Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya

(Deemed to be University)

Enathur, Kanchipuram - 631 561.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CURRICULUM AND SYLLABUS FOR FULL TIME

M.E. COMPUTER SCIENCE AND ENGINEERING

(Applicable for students admitted from 2019-2020 onwards)

M.E.(Computer Science and Engineering)

Semester – I

Sl. No	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1	1CS01	Program Core-I (Mathematical Foundations of Computer Science)	3	1	0	4
2	1CS02	Program Core-II (Advanced Data Structures)	3	1	0	4
3	1CS03	Program Core-III Advanced Computer Architecture	3	1	0	4
4	1CSEC-01	Program Elective-I (Data Science/Machine Learning/ Distributed Systems)	3	0	0	3
5	1ARM 01	Research Methodology and IPR	2	0	0	2
6	1AAC-01	Audit Course	2	0	0	0
7	1CS04	Laboratory – I (Advanced Data Structures)	0	0	4	2
8	1CS05	Laboratory – II (Based on Elective)	0	0	4	2
Total			**16**	**3**	**8**	**21**

Semester – II

Sl. No	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1	2CS06	Program Core-IV (Advanced Algorithms)	3	1	0	4
2	2CS07	Program Core-V (Soft Computing)	3	1	0	4
3	2CSEC-02	Program Elective-II (Data Preparation and Analysis/Secure Software Design & Enterprise Computing/ Computer Vision)	3	0	0	3
4	2CSEC-03	Program Elective-III (Human and Computer Interaction/GPU Computing/Robotic Process Automation)	3	0	0	3
5	2CS08	Laboratory-III (Based on Core - IV)	0	0	4	2

6	2CS09	Laboratory-IV (Based on Elective - III)	0	0	4	2
7	2CS10	Mini Project with Seminar	2	0	0	2
Total			**14**	**2**	**8**	**20**

Semester – III

Sl. No	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1	3CSEC-04	Program Elective-IV (Mobile Applications and Services/ Compiler for HPC/Optimization Techniques)	3	0	0	3
2	3CSEC-05	Open Elective 1. Business Analytics 2. Cost Management of Engineering Projects	3	0	0	3
3	3CS11	Dissertation-I/ Project Work – I	0	0	20	10
Total			**6**	**0**	**20**	**16**

Semester – IV

Sl. No	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1	4CS12	Dissertation-II/Project Work - II	0	0	32	16
Total			**0**	**0**	**32**	**16**

Audit course 1 & 2

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Stress Management by Yoga
6. Personality Development through Life Enlightenment Skills.

I SEMESTER

Course Code :	Mathematical Foundations of Computer Science	L	T	P	C
1CS01		3	1	0	4

COURSE OBJECTIVE:

1. To understand the mathematical fundamentals that is prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
2. To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.
3. To study various sampling and classification problems.

COURSE OUTCOMES:

After completion of course, students would be able to:

1. To understand the basic notions of discrete and continuous probability.
2. To understand the methods of statistical inference, and the role that sampling distributions play in those methods.
3. To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.

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 Over Fitting Model Assessment.

UNIT - IV

Graph Theory: Isomorphism, Planar Graphs, Graph Colouring, Hamilton Circuits And Euler Cycles.

Permutations And Combinations With And Without Repetition. Specialized Techniques To Solve Combinatorial Enumeration Problems.

UNIT - V

Data Mining, Network Protocols, Analysis Of Web Traffic, Computer Security, Software Engineering, Computer Architecture, Operating Systems, Distributed Systems, Bioinformatics, Machine Learning.

UNIT - VI

Recent Trands In Various Distribution Functions In Mathematical Field Of Computer Science For Varying Fields Like Bio-Informatic, Soft Computing, And Computer Vision.

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 Code :	ADVANCED DATA STRUCTURES	L	T	P	C
1CS02		3	1	0	4

COURSE OBJECTIVE

1. The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2. Students should be able to understand the necessary mathematical abstraction to solve problems.
3. To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
4. Student should be able to come up with analysis of efficiency and proofs of correctness.

COURSE OUTCOMES

After completion of course, students would be able to:

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

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.

UNIT – VI

Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem

REFERENCES:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

Course Code :	ADVANCED COMPUTER ARCHITECTURE	L	T	P	C
1CS03		3	1	0	4

UNIT - I PIPELINING AND ILP

Fundamentals of Computer Design - Measuring and Reporting Performance – Instruction Level Parallelism and Its Exploitation - Concepts and Challenges - Overcoming Data Hazards with Dynamic Scheduling – Dynamic Branch Prediction - Speculation – Multiple Issue Processors – Case Studies.

UNIT - II ADVANCED TECHNIQUES FOR EXPLOITING ILP

Compiler Techniques for Exposing ILP - Limitations on ILP for Realizable Processors - Hardware versus Software Speculation - Multithreading: Using ILP Support to Exploit Thread-level Parallelism - Performance and Efficiency in Advanced Multiple Issue Processors - Case Studies.

UNIT - III MULTIPROCESSORS

Symmetric and distributed shared memory architectures – Cache coherence issues - Performance Issues – Synchronization issues – Models of Memory Consistency - Interconnection networks – Buses, crossbar and multi-stage switches.

UNIT - IV MULTI-CORE ARCHITECTURES

Software and hardware multithreading – SMT and CMP architectures – Design issues – Case studies – Intel Multi-core architecture – SUN CMP architecture – IBM cell architecture- hp architecture.

UNIT - V MEMORY HIERARCHY DESIGN

Introduction - Optimizations of Cache Performance - Memory Technology and Optimizations - Protection: Virtual Memory and Virtual Machines - Design of Memory Hierarchies - Case Studies.

REFERENCES

1. John L. Hennessey and David A. Patterson, " Computer Architecture – A quantitative approach", Morgan Kaufmann / Elsevier, 5th. edition, 2011.
2. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture : A hardware/ software approach" , Morgan Kaufmann / Elsevier, 1997.
3. William Stallings, " Computer Organization and Architecture – Designing for Performance", Pearson Education, Seventh Edition, 2006

Course Code :	PROGRAM ELECTIVE – I (Data Science)	L	T	P	C
1CSEC-01		3	0	0	3

COURSE OBJECTIVE

1. Provide you with the knowledge and expertise to become a proficient data scientist.
2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science
3. Produce Python code to statistically analyses a dataset
4. Critically evaluate data visualizations based on their design and use for communicating stories from data

COURSE OUTCOMES

On completion of the course the student should be able to

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

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 Visualization: Introduction, Types Of Data Visualization, Data For Visualization: Data Types, Data Encodings, Retinal Variables, Mapping Variables To Encodings, Visual Encodings.

UNIT - V

Applications of Data Science,Technologies for visualisation, Bokeh (Python)

UNIT - VI

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, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.

Course Code :	PROGRAM ELECTIVE – I (Machine learning)	L	T	P	C
1CSEC-01		3	0	0	3

COURSE OBJECTIVE

1. To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
2. To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
3. Explore supervised and unsupervised learning paradigms of machine learning.
4. To explore Deep learning technique and various feature extraction strategies.

COURSE OUTCOMES

After completion of course, students would be able to:

1. Extract features that can be used for a particular machine learning approach in various IOT applications.
2. 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.
3. To mathematically analyse various machine learning approaches and paradigms.

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

UNIT - V

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 - VI

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)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

Course Code :	PROGRAM ELECTIVE – I (Distributed Systems)	L	T	P	C
1CSEC-01		3	0	0	3

COURSE OBJECTIVE:

To introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems.

COURSE OUTCOMES:

After completion of course, students would be:

1. Design trends in distributed systems.
2. Apply network virtualization.
3. Apply remote method invocation and objects.

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 MANAGEMENT SYSTEM ARCHITECTURE

Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues

UNIT – II

DISTRIBUTED DATABASE DESIGN

Alternative design strategies; Distributed design 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 CONTROL

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.

UNIT – V

PARALLEL DATABASE SYSTEMS

Parallel architectures; parallel query processing and optimization; load balancing

UNIT – VI

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 Code :	RESEARCH METHODOLOGY AND IPR	L	T	P	C
1ARM 01		2	0	0	2

COURSE OUTCOMES:

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

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding 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.

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.

UNIT – V

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT – VI

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

Course Code :	AUDIT COURSE (English For Research Paper Writing)	L	T	P	C
1AAC-01		2	0	0	0

COURSE OBJECTIVES:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title

Ensure the good quality of paper at very first-time submission

UNIT - I

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

UNIT - II

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

UNIT - III

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

UNIT - IV

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 - V

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 - VI

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's book .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Course Code :	AUDIT COURSE (Disaster Management)	L	T	P	C
1AAC-01		2	0	0	0

COURSE OBJECTIVES:

Students will be able to:

1. 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.
2. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
3. 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

UNIT – I INTRODUCTION

Disaster: Definition, Factors And Significance; Difference Between HazardAnd 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, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT – III DISASTER PRONE AREAS IN INDIA

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslide And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

UNIT – IV 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 – V 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.

UNITS – VI 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, Pardeep Et.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 Code :	AUDIT COURSE (Sanskrit For Technical Knowledge)	L	T	P	C
1AAC-01		2	0	0	0

COURSE OBJECTIVES

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

COURSE OUTCOME:

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

UNITS – I

- Alphabets in Sanskrit,
- Past/Present/Future Tense,
- Simple Sentences

UNITS – II

- Order
- Introduction of roots
- Technical information about Sanskrit Literature

UNITS – III

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

SUGGESTED READING

1. “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Code :	AUDIT COURSE (Value Education)	L	T	P	C
1AAC-01		2	0	0	0

COURSE OBJECTIVES:

Students will be able to

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

COURSE OUTCOMES:

Students will be able to

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

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 Judgments

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 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.
- 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 – IV

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

SUGGESTED READING

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

Course Code :	AUDIT COURSE (Stress Management By Yoga)	L	T	P	C
1AAC-01		2	0	0	0

COURSE OBJECTIVES:

1. To achieve overall health of body and mind
2. To overcome stress

COURSE OUTCOMES:

Students will be able to:

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

UNIT - I

- Definitions of Eight parts of yog. (Ashtanga)

UNIT - II

- Yam and Niyam. Do`s and Don't's in life.
  - I. Ahinsa, satya, astheya, bramhacharya and aparigrah
  - II. Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT - III

- Asan and Pranayam
  - I. Various yog poses and their benefits for mind & body
  - II. Regularization of breathing techniques and its effects-Types of Pranayam

SUGGESTED READING

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

Course Code :	AUDIT COURSE (Personality Development Through Life Enlightenment Skills)	L	T	P	C
1AAC-01		2	0	0	0

COURSE OBJECTIVES

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

COURSE OUTCOMES

Students will be able to

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

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

UNIT – II

- Approach to day to day work and duties.
- Shrimad Bhagwad Geeta : 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 – III

- Statements of basic knowledge.
- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

SUGGESTED READING

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

Course Code :	DATA STRUCTURES LAB USING C++	L	T	P	C
1CS04		0	0	4	2

LIST OF EXERCISE

1. Implementation of Singly ,Doubly and Circular linked list .
2. Implementation of Multi stacks in a Single Array.
3. Implementation of Circular Queue.
4. Implementation of Binary Search trees.
5. Implementation of Hash table.
6. Implementation of Heaps.
7. Implementation of AVL Rotations.
8. Implementation of Breadth First Search Techniques.
9. Implementation of Depth First Search Techniques.
10. Implementation of Prim's Algorithm.
11. Implementation of Dijkstra's Algorithm.
12. Implementation of Kruskal's Algorithm
13. Implementation of Searching Techniques
14. Implementation of Sorting Techniques

II SEMESTER

Course Code :	ADVANCED ALGORITHMS	L	T	P	C
2CS06		3	1	0	4

COURSE OBJECTIVE

1. Introduce students to the advanced methods of designing and analyzing algorithms.
2. The student should be able to choose appropriate algorithms and use it for a specific problem.
3. To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
4. Students should be able to understand different classes of problems concerning their computation difficulties.
5. To introduce the students to recent developments in the area of algorithmic design.

COURSE OUTCOMES

After completion of course, students would be able to:

1. Analyze the complexity/performance of different algorithms.
2. Determine the appropriate data structure for solving a particular set of problems.
3. Categorize the different problems in various classes according to their complexity.
4. Students should have an insight of recent activities in the field of the advanced data structure.

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 – III

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 Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.
Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm.

UNIT – V

Linear Programming: Geometry of the feasibility region and Simplex algorithm
NP-completeness: Examples, proof of NP-hardness and NP-completeness.
One or more of the following topics based on time and interest
Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm

UNIT – VI
Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

REFERENCES:

1. "Introduction to Algorithms" byCormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.

Course Code :	SOFT COMPUTING	L	T	P	C
2CS07		3	1	0	4

COURSE OBJECTIVE

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
4. To provide studentan hand-on experience on MATLAB to implement various strategies.

COURSE OUTCOMES

After completion of course, students would be able to:

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

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 –III

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

UNIT - IV

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

UNIT - V

MAT Lab/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

UNIT - VI

Recent Trands in deep learning, various classifiers, neural networks and genetic algorithm.
Implementation of recently proposed soft computing techniques.

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 Code :	PROGRAM ELECTIVE - II (Data Preparation And Analysis)	L	T	P	C
2CSEC-02		3	0	0	3

COURSE OBJECTIVE

To prepare the data for analysis and develop meaningful Data Visualizations

COURSE OUTCOMES

After completion of course, students would be:

- Able to extract the data for performing the Analysis

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

REFERENCES:

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

Course Code :	PROGRAM ELECTIVE - II (Secure Software Design And Enterprise Computing)	L	T	P	C
2CSEC-02		3	0	0	3

COURSE OBJECTIVE

1. To fix software flaws and bugs in various software.
2. To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic
3. Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
4. Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

COURSE OUTCOMES

After completion of course, students would be able to:

1. Differentiate between various software vulnerabilities.
2. Software process vulnerabilities for an organization.
3. Monitor resources consumption in a software.
4. Interrelate security and software development process.

UNIT - I

Secure Software Design

Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, Perform security testing and quality assurance.

UNIT - II

Enterprise Application Development Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

UNIT - III

Enterprise Systems Administration

Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

UNIT – IV

Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

UNIT – V

Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.

UNIT – VI

Case study of DNS server, DHCP configuration and SQL injection attack.

REFERENCES:

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley.

Course Code :	PROGRAM ELECTIVE - II (Computer Vision)	L	T	P	C
2CSEC-02		3	0	0	3

COURSE OBJECTIVE

1. Be familiar with both the theoretical and practical aspects of computing with images.
2. Have described the foundation of image formation, measurement, and analysis. Understand the geometric relationships between 2D images and the 3D world. Grasp the principles of state-of-the-art deep neural networks.

COURSE OUTCOMES

After completion of course, students would be able to:

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

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.

UNIT - VI

Recent trends in Activity Recognition, computational photography, Biometrics.

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 Code :	PROGRAM ELECTIVE - III (Human And Computer Interaction)	L	T	P	C
2CSEC-03		3	0	0	3

COURSE OBJECTIVE

1. Learn the foundations of Human Computer Interaction
2. Be familiar with the design technologies for individuals and persons with disabilities
3. Be aware of mobile Human Computer interaction.
4. Learn the guidelines for user interface.

COURSE OUTCOMES

After completion of course, students would be:

1. Understand the structure of models and theries of human computer interaction and Vision.
2. Design an interactive web interface on the basis of models studied

UNIT – I

Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

UNIT – II

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT – III

Cognitive models –Socio-Organizational issues and stake holder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT - IV

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT - V

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

UNIT – VI

Recent Trends: Speech Recognition and Translation, Multimodal System

REFERENCES:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I , II & III)
2. Brian Fling, "Mobile Design and Development", First Edition , O Reilly Media Inc., 2009 (UNIT – IV)
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, OReilly, 2009.(UNIT-V)

Course Code :	PROGRAM ELECTIVE - III (GPU Computing)	L	T	P	C
2CSEC-03		3	0	0	3

COURSE OBJECTIVE

- To learn parallel programming with Graphics Processing Units (GPUs).

COURSE OUTCOMES

After completion of course, students would be:

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

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

UNIT - VI

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 Code :	PROGRAM ELECTIVE - III (Robotic Process Automation)	L	T	P	C
2CSEC-03		3	0	0	3

Course Objectives:

This course aims at providing knowledge of basic concepts of Robotic Process Automation to University students. It further builds on these concepts and introduces key RPA Design and Development strategies and methodologies specifically in context of UiPath products. The student undergoing the course shall develop the competence to design and develop a robot for a defined process.

COURSE OUTCOMES:

To prepare students to be Junior RPA Developers

1. Learn the basic concepts of Robotic Process Automation
2. Understand processes which can be automated, associated business documentation basics, RPA journey of an organization
3. Develop familiarity and deep understanding of UiPath tools
4. Develop ability to independently design and create robots for business processes
5. Learn the business best practices

Module 0: Introduction and Class Agenda

1. About the course
    - Review course content and daily agenda
2. Introduce Materials
    - Student Workbook
    - Student Lab Guide
    - Capstone Project
3. UiPath Academic Alliance Program

Module 1: Programming Basics & Recap

Module Objectives:

After completing this module, students should be able to:

- Understand Basic Programming concepts and the underlying logic/structure
- Understand application and operation of the lesson sub- topics in IT industry from RPA perspective

Module Outline:

1. **Lesson 1: Programming Concepts Basics - 1**
    a. Understanding the application
    b. Basic Web Concepts
    c. Protocols
    d. Email Clients
    e. Data Structures
    f. Data Tables

g. Algorithms
h. Software Processes
i. Software Design
j. SDLC

2. **Lesson 2: Programming Concepts Basics - 2**
    a. Scripting
    b. .Net Framework
    c. ..Net Fundamentals
    d. XML
    e. Control structures and functions
    f. XML
    g. HTML
    h. CSS
    i. Variables & Arguments

Check Your Knowledge (no more than 5 questions)
Module Summary

Module 2: RPA Concepts

Module Objectives:
After completing this module, students should be able to:

- Describe RPA , where it can be applied and how its implemented
- Describe the business and management side of RPA

Implementation in an organization

Module Outline:

1. Lesson 1: RPA Basics
    a. History of Automation
    b. What is RPA
    c. RPA vs Automation
    d. Processes & Flowcharts
    e. Programming Constructs in RPA
    f. What Processes can be Automated
    g. Types of Bots
    h. Workloads which can be automated
2. Lesson 2: RPA Advanced Concepts
    a. Standardization of processes
    b. RPA Developemt methodologies
    c. Difference from SDLC
    d. Robotic control flow architecture
    e. RPA business case f. RPA Team
    f. Proccess Design Document/Solution Design Document
    g. Industries best suited for RPA
    h. Risks & Challenges with RPA

i. RPA and emerging ecosystem

Check Your Knowledge (no more than 5 questions) Module Summary

Module 3: UiPath Introduction & Basics

Module Objectives:

After completing this module, students should be able to:

- Learn how to install UiPath community edition and extensions required for the course
- Describe the different types of variables in Studio
- Describe Control Flow and various activities used for it
- Develop understanding and application of Data Manipulation techniques
- Understand Selectors and how they are used in UiPath Studio

Module Outline:

1. Lesson 1: Introduction to UiPath
   a. Installing UiPath Studio community edition
   b. The User Interface
   c. Keyboard Shortcuts
   d. About Updating
   e. About Automation Projects
   f. Introduction to Automation Debugging
   g. Managing Activation Packages
   h. Reusing Automations Library
   i. Installing the Chrome Extension
   j. Installing the Firefox Extension
   k. Connecting your project to a source control system
   l. Activities Guide
2. Lesson 2: Variables
   a. Managing Variables
   b. Naming Best Practices
   c. The Variables Panel
   d. Generic Value Variables
   e. Text Variables
   f. True or False Variables
   g. Number Variables
   h. Array Variables
   i. Date and Time Variables
   j. Data Table Variables
   k. Managing Arguments
   l. Naming Best Practices
   m. The Arguments Panel
   n. Using Arguments
   o. About Imported Namespaces
   p. Importing New Namespaces

3. Lesson 3: Control Flow
    a. Control Flow Introduction
    b. If Else Statements
    c. Loops
    d. Advanced Control Flow
    e. Sequences
    f. Flowcharts
    g. About Control Flow
    h. Control Flow Activities
    i. The Assign Activity
    j. The Delay Activity
    k. The Do While Activity
    l. The If Activity
    m. The Switch Activity
    n. The While Activity
    o. The For Each Activity
    p. The Break Activity
4. Lesson 4: Data Manipulation
    a. Data Manipulation Introduction
    b. Scalar variables, collections and Tables
    c. Text Manipulation
    d. Data Manipulation
    e. Gathering and Assembling Data
5. Lesson 5: Recording and Advanced UI Interaction
    a. Recording Introduction
    b. Basic and Desktop Recording
    c. Web Recording
    d. Input/Output Methods
    e. Screen Scraping
    f. Data Scraping
    g. Scraping advanced techniques
6. Lesson 6: Selectors
    a. Selectors
    b. Defining and Assessing Selectors
    c. Customization
    d. Debugging
    e. Dynamic Selectors
    f. Partial Selectors
    g. RPA Challenge

Check Your Knowledge (no more than 5 questions) Module Summary

Module 4: UiPath Advanced Automation concepts and techniques

Module Objectives:

After completing this module, students should be able to:

- Understand Image, Text and Data Tables Automation in Studio
- Understand and apply automation to Citrix, PDF, Email

Module Outline:

1. Lesson 1: Image, Text & Advanced Citrix Automation
   a. Introduction to Image & Text Automation
   b. Image based automation
   c. Keyboard based automation
   d. Information Retrieval
   e. Advanced Citrix Automation challenges
   f. Best Practices
   g. Using tab for Images
   h. Starting Apps
2. Lesson 2: Excel Data Tables & PDF
   a. Data Tables in RPA
   b. Excel and Data Table basics
   c. Data Manipulation in excel
   d. Extracting Data from PDF
   e. Extracting a single piece of data f. Anchors
   f. Using anchors in PDF
3. Lesson 3: Email Automation
   a. Email Automation
   b. Incoming Email automation
   c. Sending Email automation

Check Your Knowledge (no more than 5 questions) Module Summary

Case Study

Module 5: Exceptional Handling & Best Practices

Module Objectives:

After completing this module, students should be able to:

- Describe various types of Exceptions and strategies to handle them
- Understand Project Organization best practices

Module Outline:

1. Lesson 1: Debugging and Exception Handling
   a. Debugging Tools
   b. Strategies for solving issues
   c. Catching errors
2. Lesson 2: Project Organization
   a. What is project organization
   b. Best practices
   c. Avoiding pitfalls

d. Invoke Activity

Check Your Knowledge (no more than 5 questions) Module Summary
Case Study

Module 6: Introduction to Orchestrator

Module Objectives:

After completing this module, students should be able to:

- Understand and apply various functionalities of orchestrator

Module Outline:

1. Lesson 1: Orchestrator
   a. Tenants
   b. Authentication
   c. Users
   d. Roles
   e. Robots
   f. Environments
   g. Queues & Transactions
   h. Schedules

Check Your Knowledge (no more than 5 questions) Module Summary

Module 7: Emerging and Future Trends in IT

Module Objectives:

After completing this module, students should be able to:

- Develop an understanding of the current stage of application of AI/ML implementation in the industry
- Understand the future direction of research in AI wrt RPA and possible future trajectories of technology development

Module Outline:

1. Lesson 1: Emerging and Future Trends in IT
   a. Artificial Intelligence
   b. Machine Learning
   c. Agent awareness
   d. Natural Language Processing
   e. Computer Vision

Check Your Knowledge (no more than 5 questions) Module Summary

Module 8: Capstone Project

Module Objectives:

After completing this module, students should be able to:

- Design and Develop Robots in small teams independently

Module Outline: Capstone Project

Real life case studies which can be used to apply the concepts learnt during the course. The projects shall test student's skills right from process transformation and documentation to the design and development of the actual robot

III SEMESTER

Course Code :	PROGRAM ELECTIVE - IV (Mobile Applications And Services)	L	T	P	C
3CSEC-04		3	0	0	3

COURSE OBJECTIVE

1. This course presents the three main mobile platforms and their ecosystems, namely Android, iOS, and PhoneGap/WebOS.
2. It explores emerging technologies and tools used to design and implement feature-rich mobile applications for smartphones and tablets
3. It also take into account both the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile

COURSE OUTCOMES

1. On completion of the course the student should be able to identify the target platform and users and be able to define and sketch a mobile application
2. Understand the fundamentals, frameworks, and development lifecycle of mobile Application platforms including iOS, Android, and PhoneGap
3. Design and develop a mobile application prototype in one of the platform (challenge project)

UNIT – I

Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User

UNIT – II

More on Uis: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal Uis, . Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider

UNIT - III

Communications via Network and the Web:State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics

UNIT –IV

Putting It All Together : Packaging and Deploying, Performance Best Practices,

Android Field Service App, Location Mobility and Location Based Services Android Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia

UNIT - V

Platforms and Additional Issues : Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking , Active Transactions, More on Security, Hacking Android

UNIT – VI

Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents based communications in IOT.

REFERENCES:

1. Wei-Meng Lee, Beginning Android™ 4 Application Development, 2012 by John Wiley & Sons

Course Code :	PROGRAM ELECTIVE - IV (Compiler For HPC)	L	T	P	C
3CSEC-04		3	0	0	3

COURSE OBJECTIVE

The objective of this course is to introduce structure of compilers and high performance compiler design for students. Concepts of cache coherence and parallel loops in compilers are included

COURSE OUTCOMES

After completion of course, students would be:
Familiar with the structure of compiler Parallel loops, data dependency and exception handling and debugging in compiler

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, General 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.

UNIT - VI

Recent trends in compiler design for high performance computing and message passing machines and scalable shared memory machine**.**

REFERENCES:

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

Course Code :	PROGRAM ELECTIVE - IV (Optimization Techniques)	L	T	P	C
3CSEC-04		3	0	0	3

COURSE OBJECTIVE

1. The objective of this course is to provide insight to the mathematical formulation of real world problems.
2. To optimize these mathematical problems using nature based algorithms. And the solution is useful specially for NP-Hard problems.

COURSE OUTCOMES

After completion of course, students would be:

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

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 – III

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.

UNIT – VI

Recent trends: Applications of ant colony optimization, genetics and linear and quadratic programming in real world applications.

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 Code :	OPEN ELECTIVES (Business Analytics)	L	T	P	C
3CSEC-05		3	0	0	3

COURSE OBJECTIVE

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.

COURSE OUTCOMES

1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Students will demonstrate the ability to translate data into clear, actionable insights.

UNIT – I

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 – 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.

UNIT – VI

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 Code :	OPEN ELECTIVES (Cost Management of Engineering Projects)	L	T	P	C
3CSEC-05		3	0	0	3

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 non- technical 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 & 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.