
- Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
- Final development of product/process, testing, results, conclusions and future directions;
- Preparing a paper for Conference presentation/Publication in Journals, if possible;
- Preparing a Dissertation in the standard format for being evaluated by the Department.
- Final Seminar Presentation before a Departmental Committee.

SEMESTER IV

COPD 02

Major Project : Phase –II Dissertation

Instruction Hours/Week : 32(P) Credits : 16
Marks : 100

The object of Major Project Work Phase II& Dissertation is to enable the student to extend further the investigative study , either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student in R&D work and technical leadership. The assignment to normally include:

- In depth study of the topic assigned in the light of the Report prepared ;
- Review and finalization of the Approach to the Problem relating to the assigned topic;
- Preparing an Action Plan for conducting the investigation, including team work;
- Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
- Final development of product/process, testing, results, conclusions and future directions;
- Preparing a paper for Conference presentation/Publication in Journals, if possible;
- Preparing a Dissertation in the standard format for being evaluated by the Department.
- Final Seminar Presentation before a Departmental Committee.