M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : Mathematical Foundation of Computer Science & Information Technology							**Course Code :**1CS01		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment- Paper Duration –**1.5 Hours** **ESE:**End Semester Examination- Paper Duration - **3 Hours**									
Prerequisite: Discrete Mathematics									

Course objectives:

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: Students should be able to:

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	To understand the basic notions of discrete and continuous probability.	Apply(A)
2	To understand the methods of statistical inference, and the role that sampling distributions play in those methods.	Apply(A)
3	To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.	Analyze (AN)

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	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	7	Apply(A)
2	Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood	7	Apply(A)
3	Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of overfitting model assessment.	8	Analyze (AN)
4	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	11	Evaluate (E)
5	Computer science and engineering applications:Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.	10	Apply (A)
6	Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bioinformatics, soft computing, and computer vision.	5	Apply (A)

Reference Books:

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

M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : Advanced Data Structures							**Course Code :**1CS02		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: UG level course in Data Structures									

Course objectives:

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

Course outcomes: Students should be able to:

S.No.	**Course Outcomes**	**Cognitive levels as per Bloom's Taxonomy**
1	Understand the implementation of symbol table using hashing techniques.	Analyze (AN)
2	Develop and analyze algorithms for red-black trees, B-trees and Splay trees.	Analyze (AN)
3	Develop algorithms for text processing applications.	Create (C)
4	Identify suitable data structures and develop algorithms for computational geometry problems.	Evaluate (E)

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	**Dictionaries:**Definition, Dictionary Abstract Data Type, Implementation ofDictionaries. **Hashing:**Review of Hashing, Hash Function, Collision Resolution Techniques inHashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.	7	Analyze (AN)
2	**Skip Lists:**Need for Randomizing Data Structures and Algorithms, Search andUpdate Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists	5	Evaluate (E)
3	**Trees:** Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, BTrees, SplayTrees	9	Apply (A)
4	**Text Processing:**String Operations, Brute-Force Pattern Matching, The BoyerMoore Algorithm, The KnuthMorrisPratt Algorithm, Standard Tries, CompressedTries, Suffix Tries, The Huffman Coding Algorithm, The Longest CommonSubsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.	12	Apply (A)
5	**Computational Geometry:**One Dimensional Range Searching, Two-Dimensional Range Searching, constructing a Priority Search Tree, Searching a Priority SearchTree, Priority Range Trees, Quadtrees, k-D Trees.	10	Apply (A)
6	Recent Trends in Hashing, Trees, and various computational geometry methods forefficiently solving the new evolving problem	5	Apply(A)

Reference Books:

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.

M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : Big Data Analytics							**Course Code :**1CS111		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Data Structure, Computer Architecture and Organization									

Course objectives:

1. Understand big data for business intelligence. Learn business case studies for big data analytics. Understand nosql big data management. Perform map-reduce analytics using Hadoop and related tools

Course outcomes: Students should be able to:

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Describe big data and use cases from selected business domains	Apply(A)
2	Explain NoSQL big data management	Apply(A)
3	Install, configure, and run Hadoop and HDFS	Create(C)
4	Perform map-reduce analytics using Hadoop	Evaluate(E)
5	Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.	Apply(A)

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.	8	Apply(A)
2	Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peerpeer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.	8	Apply(A)
3	Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures	9	Analyze (AN)
4	MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats	10	Analyze (AN)
5	Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration	7	Evaluate(E)
6	Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries	6	Evaluate(E)

Reference Books:

1.Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging
2. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World ofPolyglot Persistence", Addison-Wesley Professional, 2012.
4. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
5. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
6. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
7. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
8. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
9. Alan Gates, "Programming Pig", O'Reilley, 2011.

M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : Wireless Access Technologies							**Course Code :**1CS212		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**			
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Wireless Networks									

Course objectives:

1. Overview of wireless access technologies, fixed wireless access networks. Terminal mobility issues regarding wireless access to Internet.
2. Introduction to various Network topologies, hotspot networks, Communication links: point-to-point, point-to-multipoint, multipoint-to-multipoint.
3. To provide an overview of Standards for most frequently used wireless access networks: WPAN, UWB, WLAN, WMAN, WWAN. Network services. Wireless access networks planning, design and installation
4. To get and insight of Wireless networking security issues, Wireless access network exploitation and management, software requirements, link quality control.

Course outcomes: Students should be able to:

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Interpret basic terms and characteristics of wireless access networks	Apply(A)
2	Compare various wireless access technologies	Analyze (AN)
3	Analyze measurements of wireless access network parameter	Analyze (AN)
4	Assess security issues in wireless networks	Analyze(AN)
5	Choose modulation technique for wireless transmission	Evaluate (E)

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Necessity for wireless terminals connectivity and networking. Wireless networking advantages and disadvantages, Overview of wireless access technologies. Narrowband and broadband networks, fixed and nomadic networks. Wireless local loop (WLL), Public Switched Telephone Network (PSTN) interfaces	8	Apply(A)
2	Fixed wireless access (FWA) networks, frequency bands for different networks. Criterions for frequency bands allocation, Network topologies, hotspot networks. Communication links: point-to-point (PTP), point-to-multipoint (PMP), multipoint-to-multipoint (MTM)	8	Apply(A)
3	Standards for most frequently used wireless access networks: WPAN (802.15, Bluetooth, DECT, IrDA), UWB (Ultra-Wideband), WLAN (802.11, Wi-Fi, HIPERLAN, IrDA), WMAN (802.16, WiMAX, HIPERMAN, HIPERACCESS), WWAN (802.20), Other technologies for broadband wireless access, Local Multipoint Distribution Service (LMDS), Multichannel Multipoint Distribution Service (MMDS). Ad Hoc networks, Network services. Services types based on carrier frequency and bandwidth	10	Apply(A)
4	Wireless access networks planning, design and installation. Services provision, legislative and technical aspects, Technical and economical factors for network planning: expenses, coverage, link capacity, network complexity and carrier-to-interference ratio (C/I). Base station or access point allocation. Base station and access point equipment. Terminal mobility issues regarding wireless access to Internet. Wireless networking security issues.	9	Analyze (AN)
5	Example of laptop or handheld PC wireless connection in real environment. PC wireless interface equipment. Wireless access network exploitation and management, software requirements, link quality control. Business model, wireless network services market, market research and marketing, service providers, wireless data application service providers (WDASP) and their role on public telecommunication services market, billing systems.	8	Analyze (AN)
6	Recent trends in wireless networking and various access mechanism, new standards of wireless communication	5	Apply(A)

Reference Books:

1. M. P. Clark, Wireless Access Networks: Fixed Wireless Access and WLL networks – Designand Operation, John Wiley & Sons, Chichester
2. D. H. Morais, Fixed Broadband Wireless Communications: Principles and Practical Applications, Prentice Hall, Upper Saddle River
3. R. Pandya, Introduction to WLLs: Application and Deployment for Fixed and Broadband Services, IEEE Press, Piscataway

M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : Machine Learning							**Course Code :** 1CS122		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**			**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Algorithms, DBMS									

Course objectives:

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: Students should 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

Course outcomes: Students should be able to:

S.No.	**Course Outcomes**	**Cognitive levels as per Bloom's Taxonomy**
1	Understand the concepts of machine learning algorithms	Analyze (AN)
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.	Analyze (AN) Evaluate (E)
3	To mathematically analyse various machine learning approaches and paradigms	Create (C)

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	**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.	10	Analyze (AN)
2	**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)	7	Evaluate (E)
3	Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)	6	Apply (A)
4	Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning	9	Apply (A)
5	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	9	Apply (A)
6	Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications.	5	Evaluate (E)

Reference Books:

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.

M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : Research Methodology and IPR							**Course Code :**1AMC		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**			**50**
2	-	-	2	2	15	35	-	-	
IA: In-Semester Assessment - Paper Duration –**1 Hours** **ESE:**End Semester Examination - Paper Duration - **2 Hours**									
Prerequisite: Basics of Statistics									

Course Objective:

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

- Understand research problem formulation
- Analyze research related information
- Analyze today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
- Apply knowledge in IPR and realize 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

Course Outcomes:

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

S. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Understand research problem formulation.	Apply(A)
2	Analyze research related information	Analyze(An)
3	Follow research ethics	Apply(A)
4	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.	Apply(A)
5	Understanding that when IPR would take such	Apply(A)

	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.	Apply(A)

Module No.	**Topics**	**Hrs.**	**Cognitive levels as per Bloom's Taxonomy**
1	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	4	Apply (A)
2	Effective literature studies approaches, analysis Plagiarism, Research ethics,	4	Analyze (An)
3	Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee	4	Apply (A)
4	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.	4	Apply (A)
5	Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.	4	Apply (A)
6	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.	4	Apply (A)

Reference Books:

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

M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : Value Education							**Course Code :**1AAE4		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	50
2	-	-	2	-	–	–	–	50	

IA: In Semester Assessment
ESE : End SemesterExamination
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)

Course Objective:

Students should be able to

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

Course Outcomes:

S. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Understand value of education and self- development	Apply (A)
2	Understand the importance of character	Apply (A)
3	Imbibe good values in students creating good human beings	Create(C)

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments	6	Apply (A)
2	Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature ,Discipline	6	Apply (A)
3	Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. 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	6	Apply (A)
4	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	6	Apply (A)

Reference Books:

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

M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : Data Science							**Course Code :**1CS311		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Computer Basics, Procedural Programming Languages									

Course objectives:

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 analyse a dataset;
4. Critically evaluate data visualisations based on their design and use for communicating stories from data.

Course outcomes: Students 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 thetoolkit used by data scientists;
3. Implement data collection and management scripts using Mongo DB.

Module No.	**Topics**	**Hrs.**
1	**Introduction to core concepts and technologies:**Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications	6
2	**Data collection and management:**Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources	7

3	**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.	10
4	**Data visualization:**Introduction, Types of data visualisation, Data for visualisation: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.	11
5	Applications of Data Science, Technologies for visualisation, Bokeh (Python)	7
6	Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.	7

Reference Books:

1 Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk fromthe Frontline.O'Reilly.
2. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.

M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : Distributed Systems							**Course Code :**1CS112		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Computer Basics, Procedural Programming Languages									

Course objectives:

1. 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 researchproblems.

Course outcomes: Students should be able to:

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

Module No.	**Topics**	**Hrs.**
1	**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	8
2	**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	11

3	**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	11
4	**Reliability:** Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols	8
5	**Parallel database systems:** Parallel architectures; parallel query processing and optimization; load balancing	6
6	**Advanced topics:** Mobile Databases, Distributed Object Management, Multi-databases	4

Reference Books:

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.

M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : Data Preparation and Analysis							**Course Code :**1CS113		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite:									

Course objectives:
1. To prepare the data for analysis and develop meaningful Data Visualizations

Course outcomes: Students should be able to:
1. Able to extract the data for performing the Analysis.

Module No.	Topics	Hrs.
1	**Data Gathering and Preparation:** Data formats, parsing and transformation, Scalability and real-time issues	9
2	**Data Cleaning:** Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation	11
3	**Exploratory Analysis:** Descriptive and comparative statistics, Clustering and association, Hypothesis generation	13
4	**Visualization:** Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity	15

Reference Books:
1. Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, by GlennJ. Myatt

M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : Recommender System							**Course Code :**1CS121		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**			
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Machine Learning, Web Mining									

Course objectives:

1. To learn techniques for making recommendations, including non-personalized, content-based, and collaborative filtering.
2. To automate a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations.

Course outcomes: Students should be able to:

1. Design recommendation system for a particular application domain.
2. Evaluate recommender systems on the basis of metrics such as accuracy, rank accuracy, diversity, product coverage, and serendipity.

Module No.	**Topics**	**Hrs.**
1	**Introduction:** Overview of Information Retrieval, Retrieval Models, Search and Filtering Techniques: Relevance Feedback, User Profiles, Recommender system functions, Matrix operations, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.	9
2	**Content-based Filtering:** High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, pre-processing and feature extraction, Obtaining item features from tags, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.	8

3	**Collaborative Filtering:**User-based recommendation, Item-based recommendation, Model based approaches, Matrix factorization, Attacks on collaborative recommender systems.	9
4	**Hybrid approaches:** Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: CascadeMeta-level, Limitations of hybridization strategies	8
5	**Evaluating Recommender System:** Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets, Offline evaluations.	6
6	**Types of Recommender Systems:** Recommender systems in personalized web search, knowledge-based recommender system, Social tagging recommender systems, Trust-centric recommendations, Group recommender systems	8

Reference Books:

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction,CambridgeUniversity Press (2011), 1st ed.
2. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer (2016), 1st ed.
3. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011),1st ed.
4. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer(2013), 1st ed

M.E. Semester –I

<table>
<tr><td colspan="7">ME (Computer Engineering)</td><td colspan="3">SEM : I</td></tr>
<tr><td colspan="7">Course Name :Data Storage Technologies and Networks</td><td colspan="3">Course Code :1CS123</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td></td><td></td><td rowspan="2">100</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>25</td><td>75</td><td>-</td><td>-</td></tr>
<tr><td colspan="10">IA:In-Semester Assessment - Paper Duration –1.5 Hours
ESE:End Semester Examination - Paper Duration - 3 Hours</td></tr>
<tr><td colspan="10">Prerequisite: Basic knowledge of Computer Architecture, Operating Systems, and Computer Networking is required</td></tr>
</table>

Course objectives:

1. To provide learners with a basic understanding of Enterprise Data Storage and Management Technologies

Course outcomes: Students should be able to:

1. Learn Storage System Architecture.
2. Overview of Virtualization Technologies, Storage Area Network.

Module No.	Topics	Hrs.
1	**Storage Media and Technologies:** Magnetic, Optical and Semiconductor Media, Techniques for read/write Operations, Issues and Limitations.	8
2	**Usage and Access:** Positioning in the Memory Hierarchy, Hardware and Software Design for Access, Performance issues.	9
3	**Large Storages:** Hard Disks, Networked Attached Storage, Scalability issues, Networking issues.	7
4	**Storage Architecture:** Storage Partitioning, Storage System Design, Caching, Legacy Systems.	9
5	**Storage Area Networks:** Hardware and Software Components, Storage Clusters/Grids. **Storage QoS:** Performance, Reliability, and Security issues.	10

6	Recent Trends related to Copy data management, Erasure coding, and Software defined storage appliances.	5

Reference Books:

1. The Complete Guide to Data Storage Technologies for Network-centric Computing Paperback–Import, Mar 1998 by Computer Technology Research Corporation
2. Data Storage Networking: Real World Skills for the CompTIA Storage by Nigel Poulton

M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : Mobile Applications and Services							**Course Code :**1CS213		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Wireless Communication and Mobile Computing									

Course objectives:

1. This course presents the three main mobile platforms and their ecosystems, namely Android, iOS, and Phone Gap/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: Students should be able to:

1. Identify the target platform and users and be able to define and sketch a mobile application
2. Application platforms including iOS, Android, and Phone Gap
3. Design and develop a mobile application prototype in one of the platform (challenge project)

Module No.	**Topics**	**Hrs.**
1	**Introduction:**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	8
2	**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.	8

3	**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	10
4	**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	9
5	**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	8
6	Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents based communications in IOT	5

Reference Books:

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

M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : Smart Sensors and Internet of Things							**Course Code :**1CS222		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Wireless Networks									

Course objectives:

1. Able to understand the application areas of IOT
2. Able to realize the revolution of Internet in Mobile Devices, Cloud &Sensor Networks
3. Able to understand building blocks of Internet of Things and characteristics.

Course outcomes: Students should be able to:

1. Understand the vision of IoT from a global context.
2. Determine the Market perspective of IoT.
3. Use of Devices, Gateways and Data Management in IoT.
4. Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.
5. Building state of the art architecture in IoT.

Module No.	**Topics**	**Hrs.**
1	**Environmental Parameters Measurement and Monitoring:**Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT	7
2	**Sensors:** Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc	8

3	**Important Characteristics of Sensors:** Determination of theCharacteristicsFractional order element: Constant Phase Impedance for sensing applicationssuch as humidity, water quality, milk quality Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling ofSensorsImportance and Adoption of Smart Sensors	11
4	**Architecture of Smart Sensors:** Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel	10
5	Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor	7
6	Recent trends in smart sensor for day to day life, evolving sensors and their architecture	5

Reference Books:

1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing

M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : Logic And Functional Programming							**Course Code :**1CS223		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Computer Programming, Mathematical Logic									

Course objectives:

1. To further the state of the art on the theoretical and practical aspects of developing declarative programming tools in logic programming for IOT data analysis.
2. To introduce basics of functional programming and constraint logic programming for nodes in IOT.
3. Introduction into formal concepts used as a theoretical basis for both paradigms, basic knowledge and practical experience.

Course outcomes: Students should be able to:

1. Understanding of the theory and practice of functional and logic programming For IOT.
2. The ability to write functional and logic programs for nodes in IOT.
3. The ability to solve problems in and using functional and logic programming

Module No.	**Topics**	**Hrs.**
1	**Proposition Logic:** Introduction of logic and Functional Paradigm, Propositional Concepts, Semantic Table, Problem Solving with Semantic Table	5
2	**Natural Deduction and Axiomatic Propositional Logic:** Rules of Natural Deduction, Sequent Calculus, Axiomatic Systems, Meta theorems, Important Properties of AL, Resolution, Resolving Arguments	7

3	**Introduction to Predicate Logic** Objects, Predicates and Quantifiers, Functions, First Order Language, Quantifiers, Scope and Binding, Substitution, An Axiomatic System for First Order Predicate Logic, Soundness and Completeness, Axiomatic Semantic and Programming	9
4	**Semantic Tableaux & Resolution in Predicate Logic:** Semantic Tableaux, Instantiation Rules, Problem-solving in Predicate Logic, Normal forms, Her brand Universes and H-interpretation, Resolution, Unification, Resolution as a computing Tool, Nondeterministic Programming, Incomplete Data Structure, Second Order Programming in Prolog, Logic Grammars: Definite Clause Grammar, A Grammar Interpreter.	13
5	**Lazy and Eager Evaluation strategies:** Evaluation Strategies, Lazy Evaluation: Evaluation Order and strictness of function, Programming with lazy evaluation, Interactive functional program, Delay of unnecessary Computation, Infinite Data Structure, Eager Evaluation and Reasoning	9
6	Recent trends in logical and functional programming, predicate logics and various evaluation strategies.	5

Reference Books:

1. John Kelly, “The Essence of Logic”, Prentice-Hall India.
2. Saroj Kaushik, “Logic and Prolog Programming”, New Age International ltd.

M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : English for research paper writing							**Course Code :**1AAE1		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
2	-	-	2	-	-	-	-	50	**50**
IA: In Semester Assessment **ESE :**End SemesterExamination **The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)**									

Course objectives:

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

Module No.	**Topics**	**Hrs.**
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4
2	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	4
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	4
4	Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,	4
5	Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	4

6	Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	4

Reference Books:

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

M.E. Semester –I

ME (Computer Engineering)							**SEM :** I		
Course Name : Disaster management							**Course Code :**1AAE2		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**50**
2	-	-	2	-	-	-	-	50	

IA: In Semester Assessment

ESE : End Semester Examination

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)

Course objectives:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. 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

Module No.	**Topics**	**Hrs.**
1	**Introduction:** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4
2	**Repercussions Of Disasters And Hazards:** Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	4

3	**Disaster Prone Areas In India:** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	4
4	**Disaster Preparedness And Management:** Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness	4
5	**Risk Assessment:** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.	4
6	**Disaster Mitigation:** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	4

Reference Books:

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

M.E. Semester –I

ME (Computer Engineering)							**SEM:** I		
Course Name: Sanskrit for technical knowledge							**Course Code:**1AAE3		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**50**
2	-	-	2	-	-	-	-	50	
IA: In Semester Assessment **ESE:**End Semester Examination **The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)**									

Course objectives:

1To 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
4. Enhancing the memory power.
5. The engineering scholars equipped with Sanskrit will be able to explore the
6. Huge knowledge from ancient literature.

Course outcomes: Students should 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

Module No.	**Topics**	**Hrs.**
1.0	Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences	8
2.0	Order Introduction of roots Technical information about Sanskrit Literature.	8
3.0	Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	8

Reference Books:

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.

M.E. Semester –I

ME (Computer Engineering)							**SEM:** I		
Course Name: Constitution of India							**Course Code:**1AAE5		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
2	-	-	2	-	-	-	-	50	**50**

IA: In Semester Assessment

ESE : End Semester Examination

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)

Course objectives:

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

Course Outcomes: Students will be able to:

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

Module No.	Topics	Hrs.
1	**History of Making of the Indian Constitution:**History Drafting Committee, (Composition & Working)	4
2	**Philosophy of the Indian Constitution:** Preamble Salient Features	4
3	**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	4
4	**Organs of Governance:** Parliament Composition Qualifications and Disqualifications Powers and Functions Executive President Governor Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions	4
5	**Local Administration:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	4
6	**Election Commission:** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women	4

Reference Books:

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.

M.E. Semester –I

ME (Computer Engineering)							**SEM:** I		
Course Name: Pedagogy studies							**Course Code:**1AAE6		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
2	-	-	2	-	-	-	-	50	**50**

IA: In Semester Assessment

ESE : End Semester Examination

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)

Course objectives:

1.Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.

2. Identify critical evidence gaps to guide the development.

Module No.	**Topics**	**Hrs.**
1	**Introduction and Methodology:** Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching	4
2	**Thematic overview:**Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education	2

3	Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? 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	4
4	**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	4
5	**Research gaps and future directions:** Research design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact	2

Reference Books:

1Ackers 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 educationresearch project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basicmaths and reading in Africa: Does teacher preparation count? International Journal EducationalDevelopment, 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.

M.E. Semester –I

ME (Computer Engineering)							**SEM:** I		
Course Name: Stress management by yoga							**Course Code:**1AAE7		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
2	-	-	2	-	-	-	-	50	**50**

IA: In Semester Assessment

ESE : End Semester Examination

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)

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

Module No.	**Topics**	**Hrs.**
1	Definitions of Eight parts of yog. (Ashtanga)	8
2	Yam and Niyam. Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	8
3	Asan and Pranayam i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects-Types of pranayam	8

Reference Books:

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

M.E. Semester –I

ME (Computer Engineering)							**SEM:** I		
Course Name: Personality development through life enlightenment skills							**Course Code:**1AAE8		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**50**
2	-	-	2	-	-	-	-	50	

IA: In Semester Assessment

ESE: End Semester Examination

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)

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.

Module No.	**Topics**	**Hrs.**
1	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)	8
2	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.	8

3	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	8

Reference Books:

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

M.E. Semester –I

ME (Computer Engineering)								**SEM:** I	
Course Name: Laboratory I								**Course Code:**1CS03	
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**50**
-	-	4	4	2	-	-	25	25	

IA: In Semester Assessment
ESE : End Semester Examination
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Practical (40%) and Attendance (20%)

Each Laboratory assignment will be done by an individual student. The Faculty teaching core subject will be required to propose the respective Laboratory assignments. These will be essentially hands-on practical /Case Study.

M.E. Semester –I

ME (ComputerEngineering)							**SEM:**I		
Course Name: Laboratory II							**Course Code:**1CS04		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
-	-	4	4	2	-	-	25	25	**50**

IA: In Semester Assessment
ESE : End Semester Examination
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Practical (40%) and Attendance (20%)

Each Laboratory assignment will be done by an individual student. The Faculty teaching elective subject will be required to propose the respective Laboratory assignments. These will be essentially hands-on practical /Case Study.

M.E. Semester –II

ME (Computer Engineering)							SEM : II		
Course Name : Advanced Algorithms							**Course Code :**PCC-CSME201		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: UG level course in Algorithm Design and Analysis									

Course Objectives:

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

Course Outcomes: Students should be able to:

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Analyse the complexity/performance of different algorithms.	Analyze (AN)
2	Determine the appropriate data structure for solving a particular set of problems.	Analyze (AN)
3	Categorize the different problems in various classes according to their complexity.	Analyze (AN)
4	Students should have an insight of recent activities in the field of the advanced data structure.	Apply (A)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	**Sorting:** Review of various sorting algorithms, topological sorting Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkstra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithmand time/space analysis, example of amortized analysis.	6	Analyze (AN)
2	**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.	8	Analyze (AN)
3	**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.	9	Analyze (AN)
4	**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	10	Analyze (AN)
5	**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	10	Analyze (AN)
6	Recent Trands in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.	5	Apply (A)

Reference Books:

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

M.E. Semester –II

ME (Computer Engineering)							SEM : II		
Course Name :Soft Computing							Course Code :PCC-CSME202		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	100
3	-	-	3	3	25	75	-	-	
IA: In Semester Examination - Paper Duration – 1.5 Hour ESE : End Semester Examination - Paper Duration - 3 Hours									
Prerequisite: Basic Mathematics									

Course Objective: The course should be able to introduce soft computing techniques (ANN, FL and GA) and implement solutions for real world problems.

Course Outcomes: Students should be able to:

SN	Course Outcomes	Cognitive levels as per blooms Taxonomy
1	Summarize various constituents of Soft Computing.	Understand (U)
2	Experiment Fuzzy Inference Systems.	Apply (A)
3	Compare supervised and unsupervised learning networks.	Analyze (AN)
4	Investigate ML approach to knowledge acquisition via GA.	Analyze (AN)
5	Investigate NN and FL toolbox.	Analyze (AN)
6	Summarize recent trends in Deep Learning.	Evaluate (E)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per blooms Taxonomy
1	**Introduction to Soft Computing and Neural Networks**	7	Apply (A)
	Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics		
2	**Fuzzy Logic**	8	Analyze (AN)
	Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations,Membership Functions:, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making		
3	**Neural Networks**	10	Analyze (AN)
	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		
4	**Genetic Algorithms**	5	Apply (A)
	Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.		
5	**Matlab /Python Lib**	13	Analyze (AN)
	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		
6	**Expert System**	5	Analyze (AN)
	Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm.Implementation of recently proposed soft computing techniques.		

Reference Books:

1. "Neuro: Fuzzy and Soft Computing" by Jyh: Shing Roger Jang, Chuen: Tsai Sun, EijiMizutani, Prentice Hall of India, 3rd edition, 2003.
2. “Fuzzy Sets and Fuzzy Logic: Theory and Applications” by George J. Klir and Bo Yuan, Prentice Hall of India, 1st edition, 1995.

M.E. Semester –II

M.E. (Computer Engineering)							M.E. SEM : II		
Course Name :Data Science							Course Code :PEC-CSME2012		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	100
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE:** End Semester Examination - Paper Duration - **3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Computer Basics, Procedural Programming Languages									

Course Objective: The objective of the course is to study various techniques for effective problem solving along with different Data Science Techniques and Paradigms in computer science, to illustrate the efficient ways of problem solving for any given problem.

Course Outcomes: Students should be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the complexities of various Challenges in Data Science	Understand (U)
2	Apply and analyze the complexity and identify approach to apply various Data Science techniques	Analyse (AN)
3	Apply and analyze the complexity of Data Management and Analytics techniques in Data Science	Analyse (AN)
4	Understand, apply and analyze different Data Science algorithms	Analyse (AN)
5	Understand , Apply and demonstrate Data Visualization techniques	Apply (A)
6	Demonstrate Data Science Course learning with a case study	Analyse (AN)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Data Science Key Concepts & Terminology** Introduction to core concepts and technologies: Introduction, Terminology, datascience process, data science toolkit, Types of data, Example applications.	5	Understand (U)
2	**Data Management and Pre-processing** Data collection and management: Introduction, Sources of data, Data collection andAPIs, Recent trends in various data collection and analysis techniques, Exploring and fixing data, Data storage and management, Using multiple data Sources	9	Evaluate (E)
3	**Exploratory Data Analytics and Key Statistical Techniques** Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Exploratory Data Analytics, Correlation, Regression, Testing of Hypothesis, One tail, and Two tails test Analyses of variance. Linear discriminant analysis (LDA), Logistic regression: Bayesian logistic regression,	8	Evaluate (E)
4	**Data Visualization** Data visualisation: Introduction, Types of data visualisation, Data forvisualisation: Data types, Data encodings, Retinal variables, Mapping variables toencodings, Visual encodings, Technologies for visualisation, Bokeh (Python)	8	Evaluate (E)
5	**Applications of Data Science** Applications of Data Science, Recommendation System, Predictive Analytics, Text Mining, Sentiment Analysis and Case studies	8	Create (C)
6	**Business Intelligence and Case Study of Data Science application** Business Intelligence: Introduction to Business Intelligence, Enhancing the data model, Data Analysis Expression (DAX),Case study on Retail Business.	7	Evaluate (E)
	Total Hours	**45**	

Reference Books:

1. Rachel Shutts and Cathy O'Neil, "Doing Data Science", O Reilly, Second Edition, 2014.
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data,EMC Education Services, Second Edition, 2015.
3. Kieran Healy, 'Data Visualization – A Practical Introduction', Princeton Univ. Press, 2019.
4. Field Cady, 'The Data Science Handbook,Wiley, 2018.
5. Ralph Kimball & Margy Ross, 'Data Warehousing Toolkit- A complete guide to dimensional modelling', Wiley, Second Edition, 2002.

M.E. Semester –II

ME (Computer Engineering)							SEM : II		
Course Name :Web Analytics and Development							Course Code :PEC-CSME2022		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	
3	-	-	3	3	25	75	-	-	100
IA: In-Semester Assessment - Paper Duration –1.5 Hours ESE: End Semester Examination - Paper Duration - 3 Hours									
Prerequisite: Web Mining									

Course Objective: To explore use of social network analysis to understand growing connectivity and complexity in the world ranging from small groups to WWW.

Course Outcomes: Students should be able to:

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Understand Social network and Web data and methods	Apply(A)
2	Compare different web analytics tools	Analyze (AN)
3	Perform Web Search and Retrieval	Apply(A)
4	Understand Network evolution	Understand(U)
5	Become familiar with core research communities, publications, focused on web and social media analytics and research questions engaged in	Apply(A)
6	Investigate Social involvements and diffusion of innovation	Analyze (AN)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Introduction – Social network and Web data and methods, Graph and Matrices, Basic measures for individuals and networks, Information Visualization	10	Apply(A)
2	Web Analytics tools: Click Stream Analysis, A/B testing, Online Surveys	8	Apply(A)
3	Web Search and Retrieval: Search Engine Optimization, Web Crawling and indexing, Ranking Algorithms, Web traffic models	9	Analyze (AN)
4	Making Connection: Link Analysis, Random Graphs and Network evolution,	8	Evaluate (E)
5	Social Connects: Affiliation and identity	4	Evaluate (E)
6	Connection: Connection Search, Collapse, Robustness Social involvements and diffusion of innovation	9	Apply (A)

Reference Books:

1. Hansen, Derek, Ben Sheiderman, Marc Smith. 2011. Analyzing Social MediaNetworks with NodeXL: Insights from a Connected World. Morgan Kaufmann, 304.
2. AvinashKaushik. 2009. Web Analytics 2.0: The Art of Online Accountability.
3. Easley, D. & Kleinberg, J. (2010). Networks, Crowds, and Markets: Reasoning About a Highly Connected World. New York: Cambridge University Press. http://www.cs.cornell.edu/home/kleinber/networks-book/
4. Wasserman, S. & Faust, K. (1994). Social network analysis: Methods and applications. New York: Cambridge University Press. Monge, P. R. & Contractor, N. S. (2003). Theories of communication networks. New York: Oxford University Press.

M.E. Semester –II

ME (Computer Engineering)							**SEM:** II		
Course Name: Pedagogy studies							**Course Code:**AC-CSME006		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
2	-	-	2	-	-	-	-	50	**50**

IA: In Semester Assessment

ESE: End Semester Examination

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)

Course Objectives:

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

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	**Introduction and Methodology:** Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions.Overview of methodology and Searching	4	Understand (U)
2	**Thematic overview:**Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education	2	Apply (A)
3	**Evidence on the effectiveness of pedagogical practices** **Methodology for the in depth stage**: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school Curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogicalpractices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies	4	Analyze (AN)

4	**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	4	Apply (A)
5	**Research gaps and future directions:** Research design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact	2	Analyze (AN)

Reference Books:

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 educationresearch project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basicmaths and reading in Africa: Does teacher preparation count? International Journal EducationalDevelopment, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education.
6. Oxford and Boston: Blackwell.
7. Chavan M (2003) Read India: A mass scale, rapid, ‘learning to read’ campaign.
8. www.pratham.org/images/resource%20working%20paper%202.pdf.

M.E. Semester –II

ME (Computer Engineering)							SEM : II		
Course Name :Data Visualisation							Course Code :PEC-CSME2011		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	100
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Computer Graphics, Image Processing									

Course Objectives:

1. Familiarize students with the basic and advanced techniques of information visualization and scientific visualization
2. To learn key techniques of the visualization process
3. A detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques

Course Outcomes:Students should be able to:

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Design process to develop visualization methods and visualization systems, and methods for their evaluation.	Apply(A)
2	preparation and processing of data, visual mapping and the visualization	Apply(A)
3	Understand large-scale abstract data,	Understand (U)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Introduction of visual perception, visual representation of data, Gestalt principles, information overloads.	8	Understand (U)
2	Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.	8	Apply(A)
3	Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.	10	Apply(A)
4	Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization	11	Apply(A)
5	Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations	7	Apply(A)
6	Recent trends in various perception techniques, various visualization techniques, data structures used in data visualization.	4	Understand (U)

Reference Books:

1. WARD, GRINSTEIN, KEIM, Interactive Data Visualization: Foundations, Techniques, and Applications. Natick: A K Peters, Ltd.
2. E. Tufte, The Visual Display of Quantitative Information, Graphics Press.

M.E. Semester –II

ME (Computer Engineering)							SEM : II		
Course Name :Data Warehousing and Data Mining							Course Code :PEC-CSME2013		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	
3	-	-	3	3	25	75	-	-	100
IA:In-Semester Assessment - Paper Duration –1.5 Hours ESE:End Semester Examination - Paper Duration - 3 Hours									
Prerequisite: Databases, Probability									

Course Objective: The objective of this course is to introduce data warehousing and mining techniques. Application of data mining in web mining, pattern matching and cluster analysis is included to aware students of broad data mining areas.

Course Outcomes: Students should be able to:

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1.	Study of different sequential pattern algorithms	Remember (R)
2.	Study the technique to extract patterns from time series data and it application in real world.	Remember (R)
3.	Can extend the Graph mining algorithms to Web mining	Apply (A)
4.	Help in identifying the computing framework for Big Data	Apply (A)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Introduction to Data Warehousing; Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods;	7	Understand (U)
2	Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns	8	Apply (A)
3	Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, Similarity search in Time-series analysis	8	Apply (A)
4	Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis	11	Apply (A)
5	Web Mining, Mining the web page layout structure, mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining.	9	Apply (A)
6	Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis	5	Apply (A)

Reference Books:

1. Jiawei Han and M Kamber, Data Mining Concepts and Techniques,Second Edition, Elsevier Publication, 2011.
2. Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley, 2006.
3. G Dong and J Pei, Sequence Data Mining, Springer, 2007.

M.E. Semester –II

ME (Computer Engineering)							SEM : II		
Course Name :Sensor Networks and Internet of Things							Course Code :PEC-CSME2014		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	
3	-	-	3	3	25	75	-	-	100
IA:In-Semester Assessment - Paper Duration –1.5 Hours ESE:End Semester Examination - Paper Duration - 3 Hours									
Prerequisite: Wireless Networks									

Course Objectives:

1. The course gives an overview of various topics related to wireless sensor networks, which are expected to be the basis for the emerging internet-of-things
2. The course covers topics with relation to various subdisciplines of computer science such as hardware, operating systems, distributed systems, networking, security and databases.
3. Able to understand wireless sensor network (WSN) specific issues such as localization, time synchronization, and topology control are addressed as well.

Course Outcomes:Students should be able to:

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1.	Identify requirements from emerging WSN applications on WSN platforms, communication systems, protocols and middleware	Understand (U)
2.	Understand, compare and evaluate communication and network protocols used in WSNs	Understand (U)
3.	Discuss and evaluate mechanisms and algorithms for time synchronization and localization in WSNs	Apply (A)
4.	Understand and discuss requirements for the design of security mechanisms and middleware systems to be used in WSNs	Apply (A)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	**Introduction and Applications**: smart transportation, smart cities, smart living, smart energy, smart health, and smart learning. Examples of research areas include for instance: Self-Adaptive Systems, Cyber Physical Systems, Systems of Systems, Software Architectures and Connectors, Software Interoperability, Big Data and Big Data Mining, Privacy and Security	8	Understand (U)
2	**IoT Reference Architecture**- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. **Real-World Design Constraints**- Introduction, Technical Design constraints hardware, Data representation and visualization, Interaction and remote control	9	Apply (A)
3	**Industrial Automation**- Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things. **Commercial Building Automation-** Introduction, Case study: phase one-commercial building automation today, Case study: phase two-commercial building automation in the future.	9	Apply (A)
4	Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium Access Control, Topology and Coverage Control, Routing: Transport Protocols, Network Security, Middleware, Databases	10	Understand (U)
5	IOT Physical Devices & Endpoints: What is an IOT Device, Exemplary Device Board, Linux on Raspberry, Interface and Programming & IOT Device	7	Apply (A)
6	Recent trends in sensor network and IOT architecture, Automation in Industrial aspect of IOT	5	Understand (U)

Reference Book:

1. Mandler, B., Barja, J., Mitre Campista, M.E., Cagáová, D., Chaouchi, H., Zeadally, S.,Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publishing Data mining and knowledge discovery handbook by Maimon, oded (et al.)

M.E. Semester –II

ME (Computer Engineering)							**SEM :** II		
Course Name : Data Visualisation for IoT							**Course Code :**PEC-CSME2015		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Computer Graphics, Image Processing									

Course Objectives:

1. Familiarize students with the basic and advanced techniques of information visualization and scientific visualization
2. To learn key techniques of the visualization process
3. A detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques

Course Outcomes:**Students should be able to:**

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Design process to develop visualization methods and visualization systems, and methods for their evaluation.	Apply(A)
2	preparation and processing of data, visual mapping and the visualization	Apply(A)
3	Understand large-scale abstract data,	Understand (U)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Introduction of visual perception, visual representation of data, Gestalt principles, information overloads.	8	Understand (U)
2	Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.	8	Apply(A)
3	Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.	10	Apply(A)
4	Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization	11	Apply(A)
5	Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations	7	Apply(A)
6	Recent trends in various perception techniques, various visualization techniques, data structures used in data visualization.	4	Understand (U)

Reference Books:

1. WARD, GRINSTEIN, KEIM, Interactive Data Visualization: Foundations, Techniques, and Applications. Natick : A K Peters, Ltd.
2. E. Tufte, The Visual Display of Quantitative Information, Graphics Press.

M.E. Semester –II

ME (Computer Engineering)							**SEM :** II		
Course Name : IoT Applications and Communication Protocols							**Course Code :**PEC-CSME2016		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Computer Networks									

Course Objectives:

1. Basic introduction of all the elements of IoT-Mechanical, Electronics/sensor platform, Wireless and wire line protocols, Mobile to Electronics integration, Mobile to enterprise integration
2. Open source/commercial electronics platform for IoT-Raspberry Pi, Arduino ,ArmMbedLPC
   Open source /commercial enterprise cloud platform for IoT-Ayla, iO Bridge, Libellium,Axeda, Cisco fog cloud

Course Outcomes:**Students should be able to:**

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1.	To understand merging technological options, platforms and case studies of IoT implementation in home & city automation	Understand (U)
2.	Determine the Market perspective of IoT.	Apply (A)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Basic function and architecture of a sensor — sensor body, sensor mechanism, sensor calibration, sensor maintenance, cost and pricing structure, legacy and modern sensor network. Development of sensor electronics — IoTvs legacy, and open source vs traditional PCB design styleDevelopment of sensor communication protocols, Protocols: Modbus, relay, Zigbee, Zwave, X10, Bluetooth, ANT, etc. Business driver for sensor deployment — FDA/EPA regulation, fraud/tempering detection, supervision, quality control and process	8	Apply(A)

	management. Different kind of calibration Techniques: manual, automation, infield, primary and secondary calibration — and their implication in IoT. Powering options for sensors: battery, solar, Witricity, Mobile and PoE		
2	Zigbee and Zwave — advantage of low power mesh networking. Long distance Zigbee. Introduction to different Zigbee chips. Bluetooth/BLE: Low power vs high power, speed of detection, class of BLE. Introduction of Bluetooth vendors & their review.Wireless protocols such as Piconet and packet structure for BLE and Zigbee Other long distance RF communication link.LOS vs NLOS links, Capacity and throughput calculationApplication issues in wireless protocols: power consumption, reliability, PER, QoS, LOS	9	Apply(A)
3	PCB vs FPGA vs ASIC design Prototyping electronics vs Production electronics. QA certificate for IoT-CE/CSA/UL/IEC/RoHS/IP65 Basic introduction of multi-layer PCB design and its workflow Electronics reliability-basic concept of FIT and early mortality rate Environmental and reliability testing-basic concepts Basic Open source platforms: Arduino, Raspberry Pi, Beaglebone	9	Apply(A))
4	Introduction to Mobile app platform for IoT: Protocol stack of Mobile app for IoT, Mobile to server integration, iBeacon in IoS, Window Azure, Linkafy Mobile platform for IoT, Axeda, Xively	10	Apply(A)
5	Database implementation for IoT : Cloud based IoT platforms, SQL vsNoSQL, Open sourced vs. Licensed Database, Available M2M cloud platform, AxedaXively, Omega NovoTech, Ayla Libellium, CISCO M2M platform, AT&T M2M platform, Google M2M platform	7	Apply(A)
6	Recent trends in home automation, IOT-locks, Energy optimization in home	5	Understand (U)

Reference Book:

1. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley-Blackwell.

M.E. Semester –II

ME (Computer Engineering)							SEM : II		
Course Name :Data Security and Access Control							Course Code :PEC-CSME2021		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	
3	-	-	3	3	25	75	-	-	100
IA:In-Semester Assessment - Paper Duration –1.5 Hours ESE:End Semester Examination - Paper Duration - 3 Hours									
Prerequisite: Database Management									

Course Objective: The objective of the course is to provide fundamentals of database security. Various access Control techniques mechanisms were introduced along with application areas of access control techniques.

Course Outcomes: Students should be able to:

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1.	In this course, the students will be enabled to understand and implement classical models and algorithms	Understand (U)
2.	They will learn how to analyses the data, identify the problems, and choose the relevant models and algorithms to apply.	Apply(A)
3.	They will further be able to assess the strengths and weaknesses of various access control models and to analyse their behaviour.	Apply(A)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Introduction to Access Control, Purpose and fundamentals of access control, brief history, Policies of Access Control, Models of Access Control, and Mechanisms, Discretionary Access Control (DAC), Non-Discretionary Access Control, Mandatory Access Control (MAC). Capabilities and Limitations of Access Control Mechanisms: Access Control List (ACL) and Limitations, Capability List and Limitations.	9	Understand (U)
2	Role-Based Access Control (RBAC) and Limitations, Core RBAC, Hierarchical RBAC, Statically Constrained RBAC, Dynamically Constrained RBAC, Limitations of RBAC. Comparing RBAC to DAC and MAC Access control policy.	8	Apply(A)
3	Biba' sintrigity model, Clark-Wilson model, Domain type enforcement model, mapping the enterprise view to the system view, Role hierarchies- inheritance schemes, hierarchy structures and inheritance forms, using SoD in real system. Temporal Constraints in RBAC, MAC AND DAC. Integrating RBAC with enterprise IT infrastructures: RBAC for WFMSs, RBAC for UNIX and JAVA environments Case study: Multi line Insurance Company	10	Analyze (AN)
4	Smart Card based Information Security, Smart card operating system fundamentals, design and implantation principles, memory organization, smart card files, file management, atomic operation, smart card data transmission ATR, PPS Security techniques- user identification, smart card security, quality assurance and testing, smart card life cycle-5 phases, smart card terminals.	10	Analyze (AN)
5	Recent trends in Database security and access control mechanisms. Case study of Role-Based Access Control (RBAC) systems.	7	Apply (A)
6	Recent Trends related to data security management, vulnerabilities in different DBMS.	4	Apply (A)

Reference Books:

1. Role Based Access Control: David F. Ferraiolo, D. Richard Kuhn, RamaswamyChandramouli.
2. http://www.smartcard.co.uk/tutorials/sct-itsc.pdf : Smart Card Tutorial.

M.E. Semester –II

ME (Computer Engineering)							**SEM :** II		
Course Name : Knowledge Discovery							**Course Code :**PEC-CSME2023		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:**End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Data structures, Basic Statistics									

Course Objective: Conduct case studies on real data mining examples.

Course Outcome:Students should be able to:

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1.	Have knowledge of various knowledge representation methods	Apply (A)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	**Introduction KDD and Data Mining** - Data Mining and Machine Learning, Machine Learning and Statistics, Generalization as Search,Data Mining and Ethics.	7	Understand (U)
2	**Knowledge Representation** - Decision Tables, Decision Trees, Classification Rules, Association Rules, Rules involving Relations, Trees for Numeric Predictions, Neural Networks, Clusters	10	Apply(A)
3	**Decision Trees** - Divide and Conquer, Calculating Information, Entropy, Pruning,Estimating Error Rates, The C4.5 Algorithm Evaluation of Learned Results- Training and Testing, Predicting Performance, Cross-Validation	9	Analyze (AN)
4	**Classification Rules** - Inferring Rudimentary Rules, Covering Algorithms for RuleConstruction, Probability Measure for Rule Evaluation, Association Rules, Item Sets, Rule Efficiency	8	Apply (A)

5	**Numeric Predictions -** Linear Models for Classification and Numeric Predictions,Numeric Predictions with Regression Trees, Evaluating Numeric Predictions	7	Evaluate (E)
6	**Artificial Neural Networks** – Perceptron's, Multilayer Networks, The Back propagation Algorithm **Clustering** - Iterative Distance-based Clustering, Incremental Clustering, The EM Algorithm	4	Understand (U)

Reference Books:

1. Data mining and knowledge discovery handbook by Maimon, oded(et al.)
2. Data Cleansing: A Prelude to knowledge Discovery

M.E. Semester –II

ME (Computer Engineering)							SEM : II		
Course Name :Big Data Analytics for IoT							Course Code :PEC-CSME2024		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	
3	-	-	3	3	25	75	-	-	100
IA: In-Semester Assessment - Paper Duration –1.5 Hours ESE: End Semester Examination - Paper Duration - 3 Hours									
Prerequisite: Data Structure, Computer Architecture and Organization									

Course Objectives:

1. Understand big data for business intelligence. Learn business case studies for big data analytics.
2. Understand NOSQL big data management. Perform map-reduce analytics using Hadoop and related tools

Course Outcomes: Students should be able to:

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1.	Describe big data and use cases from selected business domains.	Understand (U)
2.	Explain NoSQL big data management	Apply (A)
3.	Install, configure, and run Hadoop and HDFS	Apply (A)
4.	Perform map-reduce analytics using Hadoop	Analyze (AN)
5.	Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics	Understand (U)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.	8	Understand (U)
2	Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.	8	Apply (A)
3	Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures	9	Apply (A)
4	MapReduce workflows, unit tests with MR Unit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats	9	Apply (A)
5	Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.	10	Apply (A)
6	Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts.Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.	6	Understand (U)

Reference Books:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of
4. Polyglot Persistence", Addison-Wesley Professional, 2012.
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
6. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
7. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
8. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
9. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
10. Alan Gates, "Programming Pig", O'Reilley, 2011.

M.E. Semester –II

ME (Computer Engineering)							SEM : II		
Course Name :Network Security							Course Code :PEC-CSME2025		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	
3	-	-	3	3	25	75	-	-	100
IA:In-Semester Assessment - Paper Duration –1.5 Hours ESE:End Semester Examination - Paper Duration - 3 Hours									
Prerequisite: Computer Networks, Web Programming									

Course Objectives:

1. To learn the basics of security and various types of security issues.
2. To study different cryptography techniques available and various security attacks..
3. Explore network security and how they are implemented in real world.
4. To get an insight of various issues of Web security and biometric authentication.

Course Outcomes: Students should be able to:

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1.	To have an understanding of basics of security and issues related to it.	Understand (U)
2.	Understanding of biometric techniques available and how they are used in today's world.	Understand (U)
3.	Security issues in web and how to tackle them.	Analyze(AN)
4.	Learn mechanisms for transport and network security	Understand (U)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Data security: Review of cryptography. Examples RSA, DES, ECC.	6	Understand (U)
2	Authentication, non-repudiation and message integrity. Digital signatures and certificates. Protocols using cryptography (example Kerberos). Attacks on protocols	9	Apply(A)
3	Network security: Firewalls, Proxy-Servers, Network intrusion detection. Transport security: Mechanisms of TLS, SSL, IPSec.	9	Apply(A)
4	Web security – SQL injection, XSS, etc. Software security and buffer overflow. Malware types and case studies. Access Control, firewalls and host/network intrusion detection.	11	Apply(A)
5	Other topics: Biometric authentication, Secure E-Commerce (ex. SET), Smart Cards, Security in Wireless Communication.	8	Apply(A)
6	Recent trends in IOT security, IDS and Biometric.	5	Understand (U)

Reference Books:

1. W. R. Cheswick and S. M. Bellovin. Firewalls and Internet Security. Addison Wesley, 1994.
2. W. Stallings. Cryptography and Network Security. Prentice Hall, 1999.
3. B. Schneier. Applied Cryptography. Wiley, 1999.

M.E. Semester –II

ME (Computer Engineering)							SEM : II		
Course Name :Advanced Machine Learning							Course Code :PEC-CSME2026		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	
3	-	-	3	3	25	75	-	-	100
IA:In-Semester Assessment - Paper Duration –1.5 Hours ESE:End Semester Examination - Paper Duration - 3 Hours									
Prerequisite: Machine Learning, Probability Theory									

Course Objectives:

1. To introduce key concepts in pattern recognition and machine learning; including specific algorithms for classification, regression, clustering and probabilistic modeling.
2. To give a broad view of the general issues arising in the application of algorithms to analysing data, common terms used, and common errors made if applied incorrectly.
3. To demonstrate a toolbox of techniques that can be immediately applied to real world problems, or used as a basis for future research into the topic.

Course Outcomes:Students should be able to:

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1.	Key concepts, tools and approaches for pattern recognition on complex data sets	Understand (U)
2.	Kernel methods for handling high dimensional and non-linear patterns	Apply (A)
3.	State-of-the-art algorithms such as Support Vector Machines and Bayesian networks	Apply (A)
4.	Solve real-world machine learning tasks: from data to inference	Analyze (AN)
5.	Theoretical concepts and the motivations behind different learning frameworks	Understand (U)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Key concepts, Supervised/Unsupervised Learning, Loss functions and generalization, Probability Theory, Parametric vs Non-parametric methods, Elements of Computational Learning Theory Ensemble Learning, Bagging, Boosting, Random Forest	8	Understand (U)
2	Kernel Methods for non-linear data, Support Vector Machines, Kernel Ridge Regression, Structure Kernels, Kernel PCA, Latent Semantic Analysis	8	Apply(A)
3	Bayesian methods for using prior knowledge and data, Bayesian inference, Bayesian Belief Networks and Graphical models, Probabilistic Latent Semantic Analysis, The Expectation-Maximization (EM) algorithm, Gaussian Processes.	8	Analyze (AN)
4	Dimensionality Reduction - CCA, LDA, ICA, NMF - Canonical Variates - Feature Selection vs Feature Extraction	10	Evaluate (E)
5	Filter Methods - Sub-space approaches - Embedded methods Low-Rank approaches - Recommender Systems .Application areas - Security - Business – Scientific	9	Evaluate (E)
6	Recent trends in supervised and unsupervised learning algorithm, dimensional reducibility, feature selection and extraction	5	Understand (U)

Reference Books:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning.
2. John Shawe-Taylor and NelloCristianini, Kernel Methods for Pattern Analysis. B., 1999.

M.E. Semester –II

ME (Computer Engineering)							**SEM :** II		
Course Name : English for research paper writing							**Course Code :**AC-CSME001		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
2	-	-	2	-	-	-	-	50	**50**

IA: In Semester Assessment

ESE : End SemesterExamination

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)

Course Objectives:

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

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4	Understand (U)
2	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction	4	Understand (U)
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	4	Understand (U)
4	Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,	4	Apply (A)
5	Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	4	Apply (A)
6	Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	4	Analyze (AN)

Reference Books:

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 DordrechtHeidelberg London, 2011

M.E. Semester –II

ME (Computer Engineering)							**SEM :** II		
Course Name : Disaster management							**Course Code :**AC-CSME002		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
2	-	-	2	-	-	-	-	50	**50**

IA: In Semester Assessment

ESE : End Semester Examination

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)

Course Objectives:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. 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.

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	**Introduction:** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4	Understand (U)
2	**Repercussions Of Disasters And Hazards:** Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	4	Understand (U)
3	**Disaster Prone Areas In India:** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	4	Understand (U)

4	**Disaster Preparedness And Management:** Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness	4	Analyze (AN)
5	**Risk Assessment:** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.	4	Understand (U)
6	**Disaster Mitigation:** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	4	Understand (U)

Reference Books:

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

M.E. Semester –II

ME (Computer Engineering)							**SEM:** II		
Course Name: Sanskrit for technical knowledge							**Course Code:**AC-CSME003		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
2	-	-	2	-	-	-	-	50	**50**

IA: In Semester Assessment

ESE: End Semester Examination

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)

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
4. Enhancing the memory power.
5. The engineering scholars equipped with Sanskrit will be able to explore the
6. Huge knowledge from ancient literature.

Course Outcomes:**Students should be able to:**

S. No.	**Course Outcomes**	**Cognitive levels as per Bloom's Taxonomy**
1	Understanding basic Sanskrit language	Understand (U)
2	Ancient Sanskrit literature about science & technology can be understood	Understand (U)
3	Being a logical language will help to develop logic in students	Apply (A)

Detailed Syllabus:

Module No.	**Topics**	**Hrs.**	**Cognitive levels as per Bloom's Taxonomy**
1	Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences	8	Understand (U)
2	Order, Introduction of roots, Technical information about Sanskrit Literature.	8	Understand (U)
3	Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	8	Understand (U)

Reference Books:

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

M.E. Semester –II

ME (Computer Engineering)							**SEM :** II		
Course Name : Value Education							**Course Code :**AC-CSME004		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
2	-	-	2	-	–	–	–	50	50
IA: In Semester Assessment **ESE :**End SemesterExamination **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)									

Course Objectives:

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

Course Outcomes:**Students should be able to:**

S. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Understand value of education and self- development	Apply (A)
2	Understand the importance of character	Apply (A)
3	Imbibe good values in students creating good human beings	Create(C)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments	6	Apply (A)
2	Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature ,Discipline	6	Apply (A)
3	Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. 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	6	Apply (A)
4	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	6	Apply (A)

Reference Book:

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

M.E. Semester –II

ME (Computer Engineering)							SEM: II		
Course Name:Constitution of India							Course Code:AC-CSME005		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (50)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	
2	-	-	2	-	-	-	-	50	50

IA: In Semester Assessment

ESE : End Semester Examination

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)

Course objectives:

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

Course Outcomes:Students will be able to:

S. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1.	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	Understand (U)
2.	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	Apply (A)
3.	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.	Apply (A)
4.	Discuss the passage of the Hindu Code Bill of 1956.	Understand (U)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	**History of Making of the Indian Constitution:** History Drafting Committee, (Composition & Working)	4	Understand (U)
2	**Philosophy of the Indian Constitution:** Preamble Salient Features	4	Understand (U)
3	**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	4	Understand (U)
4	**Organs of Governance:** Parliament Composition Qualifications and Disqualifications Powers and Functions Executive President Governor Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions	4	Understand (U)
5	**Local Administration:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: 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	4	Understand (U)
6	**Election Commission:** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women	4	Understand (U)

Reference Books:

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.

M.E. Semester –II

ME (Computer Engineering)							**SEM:** II		
Course Name: Stress management by yoga							**Course Code:**AC-CSME007		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
2	-	-	2	-	-	-	-	50	**50**
IA: In Semester Assessment **ESE :**End Semester Examination **The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)**									

Course Objectives:

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

Course Outcomes:**Students will be able to:**

S. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Develop healthy mind in a healthy body thus improving social health also	Apply (A)
2	Improve efficiency	Apply (A)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Definitions of Eight parts of yog. (Ashtanga)	8	Understand (U)
2	Yam and Niyam. Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	8	Understand (U)

3	Asan and Pranayam i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects-Types of pranayam	8	Apply (A)

Reference Books:

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

M.E. Semester –II

ME (Computer Engineering)							SEM : II		
Course Name :Laboratory III (Based on cores)							Course Code:LC-CSME202		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	
-	-	4	4	2	-	-	25	25	50
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)									
Prerequisite: Advanced Algorithm, Soft Computing									

List of Practical/ Experiments:

S.N.	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels as per Blooms Taxonomy
1	**Basic Experiments**	Experiment Dijkstra's algorithm to find shortest path	2	Apply (A)
2		Experiment Graph matching algorithm to compute maximum matching	2	Apply (A)
3		Experiment Strassen's algorithm for Matrix computation	2	Apply (A)
4		Experiment Chinese Remainder theorem on integers / polynomials	2	Apply (A)
5		Implement Approximation algorithms	2	Apply (A)
6	**Design Experiments**	Design a Fuzzy Inference System in Python	4	Create (C)
7		Design Supervised Learning Neural Network	4	Create (C)
8		Design UnSupervised Learning Neural Network	4	Create (C)
9		Design Genetic Algorithm for Machine Learning Task	4	Create (C)
10		Design Deep Learning Network for classification task	4	Create (C)

M.E. Semester –II

ME (Computer Engineering)							**SEM:** II		
Course Name: Laboratory IV							**Course Code:**LC-CSME202		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
-	-	4	4	2	-	-	25	25	**50**
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Practical (40%) and Attendance (20%)									

Each Laboratory assignment will be done by an individual student. The Faculty teaching elective subject will be required to propose the respective Laboratory assignments. These will be essentially hands-on practical /Case Study.

M.E. Semester –II

ME (Computer Engineering)							**SEM:** II		
Course Name: Mini Project with Seminar							**Course Code:** LC-CSME203		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**50**
-	-	4	4	2	-	-	50	-	
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Practical (40%) and Attendance (20%)									

- Mini Project will be done by an individual student.
- Individual student has to present a seminar on Emerging trends with respect to domain, tools, products and research
- Study report, Case studies, white papers and research papers needs to be submitted based on the selected technologies.
  1. Autonomous things
  2. Augmented analytics
  3. AI-driven development
  4. Digital twins
  5. Empowered edge
  6. Immersive technologies
  7. Block chain
  8. Smart spaces
  9. Digital ethics and privacy
  10. Quantum computing, etc.

M.E. Semester –II

ME (Computer Engineering)							**SEM:** II		
Course Name: Personality development through life enlightenment skills							**Course Code:**AC-CSME008		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
2	-	-	2	-	-	-	-	50	**50**

IA: InSemester Assessment

ESE: EndSemester Examination

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)

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:**

S. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1.	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life	Understand (U)
2.	The person who has studied Geeta will lead the nation and mankind to peace and prosperity	Apply (A)
3.	Study of Neetishatakam will help in developing versatile personality of students.	Understand (U)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	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)	8	Understand (U)
2	Approach to day to day work and duties. ShrimadBhagwadGeeta : 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.	8	Apply (A)
3	Statements of basic knowledge. ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18 Personality of Role model. ShrimadBhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63	8	Understand (U)

Reference Books:

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

M.E. Semester –III

ME (Computer Engineering)							SEM : III		
Course Name :GPU Computing							Course Code :PEC-CSME3011		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral/ Presentation (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	
3	-	-	3	3	-	-	25	25	50
Prerequisite: UG level course in GPU computing									

Course Objectives: To learn parallel programming with Graphics Processing Units (GPUs).

Course Outcomes: **Students should be able to:**

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Learn concepts in parallel programming, implementation of programs on GPUs, debugging and profiling parallel programs.	Analyze (AN)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Introduction: History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallelprogramming, 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	13	Understand (U)
2	Memory: Memory hierarchy, DRAM / global, local / shared, private / local,textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamicMemory, Multi-dimensional Arrays, Memory Allocation, Memory copying acrossdevices, Programs with matrices, Performance evaluation with different memories	7	Analyze (AN)
3	Synchronization: Memory Consistency, Barriers (local versus global), Atomics,Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structuressuch as Worklists, Linked-lists. Synchronization across CPU and GPU Functions: Device functions, Host functions, Kernels functions, Using libraries(such as Thrust), and developing libraries.	10	Analyze (AN)
4	Support: Debugging GPU Programs. Profiling, Profile tools, Performance aspectsStreams: Asynchronous processing, tasks, Task-dependence, Overlapped datatransfers, Default Stream, Synchronization with streams. Events, Event-based-Synchronization - Overlapping data transfer and kernel execution, pitfalls.	8	Analyze (AN)
5	Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning	5	Analyze (AN)
6	Advanced topics: Dynamic parallelism, Unified Virtual Memory, Multi-GPUprocessing, Peer access, Heterogeneous processing	5	Apply (A)

Reference Books:

1. Programming Massively Parallel Processors: A Hands-on Approach; David Kirk, Wen-meiHwu;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)

M.E. Semester –III

ME (Computer Engineering)							**SEM : III**		
Course Name : Cloud Computing							**Course Code :**PEC-CSME3012		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	-	-	25	25	**50**
Prerequisite: UG level course in cloud computing									

Course Objectives:

- The student will also learn how to apply trust-based security model to real-world security problems.
- An overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures.
- Students will learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.

Course Outcomes: **Students should be able to:**

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Identify security aspects of each cloud model	Apply (A)
2	Develop a risk-management strategy for moving to the Cloud	Analyze(AN)
3	Implement a public cloud instance using a public cloud service provider	Analyze(AN)
4	Apply trust-based security model to different layer	Apply (A)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Introduction to Cloud Computing Online Social Networks and Applications, Cloud introduction and overview,Different clouds, Risks, Novel applications of cloud computing	4	Understand (U)
2	Cloud Computing Architecture Requirements, Introduction Cloud computing architecture, On Demand ComputingVirtualization at the infrastructure level, Security in Cloud computingenvironments, CPU Virtualization, A discussion on Hypervisors StorageVirtualization Cloud Computing Defined, The SPI Framework for Cloud Computing,The Traditional Software Model, The Cloud Services Delivery ModelCloud Deployment Models Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users,Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise	11	Analyze (AN)
3	Security Issues in Cloud Computing Infrastructure Security, Infrastructure Security: The Network Level, The HostLevel, The Application Level, Data Security and Storage, Aspects of Data Security,Data Security Mitigation Provider Data and Its Security Identity and Access ManagementTrust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocolsfor Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management	10	Analyze (AN)
4	Security Management in the Cloud Security Management Standards, Security Management in the Cloud, AvailabilityManagement: SaaS, PaaS, IaaS Privacy Issues Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, ProtectingPrivacy, Changes to Privacy Risk Management and Compliance in Relation to CloudComputing, Legal and Regulatory Implications, U.S. Laws and Regulations,International Laws and Regulations	11	Analyze (AN)
5	Audit and Compliance Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud forCompliance, Security-as-a-Cloud	8	Analyze (AN)
6	ADVANCED TOPICS Recent developments in hybrid cloud and cloud security.	4	Apply (A)

Reference Books:

1. Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publication Date: November 2, 2009

2. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory inPractice), Tim Mather, ISBN-10: 0596802765,O'Reilly Media, September 2009

M.E. Semester –III

ME (Computer Engineering)							SEM : III		
Course Name :Distributed Databases							Course Code :PEC-CSME3013		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral/ Presentation (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	
3	-	-	3	3	-	-	25	25	50
Prerequisite: Database Management Systems									

Course Objectives: The objective of course is to provide insight to distributed database, normalization techniquesand integrity rules. It also includes parallel database systems along with object oriented models.

Course Outcomes: **Students should be able to:**

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Abe to understand relational database management systems, normalization to make efficientretrieval from database and query.	Understand (U)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Introduction: Distributed Data processing, Distributed database system (DDBMS), Promises of DDBMSs, Complicating factors and Problem areas in DDBMSs, Overview Of Relational DBMS Relational Database concepts, Normalization, Integrity rules, Relational Data Languages, Relational DBMS.	11	Understand (U)
2	Distributed DBMS Architecture: DBMS Standardization, Architectural models for Distributed DBMS, Distributed DBMS Architecture. Distributed Database Design: Alternative design Strategies, Distribution design issues, Fragmentation, Allocation. Semantic Data Control: View Management, Data security, SemanticIntegrity Control.	8	Analyze (AN)
3	Overview of Query Processing: Query processing problem, Objectives of QueryProcessing, Complexity of Relational Algebra operations, characterization of Queryprocessors, Layers of Query Processing. Introduction to Transaction Management: Definition of Transaction, Properties oftransaction, types of transaction. Distributed Concurrency Control: Serializabilitytheory, Taxonomy of concurrency control mechanisms, locking bases concurrencycontrol algorithms.	9	Analyze (AN)
4	Parallel Database Systems: Database servers, Parallel architecture, Parallel DBMStechniques, Parallel execution problems, Parallel execution for hierarchicalarchitecture.	7	Analyze (AN)
5	Distributed Object Database Management systems: Fundamental Object conceptsand Object models, Object distribution design. Architectural issues, Objectmanagement, Distributed object storage, Object query processing. Transactionmanagement. Database Interoperability: Database Integration, Query processing.	8	Analyze (AN)
6	Recent approaches, models and current trends in improving the performance ofDistributed Database.	5	Apply (A)

Reference Books:

1. Principles of Distributed Database Systems, Second Edition, M. Tamer Ozsu Patrick Valduriez

2. Distributed Databases principles and systems, Stefano Ceri, Giuseppe Pelagatti, Tata McGrawHill.

M.E. Semester –III

ME (Computer Engineering)							**SEM : III**		
Course Name : Cloud Computing for IOT							**Course Code :**PEC-CSME3014		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	-	-	25	25	**50**
Prerequisite: UG level course in cloud computing									

Course Objectives:

- The student will also learn how to apply trust-based security model to real-world security problems.
- An overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures.
- Students will learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.

Course Outcomes: **Students should be able to:**

S.No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Identify security aspects of each cloud model	Apply (A)
2	Develop a risk-management strategy for moving to the Cloud	Analyze(AN)
3	Implement a public cloud instance using a public cloud service provider	Analyze(AN)
4	Apply trust-based security model to different layer	Apply (A)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Introduction to Cloud Computing Online Social Networks and Applications, Cloud introduction and overview,Different clouds, Risks, Novel applications of cloud computing	4	Understand (U)
2	Cloud Computing Architecture Requirements, Introduction Cloud computing architecture, On Demand ComputingVirtualization at the infrastructure level, Security in Cloud computingenvironments, CPU Virtualization, A discussion on Hypervisors StorageVirtualization Cloud Computing Defined, The SPI Framework for Cloud Computing,The Traditional Software Model, The Cloud Services Delivery ModelCloud Deployment Models Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users,Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise	11	Analyze (AN)
3	Security Issues in Cloud Computing Infrastructure Security, Infrastructure Security: The Network Level, The HostLevel, The Application Level, Data Security and Storage, Aspects of Data Security,Data Security Mitigation Provider Data and Its Security Identity and Access ManagementTrust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocolsfor Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management	10	Analyze (AN)
4	Security Management in the Cloud Security Management Standards, Security Management in the Cloud, AvailabilityManagement: SaaS, PaaS, IaaS Privacy Issues Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, ProtectingPrivacy, Changes to Privacy Risk Management and Compliance in Relation to CloudComputing, Legal and Regulatory Implications, U.S. Laws and Regulations,International Laws and Regulations	11	Analyze (AN)
5	Audit and Compliance Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud forCompliance, Security-as-a-Cloud	8	Analyze (AN)
6	ADVANCED TOPICS Recent devlopments in hybrid cloud and cloud security.	4	Apply (A)

Reference Books:

3. Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publication Date: November 2, 2009

4. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice), Tim Mather, ISBN-10: 0596802765,O'Reilly Media, September 2009

M.E. Semester –III

ME (Computer Engineering)							**SEM : III**		
Course Name :IOT and Smart Cities							**Course Code :**PEC-CSME3015		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	-	-	25	25	**50**
Prerequisite: Wireless Communication and Networks									

Course Objectives:

- Explain the basic methodologies and techniques of the arts and humanities, social sciences, business, and science and technology.
- to describe the current practices and future trends about smart city
- Capacity of critique the current practice and provide recommendations.

Course Outcomes: Students should be able to:

S. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Understanding the fundamental knowledge of the sustainable and smart city	Understand (U)
2	Ability to understand the technologies used for sustainable and smart cities	Understand (U)
3	Ability to integrate and apply the learnt knowledge to conduct a case study in an organized	Apply(A)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Introduction and Applications:smart transportation, smart cities, smart living, smart energy, smart health, and smart learning.	11	Understand (U)
2	IoT Reference Architecture- methods to assist local governments to develop international good e-practice	8	Analyze (AN)
3	Methods to redesign and redefine back and front offices in order to build smarter and transparent governments	9	Analyze (AN)
4	Methods to design public mobile services aimed at efficiency, costsaving and participation with attention for e-inclusion	7	Analyze (AN)
5	Methodologies for user involvement, profiling customers and indentifying needs; test methodologies to transfer these needs in appropriateservices; and test techniques to fit the right channel to the specific services andcustomers thereby setting a framework for a higher level of e-services in theNSR	8	Analyze (AN)
6	Pilot new service channels, bluetooth services for public transport, online forms in mobile phones and wireless city services	5	Apply (A)

Reference Books:

1. Smart City on Future Life - Scientific Planning and Construction by Xianyi Li

2. The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities) by NicosKomninos

3. Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia by AnthonyTownsend

M.E. Semester –III

ME (Computer Engineering)							**SEM : III**		
Course Name : Emulation and Simulation Methodologies							**Course Code :**PEC-CSME3016		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**50**
3	-	-	3	3	-	-	25	25	
Prerequisite: Probability Theory, Computer Networks									

Course Objectives:

- This module teaches the fundamentals of simulation and emulation methodologies providing guidance on how to design a performance evaluation campaign
- Set up a test scenario, select the appropriate models, level of granularity
- metrics for statistical correctness, and discuss the differences between simulation and emulation platforms and how to use them for accurate performance evaluation of communications.

Course Outcomes: Students should be able to:

S. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Ability to understand fundamentals of simulation and emulation methodologies	Understand (U)
2	Ability to identify application-based Granularity Requirements	Apply(A)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Fundamentals of Discrete Event Simulations (DES)	8	Understand (U)
2	Model-based representationor DES, from communication and networking, to mobility and data traffic.	8	Analyze (AN)
3	Application-based Granularity Requirements: from bit-level, packetlevel, to system-level evaluation, and their appropriate selection as a function of the application requirements.	8	Analyze (AN)
4	Fundamentals on Random Numbers, Fundamentals on Statistical Tools for Performance Evaluation, Simulation vs. Emulations	12	Analyze (AN)
5	Case study for the evaluation of communications for ITS	8	Analyze (AN)
6	Recent trends in simulation and emulation for IOT, model based and application based granularity presentation	4	Apply (A)

Reference Books:

1. Jack L. Burbank, An Introduction to Network Simulator 3, Wiley

M.E. Semester –III
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Computer Engineering)							**SEM :** III		
Course Name : Business Analytics							**Course Code :**OEC-CSME301		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	-	-	25	25	
Prerequisite: Undergraduate subjects related to Business Analysis.									

Course Objectives: At the end of this course, students should be able to

- Understand the role of business analytics within anorganization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of anorganization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decisionmaking.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations researchtechniques.

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

Sr. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Understand the role of business analytics within anorganization	Understand(U)
2	Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of anorganization	Analyze(An)
3	Understanding of how managers use business analytics to formulate and solve business problems and to support managerial decisionmaking.	Understand(U)
4	Manage business process using analytical and managementtools. .	Apply(A)

Detailed Syllabus:

Module No.	Topics	Hrs.
1	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	09
2	Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.	08
3	Organization Structures of Business analytics, Team management, anagement Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling Predictiveanalytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the businessanalytics Process, Prescriptive Modelling, nonlinear Optimization.	09
4	Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation.Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	10
5	Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.	08
6	Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	04

Reference Books:

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.

M.E. Semester –III
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Computer Engineering)							**SEM :** III		
Course Name : Industrial Safety							**Course Code :**OEC-CSME302		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral /Presentation(25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	-	-	25	25	
Prerequisite: Undergraduate subjects related to Industrial Safety.									

Course Objectives: At the end of this course, students should be able to

- Enable to various industrial safety organization and their function.
- Analyse industrial related accidents their occurrence, their effect and causation of accident.
- Analyse strategies applied for accident prevention.
- Understand about various industrial hazards and hazard control measures and technology applied

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

Sr. No.	**Course Outcomes**	**Cognitive levels as per Bloom's Taxonomy**
1	Understand various industrial safety organizations and their function.	Understand(U)
2	Analyse industrial related accidents their occurrence, their effect and causation of accident.	Analyze(An)
3	Understand about various industrial hazards and hazard control measures and technology applied.	Understand(U)
4	Analyse strategies applied for accident prevention.	Analyze(An)

Detailed Syllabus:

Module No.	Topics	Hrs.
1	Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.	10
2	Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.	10
3	Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.	10
4	Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler,vi.Electrical motors, Types of faults in machine tools and their general causes.	10
5	Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. 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	08

Reference Books:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da InformationServices.
2. Maintenance Engineering, H. P. Garg, S. Chand andCompany.
3. Pump-hydraulic Compressors, Audels, Mcgrew HillPublication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & HallLondon

M.E. Semester –III
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Computer Engineering)							**SEM :** III		
Course Name : Operations Research							**Course Code :**OEC-CSME303		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral /Presentation(25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	-	-	25	25	
Prerequisite: Undergraduate subjects related to Operations Research.									

Course Objectives: At the end of this course, students should be able to

- Understand and carry out sensitivity analysis.
- Apply the dynamic programming to solve problems of discrete and continuous variables.
- Apply the concept of non-linear programming.
- Model the real world problem and simulate it.

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

Sr. No.	**Course Outcomes**	**Cognitive levels as per Bloom's Taxonomy**
1	Understand and carry out sensitivityanalysis.	Understand(U)
2	Apply the dynamic programming to solve problems of discreet and continuous variables. .	Apply(A)
3	Apply the concept of non-linearprogramming.	Understand(U)
4	Model and simulate the real world problem.	Apply(A)

Detailed Syllabus:

Module No.	Topics	Hrs.
1	Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models	10
2	Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming	10
3	Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT	10
4	Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming	10
5	Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation	08

Reference Books:

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

M.E. Semester –III
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Computer Engineering)							**SEM :** III		
Course Name : Cost Management of Engineering Projects							**Course Code :**OEC-CSME304		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral /Presentation(25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	-	-	25	25	
Prerequisite: OperationsManagement and Basic knowledge of Accounting.									

Course Objectives: Students should be able to

- Understand the Strategic Cost Management Process
- Apply Cost concepts in decision-making
- Apply Quantitative techniques for cost management

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

Sr. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Use Cost concepts in decision-making	Understand(U)
2	Apply Quantitative techniques for cost management.	Apply(A)

Detailed Syllabus:

Module No.	Topics	Hrs.
1	Introduction and Overview of the Strategic Cost Management Process	10
2	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.	10

3	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	10
4	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.	10
5	Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.	08

Reference Books:

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

M.E. Semester –III
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Computer Engineering)							**SEM :** III		
Course Name : Composite Materials							**Course Code :**OEC-CSME305		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	_	_	25	25	
Prerequisite: Mechanics of Materials,Computational Methods.									

Course Objectives: Students will be able to:

- Understand the Classification and characteristics of Composite materials.
- To discuss reinforcement and Strength
- Model, simulate and optimize the performance of composite structures as well as develop practical skills in one or more common manufacturing techniques.

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

Sr. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Apply Classification and characteristics of Composite materials	Apply(A)
2	Apply reinforcement and Strength	Apply(A)

Detailed Syllabus:

Module No.	Topics	Hrs.
1	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.	10
2	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	10
3	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	10
4	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.	10
5	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	08

Text Books:

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

Reference Books:

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

M.E. Semester –III
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Computer Engineering)							**SEM :** III		
Course Name : Waste to Energy							**Course Code :**OEC-CSME306		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral /P(25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	_	_	25	25	
Prerequisite: Renewable Energy Sources, Physics, Environmental Studies.									

Course Objectives: Students will be able to:

- Review Classification of waste as fuel
- Discuss Properties of biogas

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

Sr. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Classify waste as fuel	Understand(U)
2	Apply Properties of biogas	Apply(A)
3	Identify sources of energy from bio-chemical conversion	Analyze(AN)

Detailed Syllabus:

Module No.	Topics	Hrs.
1	Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forestresidue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors	10

2	Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.	10
3	Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement forthermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation..	10
4	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.	10
5	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.	8

Reference Books:

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

M.E. Semester –III

ME (Computer Engineering)							**SEM : III**		
Course Name : Dissertation –I / Industry Project							**Course Code :**D1-CSME301		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral /Presentation (100)**	**Term Work (100)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
-	-	20	20	10	-	-	50	50	
Prerequisite: Domain knowledge, Undergraduate level core subjects and Subjects studied in Sem 1 & 2.									

Major Project objective:

It is expected from the learner toundertake industrially relevant problem to develop an optimal solution through extensiveresearch work.

Major Project Outcomes:

Sr. No.	Major Project Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Discover potential research areas in the field of study	Analyze(AN)
2	Conduct a survey of several available literature in the preferred field of study	Apply(A)
3	Compare and contrast the several existing solutions for research challenge	Analyze(AN)
4	Formulate and propose a plan for creating a solution for the research plan identified	Analyze(AN)
5	To report and present the findings of the study conducted in the preferred domain	Analyze(AN)
6	Patenting of outcomes if it is significant and of commercial value	Evaluate (E)

Guidelines: The students and faculty can design the research project in consultation with industry preferably in the region. The planning of laboratory work/ modelling/ computationalwork with

execution schedule is to be suggested at the being of the programme to ensure expected outcome.The learner has to carry out research in the area of his interest under the guidance of a recognized PG teacher. The pedagogic approach for completion of the dissertation has to be followed. Detailed guidelines are given below based on these guidelines the PG student should complete 3 chapters of the dissertation and submit a detailed research proposal at the end of the semester.

Sr no.	Detailed Guidelines	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Introduction: Problem statement, Research Question, Motivation of the study, Context causing the study, summarizing findings, importance of findings , road map	**5**	Analyze(AN)
2	Literature Review: Rigorous literature review of the area of research by reading and understanding at least 15 research papers from quality national/international journals/conferences. Seminal papers in the area of research should be included. Comprehensive and up to date, problem contextualization has to be done, Discussion on gaps found in extant literature.	**5**	Analyze(AN)
3	Theory Theory has to be appropriate should be logical and should align with the research question	**5**	Evaluate (E)
4	Research Proposal Writing A research proposal has to be prepared by each student which includes Introduction, Comprehensive Literature Survey pertinent to the topic of research along with research gaps that have been identified, rationale for the research, detailed methodology along with a rationale for its appropriateness, demonstration of the advantages and its disadvantages of the method and anticipated outcomes. Proposals should include the following sections 1. Introduction 2. Background and Significance 3. Literature Review 4. Research Design and Methods 5. Implications and anticipated outcomes 6. Conclusion Proper citations should be used for the sources while writing the proposal	**5**	Create(C)
	Total Hours	**20**	

References:

1. Handbook of Scientific Proposal Writing ByA.YavuzOruc, CRC press

2.Guide to Research Projects for Engineering Students: Planning, Writing and PresentingBy EngChoon Leong, Taylor and Francis.

3. Research Methods for EngineersBy David V. Thiel, Cambridge University Press

Web Reference:

1. https://libguides.usc.edu/writingguide/researchproposal

M.E. Semester –IV

ME (Computer Engineering)							**SEM : IV**		
Course Name : Dissertation –II / Industry Project							**Course Code :**D2-CSME401		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral /Presentation (100)**	**Term Work (100)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
-	-	32	32	16	-	-	100	100	**200**
Prerequisite: Domain knowledge, Undergraduate level core subjects and Subjects studied in Sem 1 & 2.									

Major Project objective:

It is expected from the learner toundertake industrially relevant problem to develop an optimal solution through extensive research work.

Major Project Outcomes:

S. No.	Major Project Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Discover potential research areas in the field of study	Analyze (AN)
2	Conduct a survey of several available literature in the preferred field of study	Apply (A)
3	Compare and contrast the several existing solutions for research challenge	Analyze (AN)
4	Formulate and propose a plan for creating a solution for the research plan identified	Analyze (AN)
5	To report and present the findings of the study conducted in the preferred domain	Analyze (AN)
6	Patenting of outcomes if it is significant and of commercial value	Evaluate (E)

Guidelines: Dissertation II will start after submission of Research Proposal as prescribed in Dissertation I.Detailed guidelines for completing Dissertation II are given below. Based on these guidelines the PG student should complete the 3 stages of these recommended guidelines. After completion

of these 3 stages a synopsis of thesis approved by the guide has to be submitted for approval to the BOE/ RRC. After the BOE/RRC meeting the student/guide will be intimated details of the recommendation/ suggestions of the committee about the synopsis. Based on these recommendations/suggestions the PG student has to incorporate changes in consultation with the guide and prepare the final thesis. Viva-voce will be conducted after submission of the final thesisin the prescribed formatwhich should becompleted in all respectsand approved by the recognized PG teacher, HOD and Principal.

Sr no.	Detailed Guidelines	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Methodology Appropriateness of the method to solve the research problem. Its advantages and disadvantages. Comparison with the state of art.	8	Analyze (AN)
2	Results and Analysis: Well presented in the form of graphs, charts, tables, diagrams etc. Appropriate data visualization techniques is to be used for easy and intelligent interpretation .	8	Create (C)
3	Conclusion and Discussions Findings should be summarized, implications and application discussed, Contribution to the body of knowledge/theory/society to be indicated , strengths, limitations and future directions for research should be discussed.	8	Evaluate(E)
4	Thesis/ Dissertation writing Thesis/ Dissertation should include the following sections Abstract 1. Introduction 2. Background and Significance 3. Literature Review 4. Research Design and Methodology 5. Results and Analysis 6. Conclusion and Discussions References Proper citations should be used for the sources while writing the thesis	8	Create (C)
	Total hours	**32**	

References:

1. Writing Your ThesisBy Paul Oliver, Sage Publications

2.Guide to Research Projects for Engineering Students: Planning, Writing and PresentingBy

EngChoon Leong, Taylor and Francis.

3. Ideas On How to Write a Conclusion of an Engineering Thesis or PaperBy Neil Bose,eBookIT

4. Thesis & Dissertation WritingBy Rivera, Maximiano.M.Jr.., Katha Publishing Inc

Web Reference:

1. https://libguides.usc.edu/writingguide/researchproposal