HYDERABAD INSTITUTE OF TECHNOLOGY AND MANAGEMENT									
B.TECH. HR-21 COURSE STRUCTURE									
CSE-DATA SCIENCE									
(Applicable for the batch admitted from 2021-22 onwards)									
V – Semester (III – Year)									
S. No.	**Subject Code**	**Subject**	**Hours Per Week**			**Credits**	**Scheme of Evaluation**		
							Maximum Marks		
			L	**T**	**P**		**Int.**	**Ext.**	**Tot.**
1	21PC5CD04	Software Engineering & Testing Methodologies	3	-	-	3	30	70	100
2	21PC5CD02	Data Mining and Data Analytics	3	-	-	3	30	70	100
3	21PC5CS08	Formal Languages and Automata Theory	3	-	-	3	30	70	100
4		**Professional Elective-I**	3	-	-	3	30	70	100
5		**Open Elective-I**	3	-	-	3	30	70	100
6	21PC5CD05	Software Engineering & Testing Methodologies-Lab	-	-	3	1.5	30	70	100
7	21PC5CD03	Data Mining and Data Analytics-Lab	-	-	3	1.5	30	70	100
8	21ES5MT08	Descriptive Statistics-Lab	-	1	1	1.5	30	70	100
9	21PR5IN02	Evaluation of Internship-II	-	1	-	1	100	0	100
10	21PR5CD02	**DS-Doing Engineering-2**	-	1	1	1.5	30	70	100
TOTAL						**22**	**370**	**630**	**1000**
Non Credit Courses									
11	21MC5HS03	Analytical Reasoning	2	-	-	0	100	0	100
VI – Semester (III – Year)									
S. No.	**Subject Code**	**Subject**	**Hours Per Week**			**Credits**	**Scheme of Evaluation**		
							Maximum Marks		
			L	**T**	**P**		**Int.**	**Ext.**	**Tot.**
1	21PC6CD06	Information Security	3	-	-	3	30	70	100
2	21PC6CS15	Compiler Design	3	-	-	3	30	70	100
3	21PC6CD07	Machine Learning and Data Science	3	-	-	3	30	70	100
4	21PC6CD08	Full Stack Web Development	3	-	-	3	30	70	100
5		**Professional Elective-II**	3	-	-	3	30	70	100
6		**Open elective-II**	3	-	-	3	30	70	100
7	21HS6EG05	Advanced English Communication Skills-Lab	-	-	2	1	30	70	100
8	21PC6CD09	Machine Learning and Data Science-Lab	-	-	3	1.5	30	70	100
9	21PC6CD10	Full Stack Web Development-Lab	-	-	3	1.5	30	70	100
TOTAL						**22**	**270**	**630**	**900**
10	21MC6HS04	Quantitative Aptitude	2	-	-	0	100	0	100

Professional Elective-I		
1	21PE5CD11	Information Visualisation
2	21PE5CS06	Computer Organization & Architecture
3	21PE5CS13	Computer Graphics
4	21PE5CS34	Design Patterns

Professional Elective-II		
1	21PE6CD21	Big Data Analytics
2	21PE6CD22	Blockchain Technology
3	21PE6CD23	Information Retrieval Systems
4	21PE6CD24	Data handling and Visualization

Sl.no	SUBJECT CODE	Open Elective-I	Offering Department
1	21OE6CS06	Computer Organization and Architecture	CSE
2	21OE5EC01	Electronics measurement & Instrumentation	ECE
3	21OE5ME01	Hybrid & Electric Vehicles	MECH
4	21OE5EE01	Fundamentals of Electric Circuit Analysis	EEE
5	21OE5HS01	Nanoscience and Technology	H&S
6	21OE5CM01	Introduction to Artificial Intelligence	CSE-AI&ML
7	21OE5CD01	Statistics for Data Science	CSE-DS
8	21OE5CO01	Introduction to IoT	CSE-IOT
9	21OE5CC01	Data Security	CSE-CS

Sl.no	SUBJECT CODE	Open Elective-II	Offering Department
1	21OE5CS09	OOPS using Java	CSE
2	21OE6EC02	Fundamentals of Digital Electronics	ECE
3	21OE6ME02	Total Quality Measurement & Six Sigma Applications	MECH
4	21OE6EE02	Fundamentals of Industrial Electronics	EEE
5	21OE6HS02	Medical Instrumentation	H&S
6	21OE6CM06	Expert Systems	CSE-AI
7	21OE6CD02	Data Mining and Data Analytics	CSE-DS

8	21OE6CO05	Sensors & Devices	CSE-IOT
9	21OE6CC02	Computer Hardware and System Essentials	CSE-CS

B.Tech	L	T	P	C
Subject Code: 21PC5CD04	3	0	0	3

Software Engineering & Testing Methodologies

Course Objectives:

- To provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies.
- To develop skills in software test automation and management using latest tools.

Course Outcomes:

- Ability to translate end-user requirements into system and software requirements, using e.g. UML, and structure the requirements in a Software Requirements Document (SRD).
- Identify and apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices.
- Will have experience and/or a*w*areness of testing problems and will be able to develop a simple testing report
- Design and develop the best test strategies in accordance to the development model.

UNIT - I

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs. Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT - II

Transaction Flow Testing: transaction flows, transaction flow testing techniques. Dataflow testing: Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing. Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT - III

Paths, Path products and Regular expressions: path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection. Logic Based Testing: overview, decision tables, path expressions, kv charts, specifications.

UNIT - IV

State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips.

UNIT - V

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like JMeter or Win-runner).

TEXT BOOKS: 1. Software Testing techniques - Baris Beizer, Dreamtech, second edition.

2. Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech.

REFERENCE BOOKS:

1. The craft of software testing - Brian Marick, Pearson Education.

2. Software Testing Techniques – SPD(Oreille)

3. Software Testing in the Real World – Edward Kit, Pearson.

4. Effective methods of Software Testing, Perry, John Wiley.

5. Art of Software Testing – Meyers, John Wiley

CO-PO &PSO Mapping:

Course Name - Course Outcomes / Program Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
CO1			H										H		
CO2		H											H		M
CO3			H										H		M
CO4			H										H		

B.Tech	L	T	P	C
Subject Code: 21PC5CD02	3	0	0	3

Data Mining and Data Analytics

Course Objective

1. Understand the concepts of Data Mining
2. Familiarize with association rule mining
3. Familiarize various classification algorithms
4. Understand the concepts of Cluster analysis
5. Implement the Data mining concepts with various domains

Course Outcomes:

1. Discuss varies Data Mining Principles.
2. Analyze the impact of data analytics for business decisions and strategy.
3. Apply the Association, Clustering rules for mining the data.
4. Design various classification techniques.

Module I

Introduction to Data warehouse, Difference between operational database systems and data warehouses. Data warehouse Characteristics, Data warehouse Architecture.
Introduction: What is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Preprocessing, Data Cleaning, Missing data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binarization, Data Transformation; Measures of Similarity and Dissimilarity – Basics.

Module II

Data Analytics: Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and variables. Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

Module III

Regression – Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc.
Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

Module IV

Association Rule Mining & Classification: Mining Frequent Patterns–Associations and correlations – Mining Methods–Mining Various kinds of Association Rules– Correlation Analysis.
Classification: Classification and Prediction – Basic concepts–Decision tree induction– Bayesian classification, Lazy learner.

Module V

Clustering and Applications: Cluster analysis–Types of Data in Cluster Analysis– Categorization of Major Clustering Methods– Partitioning Methods.
Hierarchical Methods– Density–Based Methods, Grid–Based Methods, Outlier Analysis.

TEXT BOOKS:

1. Data Mining – Concepts and Techniques – Jiawei Han & Micheline Kamber, 3rd Edition Elsevier.
2. Data Mining Techniques – ArunKPujari

REFERENCE BOOKS

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addision Wisley, 2006.
2. Data Mining Analysis and Concepts, M. Zaki and W. Meira

CO-PO &PSO Mapping:

Course Name - Course Outcomes / Program Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	M												M		
CO2	M	H											H		
CO3	H		M											M	
CO4	M													H	

B. Tech IIIYear–V Sem	L	T	P	C
Subject Code: 21PC5CS08	3	0	0	3

Formal Languages and Automata Theory

Prerequisite: Discrete Mathematical Structures knowledge

Course Objectives:

1) Determine the relationship between languages and machines and understand their power
2) Explain deterministic and non-deterministic machines
3) Explain the representation of Regular expressions
4) Understand the decidability and undecidability of problems

Course Outcomes:

1) Design Finite Automata for the given language
2) Write Regular expression for programming language constructs
3) Design Context free grammars for formal languages
4) Design Turing Machine and check for the decidability and undecidability of the language

Module I

Introduction: Alphabet, languages and grammars, Chomsky hierarchy of languages. Regular languages and finite automata: Deterministic Finite Automata (DFA), nondeterministic finite automata (NFA)

Equivalence of NFA: Equivalence with DFA, NFA with ε - moves, Conversion to NFA without ε- moves, minimization of finite automata, equivalence between FAs, Finite Automata with Outputs – Mealy machine, Moore machine and equivalence.

Module II

Regular Languages and Finite Automata: Regular sets, Regular expressions and languages, Operations on Languages - Union, Concatenation, Kleen Closure, equivalence between finite automata and regular expressions,

Regular grammars: Definition, productions, derivation, right linear and left linear grammars, and equivalence with Regular grammars and finite automata, properties of regular languages, pumping lemma for regular languages

Module III

Context-free languages: Context-Free Grammars (CFG) and Languages (CFL), parse trees, sentential forms, right most and left most derivations of strings, ambiguity in CFG, Language of the grammar

Simplification of Grammar: Simplification of the grammar Left recursion and left factoring in context free grammars, Chomsky and Greibach normal forms, Pumping Lemma for context-free languages, closure properties of CFLs**,** Decision properties of CFL

Module IV

Pushdown Automata: definition, model, acceptance of CFL, Pushdown Automata (PDA), Acceptance by final state and acceptance by empty stack and its equivalence, Equivalence of CFG and PDA (proofs not required), Nondeterministic Pushdown Automata (NPDA.

Context Sensitive Grammars: Context-Sensitive Grammars (CSG) and languages, Linear Bounded Automata (LBA) and equivalence with CSG

Module V:

Turing Machines: Introduction to Turing Machine, Formal Description, Instantaneous description, the language of a Turing machine. Types of Turing machine and halting

Computability Theory: Undecidability: Church-Turing Thesis, universal Turing Machine, undecidable problems about languages.LR (0) grammar, decidability of problems, Post's Correspondence Problem - The classes P and NP.

Text Books:

1. "Introduction to Automata Theory, Languages and Computations", H.E.Hopcroft, and J.D. Ullman, Second Edition, Pearson Education, 2003.

Reference Books:

1. "Elements of the theory of Computation", H.R.Lewis and C.H.Papadimitriou, Second Edition, Pearson Education/PHI, 2003
2. "Introduction to Languages and the Theory of Computation", J.Martin, Third Edition, TMH, 2003.
3. "Formal Languages and Automata Theory", K.V.N.Sunitha , N.Kalyani, 1stEdition, TMH, 2010

Web Resources:

1. JFLAP Simulator download link: http://www.jflap.org/
2. https://www.udemy.com/course/formal-languages-and-automata-theory
3. https://nptel.ac.in/courses/106/103/106103070/

CO-PO/PSO Mapping:

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1										1		
CO2	2	2	1												
CO3	2	2	1												
CO4	3	2	1												

B.Tech	L	T	P	C
Subject Code: 21PC5CD05	**0**	**0**	**3**	**1.5**

Software Engineering & Testing Methodologies -LAB

Course Objectives:

- To have hands on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development.

Course Outcomes:

1. Ability to translate end-user requirements into system and software requirements
2. Ability to generate a high-level design of the system from the software requirements
3. Will have experience and/or awareness of testing problems and will be able to develop a simple testing report
4. Design and develop the best test strategies in accordance to the development model.

List of Experiments

1. Development of problem statement.
2. Preparation of Software Requirement Specification Document, Design Documents and Testing Phase related documents.
3. Preparation of Software Configuration Management and Risk Management related documents.
4. Study and usage of any Design phase CASE tool
5. Develop test cases for unit testing and integration testing
6. Develop test cases for various white box and black box testing techniques.
7. Write a c program to demonstrate the working of the fallowing constructs:

i) do…while

ii) while…do

iii) if …else

iv)switch

v) for Loops in C language

8. Recording in context sensitive mode and analog mode

9 .a) GUI checkpoint for single property b) GUI checkpoint for multiple objects

10. a) Bitmap checkpoint for object/window b) Bitmap checkpoint for screen area

11. a) Database checkpoint for Default check

b) Database checkpoint for custom check c) Database checkpoint for runtime record check

12. a) Data driven test for dynamic test data submission

b) Data driven test through flat files c) Data driven test through front grids

d) Data driven test through excel test

13. a) Batch testing without parameter passing b) Batch testing with parameter passing

TEXT BOOKS:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, Mc Graw Hill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson Education.
3. The unified modeling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education.

CO-PO &PSO Mapping:

Course Name - Course Outcomes / Program Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
CO1	M	M	H										H		
CO2	M			H									H	M	
CO3			H										H	M	
CO4	M	M	H											M	

B.Tech	L	T	P	C
Subject Code: 21PC5CD03	**0**	**0**	**3**	**1.5**

Data mining and Data Analytics-lab

Course Objective

- To obtain practical experience using data mining techniques on real world data sets.
- Emphasize hands-on experience working with all real data sets.

Course Outcomes:

1: Build a data warehouse and query it using open-source tools.
2: Evaluate various data mining tasks using a data mining toolkit (such as weka) and visualize the results.
3: Determine the working of algorithms for data mining tasks such as association rule mining, classification, and clustering.
4: Implement classical models and algorithms in data mining

List of Programs:

Credit Risk Assessment
Description:

The business of banks is making loans. Assessing the credit worthiness of an applicant is of crucial importance. You have to develop a system to helpa loan officer decide whether the credit of a customer is good, or bad. A bank's business rules regarding loans must consider two opposing factors. On the one hand, a bank wants to make as many loans as possible. Intereston these loans is the banks profit source. On the other hand, a bank cannot afford to make too many bad loans. Too many bad loans could lead to the collapse of the bank. The bank's loan policy must involve a compromise: nottoo strict, and not too lenient. To do the assignment, you first and foremost need some knowledge about the world of credit. You can acquire such knowledge in a number of ways.

i. Knowledge Engineering. Find a loan officer who is willing to talk. Interview her and try to represent her knowledge in the form of production rules.
ii. Find some training manuals for loan officers or perhaps a suitable textbook on finance. Translate this knowledge from text formto production rule form.
iii. Common sense. Imagine yourself as a loan officer and make up reasonable rules which can be used to judge the credit worthiness ofa loan applicant.
iv. Case histories. Find records of actual cases where competent loan officers correctly judged when, and when not to, approve a loan application.

The German Credit Data:
Actual historical credit data is not always easy to come by because of confidentiality rules. Here is one such dataset, consisting of 1000 actual cases collected in Germany. credit dataset (original) Excel spreadsheet version of the German credit data.

In spite of the fact that the data is German, you should probably make use of it for this assignment. (Unless you really can consult a real loan officer!)

A few notes on the German dataset

- DM stands for Deutsche Mark, the unit of currency, worth about 90 cents Canadian (but looks and acts like a quarter).
- owns telephone. German phone rates are much higher than in Canada so fewer people own telephones.
- foreign worker. There are millions of these in Germany (many from Turkey). It is very hard to get German citizenship if you were not born of German parents.
- There are 20 attributes used in judging a loan applicant. The goal is the classify the applicant into one of two categories, good or bad.

Subtasks: (Turn in your answers to the following tasks)

1. List all the categorical (or nominal) attributes and the real-valued attributes separately.
2. What attributes do you think might be crucial in making the credit assessment? Come up with some simple rules in plain English usingyour selected attributes.
3. One type of model that you can create is a Decision Tree - train a Decision Tree using the complete dataset as the training data. Report the model obtained after training.
4. Suppose you use your above model trained on the complete dataset, and classify credit good/bad for each of the examples in the dataset.What % of examples can you classify correctly? (This is also called testing on the training set) Why do you think you cannot get 100 % training accuracy?
5. Is testing on the training set as you did above a good idea? Why or Why not ?
6. One approach for solving the problem encountered in the previous question is using cross-validation? Describe what is cross-validationbriefly. Train a Decision Tree again using cross-validation and report your results. Does your accuracy increase/decrease? Why?
7. Check to see if the data shows a bias against “foreign workers” (attribute 20), or “personal-status” (attribute 9). One way to do this (perhaps rather simple minded) is to remove these attributes from the dataset and see if the decision tree created in those cases is significantly different from the full dataset case which you have already done. To remove an attribute you can use the preprocess tab in Weka’s GUI Explorer. Did removing these attributes have any significant effect? Discuss.
8. Another question might be, do you really need to input so many attributes to get good results? Maybe only a few would do. For example, you could try just having attributes 2, 3, 5, 7, 10, 17 (and 21, the class attribute (naturally)). Try out some combinations. (You had removed two attributes in problem 7. Remember to reload the arff data file to get all the attributes initially before you start selectingthe ones you want.)
9. Sometimes, the cost of rejecting an applicant who actually has a good credit (case 1) might be higher than accepting an applicant who has bad credit (case 2). Instead of counting the misclassifications equally in both cases, give a higher cost to the first case (say cost 5)and lower cost to the second case. You can do this by using a cost matrix in Weka. Train your Decision Tree again and report the DecisionTree and cross-validation results. Are they significantly different from results obtained in

problem 6 (using equal cost)?

10. Do you think it is a good idea to prefer simple decision trees insteadof having long complex decision trees? How does the complexity of a Decision Tree relate to the bias of the model?
11. You can make your Decision Trees simpler by pruning the nodes. One approach is to use Reduced Error Pruning - Explain this idea briefly. Try reduced error pruning for training your Decision Trees using cross-validation (you can do this in Weka) and report the Decision Tree you obtain? Also, report your accuracy using the pruned model. Does your accuracy increase?
12. (Extra Credit): How can you convert a Decision Trees into "if-then- else rules". Make up your own small Decision Tree consisting of 2-3.levels and convert it into a set of rules. There also exist different classifiers that output the model in the form of rules - one such classifier in Weka is rules. PART, train this model and report the set of rules obtained. Sometimes just one attribute can be good enough in making the decision, yes, just one ! Can you predict what attributethat might be in this dataset? OneR classifier uses a single attributeto make decisions (it chooses the attribute based on minimum error).Report the rule obtained by training a one R classifier. Rank the performance of j48, PART and oneR.

Note: The above experiments can be implemented using weka tool.

TEXT BOOKS:

1. Data Mining – Concepts and Techniques – Jiawei Han & Micheline Kamber, 3rd Edition Elsevier.
2. Data Mining Techniques – ArunKPujari

References:

1. Mentor lecture on Decision Trees
2. Andrew Moore's Data Mining Tutorials (See tutorials on Decision Treesand Cross Validation)
3. Decision Trees (Source: Tan, MSU)
4. Tom Mitchell's book slides (See slides on Concept Learning andDecision Trees)
5. Introduction to Weka

CO-PO &PSO Mapping:

CO-PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO-1	L				H										
CO-2	L				H										
CO-3	L				H										
CO-4	L				H										

B. Tech IIIYear–V Sem	L	T	P	C
Subject Code: 21ES5MT08	0	1	1	1.5

Descriptive Statistics Lab

(Common to CSD/ CSM)

Pre-requisite: Basic knowledge of Statistics.
Course Objectives: To provide the student with

- To understand and perform the basic statistical methods on the given data.
- To analyze the data using different visualization techniques.
- To use heat map to interpret the relationship between variables.
- To apply parametric tests on the given data.

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

LAB PROGRAMS:

Week – 1: For the given csv data, describing categorical data and construction of frequency distribution tables.

Week – 2: For the given csv data, measure the central tendency – mean, median and mode, measure of dispersion -variance and standard deviation.

Week – 3: Use heat map to develop and assess the correlation matrix for finding the relationship between independent and dependent variables and also to find the relationship among dependent variables.

Week – 4: Visualizing the categorical data (Univariate Analysis) using Count plot and Pie Chart.

Week – 5: i. Visualizing the numerical data (Univariate Analysis) using Histogram and Boxplot.
ii. Visualizing the data (Univariate Analysis) using Scatterplot.

Week – 6: Visualizing the data (Multivariate Analysis) using Bar plot and Boxplot

Week – 7: Visualizing the data (Multivariate Analysis) using Line Graph.

Week – 8: Conduct sample t-test using stats library in python Make assumptions about the samples. For the given data, apply, 1-sample t-test: testing the value of a population mean.

Week – 9: For the given data, apply, 2-sample t-test: testing for difference across populations
a) Conduct sample t-test using stats library in python
b) Make assumptions about the samples.

Week – 10: For the given data, develop the contingency table and apply Chi-square test and interpret it with suitable p value.

Week – 11: For the given data, apply one way ANOVA test and perform the interpretation.

Note: The above experiments can be executed by any of the R-software or Python or Mat-lab.

TEXT BOOKS:

1. Fundamentals of mathematical statistics – SC Gupta and VK Kapoor, Sultan Chand and Sons Publication, New Delhi,11th Edition,2018
2. The art of R programming – Norman Matloff, no starch Press, San Francisco October 2011.
3. R in Action – Robert I. Kabacoff, Second Edition, Dreamtech Press, 2nd Edition, May 2015.

REFERENCE BOOKS:

1. https://www.geeksforgeeks.org/mean-median-and-mode-in-r-programming/
2. https://www.crumplab.com/statisticsLab/software.html#data
3. https://remiller1450.github.io/s209s19/Lab_1.html

Course Outcomes: After learning the contents of this paper the student must be able to

CO1: Apply the statistical tests on the given data.

CO2: Analyze the univariate and multivariate data using different visualization techniques.

CO3: Use heat map to interpret the relationship between variables.

CO4: Apply different parametric tests on the given data

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low															
Course Outcomes (COs)				**Program Outcomes (POs)**											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3											1		1
CO2	3	3											1		1
CO3	3	3											1		1
CO4	3	3											1		1

B. Tech III Year- I Sem **L T P C**
Subject Code: 21MC7HS05 **1 0 0 0**

Analytical Reasoning
(Common to CSE/EEE/ECE/CSM/CSD/CSC/CSO/ME)

Pre-requisite: Nil

Course Objectives:

1. Improve logical thinking to solve various questions and puzzles in Reasoning.
2. To help the student understand the importance of having his language skills kept ready for effective use
3. To understand the concept of employability skills
4. To enrich their problem solving, critical and analytical skills

Course Outcomes: Upon completion of the course, the student should be able to

1. Improve logical thinking to solve various questions and puzzles in Reasoning.
2. To help the student understand the importance of having his language skills kept ready for effective use
3. To understand the concept of employability skills
4. To enrich their problem solving, critical and analytical skills

Module I:

Coding and Decoding: Coding and Decoding, Arrow Method, Chinese coding, Series, Analogy, Odd man out

Articles and Tenses: Introduction, usage of articles, Omission of Articles, Types of tenses, Forms and Usage of tenses.

Module II:

Direction Sense: Introduction, Distance method, Facing Method and Shadow Method.
Blood Relations: Introduction, Direct, Puzzle and Coded models.

Module III:

Voices and Forms of Speech: Introduction, conversion of active and passive voice, conversions of direct and indirect speech.

Module IV:

Data Arrangements: Linear Arrangement, Circular Arrangement, Multiple Arrangements.
Syllogisms: Introduction, Tick-Cross method, Inferential Technique, Venn-Diagram method.

Module V:

Visual Reasoning: Patterns, Folded Images, Cubes and Analytical Reasoning.
Sentence Correction: Subject-Verb Agreement, Pronoun Antecedent, Parallelism, Verb-Time Sequence Error, Determiners and Modifiers.

Text Books:

1. Quick Learning Objective General English, R.S. Aggarwal, Vikas Aggarwal, 2nd edition, S.Chand, 2003.
2. A Modern Approach to Logical Reasoning, R.S. Aggarwal, Revised Edition, 2nd edition, S Chand & Co Ltd, 2018.

Reference Books:

1. Test of Reasoning for all competitive examinations, Edgar Thorpe, 6th Edition, McGraw Hill Education, 2017.
2. How to Prepare for Logical Reasoning for CAT and other Management Examinations, Arun Sharma, 4th edition, McGraw Hill Education, 2017.
3. English Grammar and Verbal Reasoning – The Toolkit for Success, Simbo Nuga, Trafford Publishing, 2013

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	1	-	-	-	-	2	3	-	-
CO2	-	-	-	-	-	1	-	-	-	-	2	3	-	-
CO3	-	-	-	-	-	1	-	-	-	-	2	3	-	-
CO4	-	-	-	-	-	1	-	-	-	-	2	3	-	-

B.Tech	L	T	P	C
SubjectCode: 21PE5CD11	**3**	**0**	**0**	**3**

Information Visualization

Course Objective

1. To understand the various types of data, apply and evaluate the principles of data visualization.
2. Acquire skills to apply visualization techniques to a problem and its associated dataset.
3.To apply structured approach to create effective visualizations.
4.To learn how to bring valuable insight from the massive dataset using visualization.

Course Outcomes

1. Identify the data types and its associated visualization mechanisms.
2. Apply the various scalar and vector visualization techniques to create suitable visualization for real life applications.
3. Handle and analyse multidimensional data and hierarchical data for visualization.
4.Perform multivariate data analysis and visualization.

Module I

Introduction to Data Visualization : Overview of data visualization - Data Abstraction - Task Abstraction - Analysis: Four Levels for Validation, Human Visual Perception

Module II

Visualization Techniques – I : Scalar and point techniques – vector visualization techniques – matrix visualization

Visualization Techniques – II : Visualization Techniques for Trees, Graphs, and Networks, Multidimensional data

Module III

Visual Analysis of data from various domains – I : Time-oriented data visualization – Spatial data visualization and case studies

Visual Analysis of data from various domains – II : Text data visualization – Multivariate data visualization, and case studies

Module IV

Designing Effective Visualizations : Guidelines for designing successful visualizations, Data visualization dos and don’ts

Module V

Dashboard Creation and Visual Story Telling : Dashboard Design principles, Effective Dashboard Display Media, Dashboard creation using visualization tools for the use cases: Finance- marketing-insurance-healthcare etc.,

TEXT BOOKS:

1. Tamara Munzer, "Visualization Analysis and Design", CRC Press, 2014.

2. Stephen Few, "Now You See It", Analytics Press, 2009.

REFERENCE BOOKS:

1. Stephen Few, "Information Dashboard Design: the effective visual communication of data", Oreilly, 2006.
2. Matthew O. Ward, Georges Grinstein, Daniel Keim "Interactive Data Visualization: Foundations, Techniques, and Applications", CRC Press, Second Edition, 2015.
3. Dr.Chun-hauh Chen, W.K.Hardle, A. Unwin, "Handbook of Data Visualization", Springer publication, 2008.
4. Ben Fry, "Visualizing Data", O'Reilly Media, 2008
5. Winston Chang, "R Graphics Cookbook", O'Reilly, 2012.

CO-PO &PSO Mapping:

Course Name - Course Outcomes / Program Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
CO1	M												M		
CO2	H												H		
CO3	M												M		
CO4	H												H		

B. Tech III Year – I Sem	**L**	**T**	**P**	**C**
Subject Code: 21PE5EC12	3	0	0	3

Computer Organization and Architecture
(Professional Elective –I)

Prerequisite: Digital logic Design

Course Objectives: This course will enable students to:

1. To describe the functional blocks of a computer to interpret the instructions and various addressing modes for the execution of instruction cycle
2. To perform Arithmetic micro operations on integers and floating-point numbers
3. To study the design of data path unit and control unit for processor
4. To discuss the different ways of communicating with I/O devices & interfaces and the design techniques to enhance the performance using pipelining, parallelism.

Course Outcomes: Upon completing this course, the student will be able to

1. Describe data representation, instruction formats and the operation of a digital computer
2. Analyze the fixed point and floating-point arithmetic for ALU operation
3. Discuss about implementation schemes of control unit and pipeline performance
4. Explain the concept of various memories, interfacing and organization of multiple processors.

Module-I

Functional Blocks of a Computer: CPU, memory, input-output subsystem, control unit. Instruction set architecture of a CPU – registers. Instruction execution cycle, **RTL:** Register Transfer Language and Micro Operations: Register Transfer Language, Register Transfer Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit, Instruction Codes, Computer Registers, Computer Instructions – Instruction Cycle. Memory – Reference Instructions, Input – Output and Interrupt, STACK Organization, Instruction Formats, Addressing Modes, DATA Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

Module-II

Data Representation: Signed number representation, fixed and floating point representations, character representation. Computer Arithmetic: Integer Addition and Subtraction - Ripple carry adder, carry look- ahead adder. Multiplication – Shift-and add, Booth multiplier, carry save multiplier. Division – Restoring and non-restoring techniques, floating point arithmetic

Module-III

The Memory System: Virtual Memories Secondary Storage, Introduction to RAID.
Input - Output Organization : Input-Output Interface, Asynchronous Data Transfer Modes, Priority Interrupt, Direct Memory Access, Input –Output Processor (IOP), Serial Communication; Introduction to Peripheral Components, Interconnect (PCI) Bus, Introduction to Standard Serial Communication Protocols like RS232, USB, IEEE1394

Module-IV

Peripheral Devices and their Characteristics: Input-output subsystems, I/O device interface, I/O transfers, - program controlled, Interrupt driven and DMA, privileged and non –privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in

process state transitions, I/O device interfaces – SCSI, USB .The Processor: Introduction, Logic Design Conventions, Building a Data path – A Simple Implementation scheme. Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions.

Module-V

Advanced Computer Architecture: Parallel processing architectures and challenges, Hardware multithreading, Multicore and shared memory multiprocessors, Introduction to Graphics Processing Units, Clusters and Warehouse scale computers – Introduction to Multiprocessor network topologies. Pipeline and Vector Processing: Parallel Processing, Pipelining, Pipelining concepts, Types of Data Hazards and Control Hazards, Understanding various techniques to handle these hazards, Arithmetic Pipeline, Instruction pipe line, RISC pipeline Vector Processing, Array Processors

Textbooks:

1. Computer Organization and Design, David A. Patterson and John L. Hennessey, Fifth edition, Morgan Kauffman / Elsevier, 2014.
2. Computer Architecture and Organization: An Integrated approach, Miles J. Murdocca and Vincent, P. Heuring, Second edition, Wiley India Pvt Ltd, 2015

Reference Books:

1. Computer Organization, V. Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky,Fifth edition, Mc Graw-Hill Education India Pvt Ltd, 2014.
2. Computer Organization and Architecture‖, William Stallings, Seventh Edition, Pearson Education, 2006.
3. Computer Architecture and Organization, Design Principles and Applications, Govindarajalu, Second edition, McGraw-Hill Education India Pvt Ltd, 2014.

Web Resources:

1. https://www.sites.google.com/site/coaexpert/useful-links

CO-PO MAPPING:

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	2	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	-	1	-	1	-	-	-	-	-	-	-	-	2

B.Tech III Year- V Sem	L	T	P	C
Subject Code: 21PE5CS13	3	0	0	3

Computer Graphics

Course Objectives

1. To provide a comprehensive introduction to computer graphics leading to the ability to understand contemporary terminology, progress, issues, and trends.
2. To understand computer graphics techniques (2-D/3-D), focusing on 3D modelling, image synthesis, and rendering.
3. Introduce geometric transformations, geometric algorithms, software systems (OpenGL), 3D object models (surface, volume and implicit), visible surface algorithms, image synthesis, shading and mapping, ray tracing, radiosity, global illumination, photon mapping, and anti-aliasing.
4. To explore the interdisciplinary nature of computer graphics which is emphasized in the wide variety of examples and applications.

Course Outcomes

1. Develop a facility with the relevant mathematics of computer graphics, e.g., 3D rotations using both vector algebra, geometrical transformations and projections using homogeneous co-ordinations.
2. Illustrate Geometric transformations on both 2D and 3D objects
3. Apply principles and techniques of computer graphics.
4. Apply computer graphics concepts in the development of computer games, information visualization, and business applications.

MODULE- I

Introduction and Line Generation: Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Midpoint circle generating algorithm, and parallel version of these algorithms.

MODULE -II

Transformations: Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing. Windowing and Clipping: Viewing pipeline, Viewing transformations, 2-D Clipping algorithms-Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against nonrectangular clip windows; Polygon clipping – Sutherland Hodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping.

MODULE -III

Three Dimensional: 3-D geometric primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping.

MODULE-IV

Curves and Surfaces: Quadric surfaces, Spheres, Ellipsoid, Blobby objects, introductory concepts of Spline, B spline and Bezier curves and surfaces.

MODULE -V

Computer animation: Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications

Hidden Lines and Surfaces: Back Face Detection algorithm, Depth buffer method, A- buffer method, Scan line method

Text Books

1. Computer Graphics C Version – Donald Hearn and M Pauline Baker, Pearson Education
2. "Computer Graphics Principles & practice", second edition in C, Foley, Van Dam, Feiner and Hughes, Pearson Education.

Reference Books

1. Computer Graphics – Amrendra N Sinha and Arun D Udai, TMH Publications
2. Computer Graphics: A Programming Approach – Steven Harrington, TMH Publications
3. Procedural Elements of Computer Graphics – Rogers, McGraw Hill
4. Computer Graphics, Steven Harrington, TMH Publications

CO-PO &PSO Mapping:

Course Name - Course Outcomes / Program Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
CO1	3		3						3						
CO2	3		3		3				3						
CO3	3		3		3				3						
CO4	3		3		3				3						

B. Tech III Year–V Sem **L T P C**
3 0 0 3

Subject Code: 21PE5CS34

Design Patterns

Prerequisites: Database Management Systems

Course Objectives:

1. Understand the concept of Design patterns and its importance.
2. Understand the behavioral knowledge of the problem and solutions.
3. Relate the Creational, Structural, behavioral Design patterns.
4. Apply the suitable design patterns to refine the basic design for given context.

Course Outcomes:

1. Identify the appropriate design patterns to solve object oriented design problems..
2. Develop design solutions using creational patterns.
3. Apply structural patterns to solve design problems.
4. Construct design solutions by using behavioral patterns.

Module: 1

Design Patterns & Anti-patterns: What Is a Design Pattern?, Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern. The symptoms of bad design, which we call code smells or anti patterns.

Module 2:

A Case Study: Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation.

Module 3:

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype,Singleton.

Module 4:

Structural Patterns: Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy.

Module 5:

Behavioral Design Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, Strategy, Template Method, Visitor.

Text Books

1. Design Patterns By Erich Gamma, Pearson Education

2. Design Patterns E xplained By Alan Shalloway,Pearson Education..

3. Meta Patterns designed by Wolf gang , Pearson.

References

1. Head First Design Patterns By Eric Freeman-Oreilly-spd

2. JAVA Enterprise Design Patterns Vol-III By Mark Grand ,Wiley DreamTech.

3. Pattern‟s in JAVA Vol-I By Mark Grand ,Wiley DreamTech.

4. Pattern‟s in JAVA Vol-II By Mark Grand ,Wiley DreamTech.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		2									
CO2	3	2										
CO3	3		2	2								
CO4	3		2									

B. Tech III Year–V Sem	L	T	P	C
Subject Code: 21OE5CS06	3	0	0	3

Computer Organization and Architecture

Pre-requisite: NIL

Course Objective:

1. The purpose of the course is to introduce principles of computer organization and the basic architectural concepts
2. Understand the representation fixed-point and floating-point numbers in computer and develop hardware algorithms using them for fixed-point and floating-point arithmetic.
3. The course would display understanding of instruction set of RISC processor and develop understanding of how memory is organized and managed in a modern digital computer, including cache, virtual and physical memory.
4. It discusses input-output units and how they communicate with the processor, and howtheir performance is computed.

Course Outcomes:

1. Understand the theory and architecture of Digital computer system
2. Define different number systems, compliments, combinational circuits and Sequential circuits
3. Explain and use fixed point addition, subtraction, multiplication (Booth's) and division (Restoring and non-restoring) algorithms
4. Explain the concept of Computer I/O Organization, Memory, RISC, CISC Characteristics

Module I:

Digital Computers: Introduction to digital computers, need of Computer Organization and Computer Architecture, Basic of Computer Architecture and Organisation, Von Neumann Computers

Data Representation: Data Types, (r-1)'s Compliment, r's compliment, Fixed point Representation, conversion of Fractions, Floating point representation, Gray code, Error detection code

Module II:

Digital Logic Circuits -I: Logic gates, Boolean Algebra, Map simplification, Combinational circuits-Half Adder and Full Adder, Decoders and Multiplexers

Digital Logic Circuits -II: Flip-Flops- SR, JK, D, T and Edge triggered, Excitation Tables, Registers, Shift Registers, Binary Counters

Module III:

Computer Arithmetic -I: Addition and subtraction, multiplication Algorithms, Division Algorithms

Computer Arithmetic –II: Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.

Module IV:

Basic Computer Organization: Instruction Codes, Computer Registers, Computer Instructions, Timing and control, Instruction Cycle, Memory- Reference Instructions, Input-Output and Interupt

Input-Output Organization: Priority interrupt, Peripheral devices, Input output interface, Data transfer schemes, Program control and interrupts, Direct memory access transfer, Input/output processor.

Module V:

Memory Unit: Memory Hierarchy, Main Memory, Auxiliary Memory, Associate Memory and Cache Memory

Computer Architecture: CISC Characteristics, RISC Characteristics.

Text Books:

1. Computer System Architecture by Morris Mano, Prentice hall, 3rd Edition, (2007)
2. Computer Organization by Carl Hamacher, Zvonko Vranesic, SafwatZaky, Tata McgrawHill, 5th Edition, (2011)

References:

1. Computer Architecture: A Quantitative Approach by Hennessy, J. L, David A Patterson, and Goldberg, Pearson Education, 4th Edition, (2006)
2. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.

CO-PO/PSO Mapping Chart:

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*		
CO-PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO-1	2													**2**	
CO-2	2	2	3											2	
CO-3	2	2	2											2	
CO-4	2	2	2											2	

B. Tech III Year – V Sem	L	T	P	C
Subject Code: 21OE5EC01	3	0	0	3

ELECTRONIC MEASUREMENTS & INSTRUMENTATION

(OPEN ELECTIVE)

Prerequisite: Basic Electrical and Electronics

Course Objectives: This course will enable students to:

1. Learn and understand functioning of various measuring system and metrics for performance analysis.
2. Acquire knowledge of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
3. To Compare various measuring bridges and their balancing conditions.
4. Learn and understand the use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

Course Outcomes: Upon completion of the course, the student should be able to

1. Explain the instrument and measurements of the parameters
2. Describe signal generators and analyzers
3. Categorize oscilloscopes for different applications
4. Apply the transducers for measurement of different parameters

MODULE I : Performance characteristics of instruments

Static characteristics: Accuracy, Resolution, Precision, Expected value, Error, Sensitivity.

Dynamic Characteristics: Speed of response, Fidelity, Lag and Dynamic error.

Types of errors in measurements and their analysis. Design of multi-range AC , DC meters (voltmeter &ammeter) and ohmmeter(series &shunt type) using D'arsonval movement. True rms meter.

MODULE II

Bridge circuits : Wheat stone bridge, measurement of very low resistance, Measurement of inductance- Maxwell's bridge, Anderson bridge. Measurement of capacitance-Schearing Bridge. Wien Bridge, Errors and precautions in using bridges.

Q-meter: principle of operation, measurement methods and sources of errors.

Counters : principle of operation -modes of operation- totalizing mode, frequency mode and time period mode- sources of errors.

MODULE III

Specifications and designing aspects of Signal Generators: AF sine and square wave signal generators, Function Generators, Random noise generators, arbitrary waveform generators.

Wave Analyzers: Harmonic Distortion Analyzers, Spectrum Analyzers, Digital Fourier Analyzers.

MODULE IV:

General purpose CROs: Block diagram, functions and implementation of various blocks, specifications, various controls and their functions, types of probes used in CROs. Measurement of frequency and phase difference using Lissajous patterns.

Special purpose CROs: sampling oscilloscope, analog storage oscilloscope, digital storage oscilloscope.

MODULE V:

Transducers: Transducers, Active & Passive transducers: Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers.

Measurement of physical parameters: Temperature, force, pressure, velocity, acceleration and displacement.

Textbooks :

1. Electronic instrumentation, second edition - H.S. Kalsi, Tata McGrawHill,2004.
2. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrickand W.D. Cooper, PHI, 5th Edition, 2002.
3. Electronic Measurements And Instrumentation- A.K. Sawhney, Dhanpat Rai&CO(P) Limited, Jan2015.

Reference books:

1. Electronic Instrumentation & Measurements - David A. Bell, PHI, 3rd Edition,2013.
2. Electrical and Electronic Measurement and Instrumentation A.K. Sawhney. Dhanpat Rai & Co, 12thEdition,2002.

CO-PO &PSO Mapping:

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	-	-	-	-	-	-	-	-	-	1	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO4	2	2	-	-	-	-	-	-	-	-	-	1	2	-

B. Tech III Year–V Sem	L	T	P	C
Subject Code: 21OE5ME01	3	0	0	3

Hybrid & Electric Vehicles

Pre-requisites: IC engines, automobile engineering, basic electrical electronics engineering

Objectives: To understand the fundamental concepts, and principles, of hybrid and electric vehicles.

To know the various aspects of hybrid and electric drive trains such as their configuration,

Students should understand various automotive systems and the basics of the drive train in automobiles.

Module I

Introduction: Layout of the automobile–introduction chassis and body components. Types of Automobile engines–Power unit -working of two stroke and four stroke engine–Introduction to engine lubrication–engine servicing

Fuel System: Fuel supply systems working in IC engines,–fuel injection an its types.

Cooling System: Cooling Requirements, Air Cooling, Forced Circulation System–Radiators–Types–Cooling Fan-water pump, thermostat, evaporative cooling-antifreeze solutions.

Module II

Ignition System: Function of an ignition system, battery ignition system, constructional features ofstorage, battery, auto transformer, contact breaker points, condenser, and spark plug.

Electrical System: Charging circuit, generator, current – voltage regulator – starting system, Bendixdrive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge–oil pressure gauge, engine temperature indicator etc.

Transmission System: -components and working principle. The layout of the power transmission system in a conventional and hybrid vehicle (fuel vs electrical)-introduction of components

Suspension System: Objects of suspension systems –, Dependent and Independent suspension system, air suspension system. Vehicle stability assist supplemental restraint system (SRS).

Module III

Braking System: Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic..

Steering System: Steering geometry – Ackerman Steering Mechanism, Davis Steering Mechanism ,Hydraulic and electric power steering-working principle ,construction and working.

Introduction To Hybrid Vehicles:

History of hybrid and electric vehicles, social and The environmental importance of hybrid and electric vehicles, the impact of modern drive-trains on energy supplies.

Module IV

Hybrid Electric Drive-Trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Electric Trains: Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Module V

Energy Storage: Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

Energy Management Strategies: Energy Management Strategies: Introduction to energy

management strategies used in hybrid and electric vehicles, classification of different energy management strategies,

TEXTBOOKS:

1. Automobile Engineering/WilliamHCrouse.
2. A Text Book Automobile Engineering–Manzoor, Nawazish Mehdi & Yosuf Ali, Frontline Publications.
3. T. Denton, Electric and Hybrid Vehicles, Routledge, 2016

Reference Books:

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016
3. K. Netwon, W. Steeds, T. K.Garrett, ―Automotive Engineering‖, Butterworth-Heinamann, 13th Edition, 2016.

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

1. Understand the working of IC engines,
2. Demonstrate the working of power transmission and brakes.
3. Understand the models to describe conventional, and hybrid vehicles and their performance.
4. Understand the different strategies related to energy storage systems.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – High; 2 – Medium; 1 –Low

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1											2	2
CO2	3	1											2	2
CO3	3	1											2	2
CO4	3	1											2	2

	L	T	P	C
B.Tech III Year – V Sem				
Subject Code: 21OE5EE01	**3**	**0**	**0**	**3**

FUNDAMENTALS OF ELECTRICAL CIRCUIT ANALYSIS

Pre-requisite: Basic Mathematics & Physics

Course Objectives:

1) To introduce the concepts of electrical circuits and their components
2) To Analyze electrical circuits with the help of network theorems
3) To understand DC circuits and single-phase AC circuits
4) To analyse the magnetic circuits

Course Outcomes:

At the end of course student will be able to do

1. CO1 – To understand the electrical circuits with DC excitation.
2. CO2 – To analyze electrical circuits with the help of network theorems
3. CO3 – To analyze electrical circuits with AC excitation
4. CO4 – To analyse the magnetic circuits.

Module I: D.C. Circuits

Introduction to Electrical Circuits: Current, Voltage, Power, Energy, Ohm's law, types of elements, Kirchoff laws, types of sources, resistive networks, inductive networks, capacitive networks, series, parallel circuits, analysis of simple circuits with dc excitation.

Network Analysis: Mesh and Nodal analysis, Voltage and current divide rule, source transformation technique, and star-delta and delta star transformation, simple problems.

Module II:Network Theorems

Network Theorems -I: Superposition, reciprocity, Thevenin's, Norton's theorems for DC excitations, numerical problems.

Network Theorems -II: Tellegen's, Maximum power transfer, Milliman's for DC excitations, numerical problems.

Module III:A.C. Circuits

Single Phase AC Circuits: Representation of sinusoidal waveforms, Average and RMS values, peak factor, and Formfactor. Real power, Reactive power, Apparent power, power factor, Numerical problems.

RLC Analysis:Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, and RLC combinations for both series and parallel, Numerical problems.

Module IV:Magnetic Circuits

Absolute and Relative Permeability of a Medium, Laws of Magnetic Force,Flux Density (B),Faraday's laws of electromagnetic induction –concept of self and mutual inductance – dot convention

Coefficient of coupling –composite magnetic circuit - Analysis of series and parallel magnetic circuit, Simple Problems.

Module V: Network Topologies

Network Topology-I
Basic definitions of graph theory, Incidence Matrices, Branch path incidence matrices**,** and numerical problems.

Network Topology-II
Cut set matrices, Relation between branch currents I_b and loop currents I_l, Tie set matrices, the relation between branch voltages and node voltages. Duality concept and numerical problems.

TEXTBOOKS:

1. A Chakrabarty, "Electric Circuits", Dhanipat Rai & Sons, 6th Edition, 2010. L.S. Bobrow, Fundamentals of Electrical Engineering", Oxford University Press, 2011
2. M E Van Valkenberg, "Network Analysis", PHI, 3rd Edition, 2014.

REFERENCE BOOKS:

1. A Sudhakar, Shyammohan S Palli, "Circuits and Networks", Tata McGraw-Hill, 4th Edition, 2010.
2. David A Bell, "Electric circuits", Oxford University Press, 7th Edition, 2009.
3. Electrical Engineering Fundamentals, Vincent Deltoro, Second Edition, Prentice-Hall India, 1989

Web Resources:

1. **https://nptel.ac.in/courses/108/104/108104139/**

2. https://nptel.ac.in/courses/117/106/117106108/

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2			3								2	2
CO2	2	3											2	
CO3	2	3											2	
CO4	2	1											2	

B.Tech III Year – V Sem	**L**	**T**	**P**	**C**
Subject Code: 21OE5CM01	**3**	**0**	**0**	**3**

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Course Objectives

1. To provide a strong foundation of fundamental concepts in artificial intelligence.
2. To provide a basic exposition to the goals and methods of Artificial intelligence
3. To provide the exposition to uncertainty management, decision making and learning methods.
4. To provide different knowledge representation, reasoning, and learning techniques.

Course Outcomes

1. Discuss basic concepts of Artificial Intelligence, AI principles, AI Task domains and application.
2. Apply searching techniques, constraint satisfaction problem and game playing techniques which involve perception, reasoning and learning.
3. Explain working of uncertainty management, decision making and learning methods.
4. Apply different knowledge representation, reasoning, and learning techniques to real world problems.

MODULE-I

Introduction: Artificial Intelligence, AI Problems, AI Techniques, the Level of the Model, Criteria for Success. Problem Space and Search, Defining the Problem as a State Space Search, Problem Characteristics; Tic-Tac-Toe Problem, Production Systems.

Basic Search Techniques: Solving Problems by searching; Issues in The Design of Search Programs; Uniform search strategies; Breadth first search, depth first search, depth limited search, bidirectional search, Best First search, comparing search strategies in terms of complexity.

MODULE-II

Special Search Techniques: Heuristic Search, greedy best first search, A* search Problem Reduction, AO*Algorithm; Hill climbing search, Simulated Annealing search; Genetic Algorithm; Constraint Satisfaction Problems; Adversarial search, Games, Optimal decisions and strategies in games, Minimax search, Alpha, beta pruning.

Knowledge Representation: Procedural Vs Declarative Knowledge, Representations & Approaches to Knowledge Representation, Forward Vs Backward Reasoning, Matching Techniques, Partial Matching, Fuzzy Matching Algorithms and RETE Matching Algorithms.

MODULE-III

Symbolic Logic: Propositional Logic, First Order Predicate Logic: Representing Instance and is-a Relationships, Computable Functions and Predicates, Syntax & Semantics of FOPL, Normal Forms, Unification &Resolution, Representation Using Rules, Natural Deduction.

Structured Representations of Knowledge: Semantic Nets, Partitioned Semantic Nets, Frames, Conceptual Dependency, Conceptual Graphs, Scripts, CYC.

MODULE-IV

Reasoning under Uncertainty: Introduction to Non-Monotonic Reasoning, Truth Maintenance Systems, Logics for Non-Monotonic Reasoning, Model and Temporal Logics.

Statistical Reasoning: Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Probabilistic Inference, Bayesian Networks, Dempster-Shafer Theory.

Fuzzy Logic: Crisp Sets, Fuzzy Sets, Fuzzy Logic Control, Fuzzy Inferences & Fuzzy Systems.

MODULE-IV

Experts Systems: Overview of an Expert System, Structure of an Expert Systems, Different Types of Expert Systems- Rule Based, Model Based, Case Based and Hybrid Expert Systems, Knowledge Acquisition and Validation Techniques, Black Board Architecture, Knowledge Building System Tools, Expert System Shells, Fuzzy Expert systems.

Learning: Types of learning, general learning model, Learning by induction; generalization, specialization, example of inductive learner.

Text Book:

1. Artificial Intelligence, George F Luger, Pearson Education Publications
2. Artificial Intelligence, Elaine Rich and Knight, Mcgraw-Hill Publications

References:

1. Introduction To Artificial Intelligence & Expert Systems, Patterson, PHI
2. Multi Agent systems- a modern approach to Distributed Artificial intelligence, Weiss. G, MIT Press.
3. Artificial Intelligence: A modern Approach, Russell and Norvig, Printice Hall

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low

CO/PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO2	PSO3
CO-1		3										2	2		
CO-2	3												2		
CO-3		3										2	2		
CO-4	3											2	2		

B.Tech III – V Sem **L T P C**
Subject Code: 21OE5CD01 **3 0 0 3**

Statistics for Data Science

Course Objective

1. The Number Theory basic concepts useful for cryptography etc
2. The theory of Probability, and probability distributions of single and multiple random variables 3. The sampling theory and testing of hypothesis and making inferences
4. Stochastic process and Markov chains.

Course Outcomes:

1. Apply the number theory concepts to cryptography domain
2. Apply the concepts of probability and distributions to some case studies
3. Correlate the material of one unit to the material in other units
4. Resolve the potential misconceptions and hazards in each topic of study.

Module I

Greatest Common Divisors and Prime Factorization: Greatest common divisors, The Euclidean algorithm, The fundamental theorem of arithmetic, Factorization of integers and the Fermat numbers
Congruences: Introduction to congruences, Linear congruences, The Chinese remainder theorem, Systems of linear congruences

Module II

Simple Linear Regression and Correlation: Introduction to Linear Regression, The Simple Linear Regression Model, Least Squares and the Fitted Model, Properties of the Least Squares Estimators, Inferences Concerning the Regression Coefficients, Prediction, Simple Linear Regression Case Study
Random Variables and Probability Distributions: Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions, Statistical Independence. Discrete probability
Distributions: Binomial Distribution, Poisson distribution.

Module III

Continuous Probability Distributions: Normal Distribution, Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial, Fundamental Sampling
Distributions: Random Sampling, Sampling Distributions, Sampling, Distribution of Means and the Central Limit Theorem, Sampling Distribution of S2, t–Distribution, F Distribution.

Module IV

Estimation & Tests of Hypotheses: Introduction, Statistical Inference, Classical Methods of Estimation. Estimating the Mean, Standard Error of a Point Estimate, Prediction Intervals, Tolerance Limits, Estimating the Variance, Estimating a Proportion for single mean, Difference between Two Means, between Two Proportions for Two Samples and Maximum Likelihood Estimation.

Module V

Stochastic Processes and Markov Chains: Introduction to Stochastic processes- Markov process. Transition Probability, Transition Probability Matrix, First order and Higher order Markov process, n step transition probabilities, Markov chain, Steady state condition, Markov analysis.

TEXT BOOKS:

1. Kenneth H. Rosen, Elementary number theory & its applications, sixth edition, Addison Wesley, ISBN 978 0-321-50031-1
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists, 9th Ed. Pearson Publishers.
3. S. D. Sharma, Operations Research, Kedarnath and Ramnath Publishers, Meerut, Delhi

REFERENCE BOOKS:

1. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications 2. T.T. Soong, Fundamentals of Probability And Statistics For Engineers, John Wiley & Sons Ltd, 2004.
3. Sheldon M Ross, Probability and statistics for Engineers and scientists, Academic Press.

CO-PO &PSO Mapping:

Course Name - Course Outcomes / Program Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO 2	PSO 3
CO1	M	L			L										
CO2	M	L			L										
CO3	M	L			L										
CO4	M	L			L										

B. Tech III Year – V Sem	L	T	P	C
Subject Code: 21OE5CO01	3	0	0	3

FUNDAMENTALS OF IOT

PREREQUISITE: Basics of computers

COURSE OBJECTIVE:

1. The Internet is evolving to connect people to physical things and also physical things to other physical things all in real time.
2. The course enables student to understand the basics of Internet of things and protocols.
3. Introduces some of the application areas where Internet of Things can be applied.
4. Students will learn about the middleware for Internet of Things. To understand the concepts of Web of Things

COURSE OUTCOMES:

1. Interpret the concepts of IoT
2. Analyze the importance of Protocols in IoT
3. Understand the IoT architecture
4. Apply IoT concepts in Industry applications and IoT platforms

Module 1:

Introduction to IOT - IoT and its importance, Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications

Overview of Governance, Privacy and Security Issues.

Module II

IOT PROTOCOLS - Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – **Protocols** – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security

Module III

IOT ARCHITECTURE - IoT Open-source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models

IoTivity : An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.

Module IV

WEB OF THINGS - Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT

Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.

Module V:

IOT APPLICATIONS – Qualitative study of sensors, IoT applications for industry: Future Factory Concepts, Smart Objects, Smart Applications.

Study of existing IoT platforms /middleware, IoT- A, Hydra etc.

TEXT & REFERENCES:

Text:

- Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.
- Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet ofThings", Springer, 2011.
- David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a HighlyConnected World", Cambridge University Press, 2010.
- Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applicationsand Protocols", Wiley, 2012.

References:

- Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014
- Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to ConnectingEverything", 1st Edition, Apress Publications, 2013
- CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1

Course Outcomes (CO)	**CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low**													
	Program Outcomes (POs)												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3								2	2			1	
CO2	3	1			3				2	2			2	
CO3	3	1			2				2	2			2	
CO4	3	1	3		3				2	2			1	

B. Tech III Year–V Sem	**L**	**T**	**P**	**C**
Subject Code: 21OE5CC01	**3**	**1**	**-**	**4**

DATA SECURITY

Prerequisite(s): Nil

Course Objectives:

• To introduce different classical cryptographic techniques and its theoretical security analysis.
• To provide and demonstrate different cryptanalysis attacks against the cryptographic techniques, and their attack models.
• To show the impact of these ciphers on society during the time of their use.

Course Outcomes:

At the end of the course, students are able to:

CO1: Identify the basic language & terminologies of cryptography.
CO2: Demonstrate Encryption and Decryption methods using various ciphers of classical cryptography.
CO3: Perform cryptanalysis of classical cryptography.
CO4: Understand the concept of digital signatures.

Module 1:

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks.
Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric keycryptography, steganography, key range and key size, possible types of attacks.

Module 2:

Symmetric key Ciphers: Algorithms Types, Algorithm Modes, Data Encryption Standards, International Data Encryption Algorithm (IDEA), RC4, RC5, Blowfish,
Case Study: Secure Multiparty Calculation.

Module 3:

Asymmetric key Ciphers - I: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Comparison of symmetric and symmetric Key Cryptography.

Module 4:

Asymmetric key Ciphers - II: Digital signatures, Elgamal Digital Signature Scheme, Attacks on Digital Signature, Knapsack Algorithm, Problems with Public key Exchange.

Module 5:

Public – Key Infrastructure : Digital Certificates, private - Key management, The PKIX Model, Public Key Cryptography Standards(PKCS) , XML, PKI and security.

Text Books:

1. Padmanabhan T R, Shyamala C and Harini N, "Cryptography and Security", Wiley Publications 2011.
2. Josef Pieprzyk, Thomas Hardjono and Jenifer Seberry, "Fundamentals of Computer Security", Springer 2010.

Resources:

1. Douglas R Stinson, "Cryptography: Theory and Practice", CRC Press 2005.
2. Alfred J Menezes, Paul C Van Oorshot and Scott A. Vanstone, "Handbook of Applied Cryptography", CRC press 1996.

CO-PO/PSO Mapping:

CO-PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO2	PSO3
CO-1			2				3								
CO-2				2			1								
CO-3				3				1							
CO-4		1						3							

B.Tech	L	T	P	C
SubjectCode: 21PC6CD06	3	0	0	3

Information Security

Course Objective

- To understand the fundamentals of Cryptography
- To understand various key distribution and management schemes
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To apply algorithms used for secure transactions in real world applications

Course Outcomes:

- Demonstrate the knowledge of cryptography, network security concepts and applications.
- Apply security principles in system design.
- Understand the basic cryptographic algorithms, message and web authentication and security issues.
- Identify information system requirements for both of them such as client and server.

Module I

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security. Classical Encryption Techniques, DES, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operation, Blowfish, Placement of Encryption Function, Traffic Confidentiality, key Distribution, Random Number Generation.

Module II

Public key Cryptography Principles, RSA algorithm, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography. Message authentication and Hash Functions, Authentication Requirements and Functions, Message Authentication, Hash Functions and MACs Hash and MAC Algorithms SHA-512, HMAC.

Module III

Digital Signatures, Authentication Protocols, Digital signature Standard, Authentication Applications, Kerberos, X.509 Directory Authentication Service. Email Security: Pretty Good Privacy (PGP) and S/MIME.

Module IV

IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.
Web Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET)

Module V

Intruders, Viruses and Worms Intruders, Viruses and related threats Firewalls: Firewall Design Principles, Trusted Systems, Intrusion Detection Systems.

TEXT BOOKS:

1. Cryptography and Network Security (principles and approaches) by William Stallings Pearson Education, 4th Edition.

REFERENCE BOOKS:

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Principles of Information Security, Whitman, Thomson.

CO-PO &PSO Mapping:

Course Name - Course Outcomes / Program Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
CO1	M	M	H										H		
CO2	H													M	
CO3	M		H										M		
CO4		M	H											H	

B.Tech III Year – VI Sem	L	T	P	C
Subject Code: 21PC6CS15	3	0	0	3

COMPILER DESIGN

Prerequisite: Formal Languages of Automata Theory and C programming

Course Objectives:

1. To introduce the major concept areas of language translation and compiler design
2. To enrich the knowledge in various phases of compiler and its use
3. To implement Various parsers like LL,LR
4. To provide practical programming skills necessary for constructing a compiler

Course Outcomes:

1. Ability to apply the knowledge of lex tool &yacc tool to develop a scanner & parser
2. Ability to design a compiler, given a set of language features
3. Ability to implement various parsers like LR,LL
4. Design algorithms to do code optimization in order to improve the performance of a program in terms of space complexity and time complexity.

Module-1:

Introduction to Compilers – Analysis of the source program – Structure of a compiler, Phases of a compiler —the science of building a compiler, Compiler construction tools-YACC.

Lexical Analysis — Role of Lexical Analyzer — Input Buffering — Recognition of Tokens — the Lexical-Analyzer Generator Lex — Finite Automata — From Regular Expressions to Automata — Minimizing DFA

Module-2:

Syntax Analysis: Introduction, Grammars — Context-free grammars — Writing a grammar .Types of Parsings—Top-Down, Bottom-U, **Top-Down Parsing :** With Back Tracking –Eg : Brute Force ;Without Back Tracking or Predictive Parsing – i) Recursive Descent Parser, ii)Non-Recursive descent like LL(1) parser.

Bottom-UP Parsing, **shifts reduce parser**:

i) LR parser, LR (0), SLR (1),LALR(1),CLR(1)
ii) Operator Precedence parser Error Handling and Recovery in Syntax Analyzer-YACC.

Module – 3:
Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's.

Intermediate-Code Generation:
Variants of Syntax Trees, Three-Address Code, Types and Declarations, Type Checking, Control Flow, Switch-Statements, Intermediate Code for Procedures.

Module – 4:

Run-Time Environment And Code Generation: Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management ,Garbage and Trace-Based collection

Code Generation: Issues in design of Code Generation —design of a simple Code Generator.

Module-5:

Code Optimization: The Principal Sources of Optimization , Peephole Optimization , DAG ,Foundations of Data flow analysis, constant propagation, partial-redundancy elimination, loops in flow graphs, Register allocation and assignment, dynamic programming.

Text Books

1. Alfred V. Aho, Jeffrey D Ullman, “Compilers: Principles, Techniques and Tools”, Pearson Education Asia, 2012

2. Jean Paul Tremblay, Paul G Serenson, "The Theory and Practice of Compiler Writing", BS Publications, 2005

Reference books

1. Allen I. Holub, “Compiler Design in C”, Prentice Hall of India, 2003

2. C. N. Fischer and R. J. LeBlanc, “Crafting a compiler with C”, Benjamin Cummings, 2003

3. HenkAlblas and Albert Nymeyer, “Practice and Principles of Compiler Building with C”, PHI, 2001

4. Kenneth C. Louden, “Compiler Construction: Principles and Practice”, Thompson Learning, 2003

5. Dhamdhere, D. M., "Compiler Construction Principles and Practice", 2nd edition, Macmillan India Ltd., New Delhi, 2008

CO-PO &PSO Mapping:

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	1												2
CO2		3			2									
CO3		3												2
CO4	2	1			1									

	L	T	P	C
B.Tech				
SubjectCode: 21PC6CD07	**3**	**0**	**0**	**3**

Machine Learning and Data Science

Course Objectives:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To enable students to apply feature engineering techniques on the given data.
- To enable students to apply machine learning concepts in real time problems.

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

- Use different handling techniques on the given data.
- Illustrate the linear and Non-linear algorithms with suitable examples.
- Employ clustering algorithm to handle unlabelled data.
- Criticize supervised and unsupervised learning techniques.

Module -I

Introduction to Data Science:
Introduction to Data Science, Data Science in various fields, Data Analytics Life Cycle, Data Science Toolkit, understanding data: Introduction, Types of Data: Numeric and Categorical Data, Data Collection (Sources), Different techniques to handle missing data, Different types of data distribution: Normal distribution, Skewed distribution.

Module -II:

Introduction to Machine Learning:
Introduction to Machine learning, Types of Machine Learning: Supervised Learning, Unsupervised Learning, Semi-supervised Learning, Reinforcement Learning, Deep Learning, Extreme Learning, Application of Machine learning.Bias-Variance Trade-Off, Overfitting and Underfitting in Machine Learning,A Good Fit in Machine Learning, Handling Imbalanced Data.

Module -III:
Linear Algorithms:
Linear Algorithms: Linear Regression, Logistic Regression, Logistic Regression using Maximum Likelihood Estimation, Gradient Descent for Machine Learning, Batch Gradient Descent, Stochastic Gradient Descent,performance metrics for Linear algorithms, lasso and ridge regression.

Module –IV:

Non-Linear Algorithms:

Non-Linear Algorithms: Decision Trees: ID3, CART, Naive Bayes, K-Nearest Neighbor's, Support Vector Machines: Maximal-Margin Classifier, Soft Margin Classifier, Kernels, performance metrics for Non-linear algorithms.

Module - V:

Unsupervised Learning: Introduction to Unsupervised learning, fundamentals of Clustering techniques: K-mean clustering, Hierarchical clustering-agglomerative and divisive clustering, linkages, different distance measures, and its appropriate application.

Text Books:

1. Master Machine Learning Algorithms by Jason Brownlee.
2. Introduction to Machine Learning with Python: A Guide for Data Scientists, O'reilly, 2016.
3. Python Machine Learning, Sebastian Rascha, Packt Publishing, 2015.
4. Statistics for Business and Economics by Anderson, Sweeney and Williams
5. Deeper Insights into Machine Learning by BIRMINGHAM(Packt)

Reference Books:

1. Using Multivariate Statistics - Barbara G. Tabachnick, Linda S. Fidell, Pearson.
2. Introduction to Machine Learning - EthemAlpaydm, The MIT Press.

CO-PO &PSO Mapping:

CO-PO/PSOMappingChart (3/2/1indicatesstrengthofcorrelation) 3 – High; 2 – Medium; 1 – Low															
CO/PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO2**	**PSO3**
CO-1	M		H	M									H		
CO-2		M		H									M	H	
CO-3					M								M	H	
CO-4			H										H		

B.Tech	L	T	P	C
Subject Code: 21PC6CD08	3	0	0	3

FULL STACK WEB DEVELOPMENT

Course Objectives:

1. Understand the core concepts of both the frontend and backend programming course
2. Get familiar with the latest developments in web technologies
3. Learn new technologies by applying foundation paradigms
4. Knowledge on the client-server architecture using MVC.
5. Connect the web applications to the databases using PHP and MySQL.

Course Outcomes:

1. To develop a complete web application from the scratch that includes Front-end, Back-end and Data-exchange technologies
2. Attain the knowledge of web development basics, HTML, CSS and building interactive web pages using JavaScript & jQuery.
3. Design the applications using XML and AngularJS.
4. Construct the real-world applications using PHP and MySQL

MODULE- I

HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets. Introduction to Java Scripts, Objects and Functions in java script, Manipulating DOM, HTML DOM Events, Learning Ajax
jQuery Programming: Selectors & Mouse Events, Form Events, DOM Manipulation, Effects & Animation, Traversing & Filtering

MODULE - II

XML: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemes, Document Object Model, XHTML Parsing XML Data – DOM and SAX Parsers.
Angular JS: Introduction, Expressions, Modules, directives, AngularJS HTML DOM, Events, Forms.

MODULE -III

Introduction to Servlets: Common Gateway Interface (CGI), Life cycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC.

MODULE - IV

Introduction to JSP: The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies, and session for session tracking, connecting to database in JSP

MODULE – V

Database Design using MySQL: An Overview of SQL, XAMPP and MySQL Setup, Create

Tables, Columns and Insert Data, Selecting Data, Distinct, Aliases & Concat, Update, Delete & Alter, Foreign Keys, Table Joins.
PHP Programming Fundamentals, PHP Data Types & Dates, Cookies, Sessions, Objects and Classes, Intro to PHP & MySQL, creating a MySQL Database, Connect & Fetch data from MySQL, Insert and Delete MySQL data from PHP.

Textbooks:

1. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech
2. Learning AngularJS: A Guide to AngularJS Development, Ken Williamson, O'Reilly
3. Java Server Pages –Hans Bergsten, SPD O'Reilly
4. The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer 1st ed. Edition, Kindle Edition by Chris Northwood

References:

1. Quick Start Full Stack Web Development: Build Secure Asynchronous Single-Page Apps with Flask, React, and PostgreSQL by Erik M. Ferragut (Author)

CO-PO &PSO Mapping:

CO-PO/PSOMappingChart (3/2/1indicatesstrengthofcorrelation) 3 – High; 2 – Medium; 1 – Low															
CO/PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO2**	**PSO3**
CO-1			M		M	H							M		
CO-2		M			H								M	H	
CO-3	M			M									H		
CO-4			H											M	

B.Tech III Year -I/II Sem **L T P C**

Subject Code:21HS6EG05 **0 0 2 1**

ADVANCED ENGLISH COMMUNICATION SKILLS LAB

(Common to CSE/EEE/ECE/CSM/CSD/CSC/CSO/ME)

1. INTRODUCTION:

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. Atthis stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

1. Gathering ideas and information to organize ideas relevantly and coherently.
2. Engaging in debates.
3. Participating in group discussions.
4. Facing interviews.
5. Writing project/research reports/technical reports.
6. Making oral presentations.
7. Writing formal letters.
8. Transferring information from non-verbal to verbal texts and vice-versa.
9. Taking part in social and professional communication.

2. OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

1. To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakersand respond appropriately in different socio-cultural and professional contexts.
2. Further, they would be required to communicate their ideas relevantly and coherently in writing.
3. To prepare all the students for their placements.
4. Learn conversation skills
5. Learn reading strategies
6. Learn time management
7. Learn stress management
8. Learn career planning

Course outcomes

- Express conversational skills
- Specify reading strategies
- Perform time management

- Perform stress management
- Explore career planning

6. **SYLLABUS**:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. **Activities on Fundamentals of 7c's of effective Communication, Behaviour skills and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language - Concise - Clear - Concerts - Coherent - Complete - Correct.
   Behaviour Skills - Grooming - Formal and Informal Communication - Body language - Time Management.

   – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, wordroots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension and Business English** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading& effective googling,6.listening in effective communication,Style of Communication.
   Business Conversation with dialogues reading and speaking activity
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/Technical report writing/* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/**PPTs** and written presentations through posters/projects/reports/**Group Writing, info-graphics,**
   e-mails/assignments etc.
5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice,Career Planning, body language, relevance, fluency and organization of ideas and rubrics for evaluation-Concept and process, pre-interview planning, opening strategies, answering strategies, interviewthrough tele-conference & video-conference and Mock Interviews.

	L	T	P	C
B.Tech				
SubjectCode: 21PC6CD09	**0**	**0**	**3**	**1.5**

Machine Learning and Data Science Lab

Course Objectives:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To enable students to apply feature engineering techniques on the given data.
- To enable students to apply machine learning concepts in real time problems.

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

- Use different handling techniques on the given data.
- Illustrate the linear and Non-linear algorithms with suitable examples.
- Employ clustering algorithm to handle unlabelled data.
- Criticize supervised and unsupervised learning techniques.

TASK

1. Interactive commands in Python, data operations, simple programs for writing into files and reading from files. Data file manipulations programs.
2 Familiarization with IDE in Python.
3 Writing programs for standard algorithms of sorting and searching in Python.
4 Plotting the data using X-Y graph, Bar- chart, and using other plotting techniques.
5 Write programs to perform exploratory data analysis: variance, standard derivation, summarization, distribution, and statistical inference.
6 Plotting the various distributions for given data sets.
7 Classifying and presentation of data using support vector machine.
8 Write programs for k-means clustering and presentation for given data sets.

a) Implement K-Means clustering using sklearn.

b) Check for the best k-value.

1. Use K-Nearest Neighbor technique on a given dataset and analyze the performance by changing the value of K.

a) Implement the KNN algorithm.

b) Apply KNN model to the dataset and perform testing on unseen dataset.

c) Change the value of K in KNN and analyze the model's performance.

2. Use the different classification algorithms on the given dataset and perform the comparison.

a) Compare different classification techniques.

b) Justify which classification technique is better

3. Write programs on graphs of social networks for community detection

4. Write programs for analysis of graphs to find centrality and page-rank.

Text Books:

1. Master Machine Learning Algorithms by Jason Brownlee.
2. Introduction to Machine Learning with Python: A Guide for Data Scientists, O'reilly, 2016.
3. Python Machine Learning, Sebastian Rascha, Packt Publishing, 2015.
4. Statistics for Business and Economics by Anderson, Sweeney and Williams
5. Deeper Insights into Machine Learning by BIRMINGHAM(Packt)

Reference Books:

1.Using Multivariate Statistics - Barbara G. Tabachnick, Linda S. Fidell, Pearson.

Introduction to Machine Learning - EthemAlpaydm, The MIT Press

CO-PO &PSO Mapping:

CO-PO/PSOMappingChart (3/2/1indicatesstrengthofcorrelation) 3 – High; 2 – Medium; 1 – Low															
CO/PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO2**	**PSO3**
CO-1	M		H	M									H		
CO-2		M		H									M	H	
CO-3					M								M	H	
CO-4			H										H		

B.Tech	L	T	P	C
Subject Code: 21PE6CD10	**0**	**0**	**3**	**1.5**

FULL STACK WEB DEVELOPMENT LAB

Prerequisites:
Knowledge of Object Oriented Programming concepts

Course Objectives:
1. To understand designing of Front-End Applications.
2. To design client-side applications using HTML, JavaScript.
3. To build robust and scalable websites, backend APIs.
4. To understand end-to-end application with exciting features and test it
5. To understand database connectivity with web applications.

Course Outcomes:
1. Design a website and to implement client-side validation.
2. To develop the robust and scalable websites, backend APIs
3. To implement end-to-end applications.
4. To design web applications with database connectivity.

TASK 1
Develop a website by implementing JavaScript functions for the following problems:
Parameter: A string
Output: The position in the string of the left-most vowel Parameter: A number
Output: The number with its digits in the reverse order

TASK 2
Write a JavaScript program to calculate the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.

TASK 3
Write a JavaScript program to display text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays “TEXT-SHRINKING” in BLUE color. Then the font size decreases to 5pt.

TASK 4
Write a JavaScript program to design a simple calculator to perform the following operations: sum, product, difference and quotient

TASK 5
Write a JQuery AJAX program to request data from the server with an HTTP.

TASK 6
Create following Student Information form with submit and reset functionality using Angular JS.

Sample AngularJS Form

TASK 7
Use AngularJS features to make a shopping list, where you can add or remove items as shown below.
My Shopping List
- Milk×
- Bread×
- Cheese×

Add

TASK 8
Write a Servlet Program that accepts the Mobile phone details from user and displays the details on the next page. Create a table and perform insert operation as shown in the Figure 1 below. Connect using JDBC to display each record at a time on the webpage using servlet request and response.

Mobile Details

Model Id	Price(Rs.)	Company	Color
J2	12000	Samsung	Silver
6600	20000	Nokia	Black
Note 3	12000	Red Mi	Grey
Zenfone 2	20000	Asus	Grey

Table Details

TASK 9
Develop a JSP Program to validate a particular user login based on the username password stored in the database and display a welcome page.

TASK 10
Write PHP programs to do the following tasks:
a. Implement simple calculator operations.
b. Find the transpose of a matrix.
c. Multiplication of two matrices.
d. Addition of two matrices.

TASK 11
Write a PHP program named states.py that declares a variable states with value "Mississippi Alabama Texas Massachusetts Kansas". Write a PHP program that does the following:
a. Search for a word in variable states that ends in xas. Store this word in element 0 of a list named statesList.
b. Search for a word in states that begins with k and ends in s. Perform a case insensitive comparison. [Note: Passing re.Ias a second parameter to method compile performs a case-insensitive comparison.] Store this word in element1 of statesList.
c. Search for a word in states that begins with M and ends in s. Store this word in element 2 of the list.
d. Search for a word in states that ends in a. Store this word in element 3 of the list.

TASK 12
Write a PHP program to sort the student records which are stored in the database using selection sort.

Text books:
1. Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker 1st ed. Edition by Frank Zammetti
2. Web Design with HTML, CSS, JavaScript and jQuery Set 1st Edition by Jon Duckett
3. The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer 1st ed. Edition, Kindle Edition by Chris Northwood

References:
1. Quick Start Full Stack Web Development: Build Secure Asynchronous Single-Page Apps with Flask, React, and PostgreSQL by Erik M. Ferragut (Author)
2. Full Stack Web Development For Beginners: Learn Ecommerce Web Development Using HTML5, CSS3, Bootstrap, JavaScript, MySQL, and PHP by Riaz Ahmed.

CO-PO &PSO Mapping:

CO-PO/PSOMappingChart (3/2/1indicatesstrengthofcorrelation) 3 – High; 2 – Medium; 1 – Low															
CO/PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO2**	**PSO3**
CO-1			M		M	H							M		
CO-2		M			H								M	H	
CO-3	M			M									H		
CO-4			H											M	

	L	T	P	C
Subject Code: 21MC6HS04	**2**	**0**	**0**	**0**

QUANITATIVE APTITUDE
(Common to CSE/EEE/ECE/CSM/CSD/CSC/CSO/ME)

Course Overview

This course provides the basic skills required in solving the problems of Aptitude required by various companies for Campus Recruitment and competitive tests. The contents of course include solving problems on different concepts such as Permutations and Combinations, Averages, Percentages and Logarithms etc.

Course Pre/co-requisites

No prior knowledge is required.

Course Objectives:

1. To categorize, apply and use thought process to distinguish between concepts of Quantitative methods.
2. To prepare and explain the fundamentals related to various possibilities and probabilities related to quantitative aptitude.
3. To critically evaluate numerous possibilities related to puzzles.

Course Outcomes (COs)

After the completion of the course, the student will be able to:

1. Apply the concepts of ratios, proportions and percentages to solve problems.
2. Solve problems on Logarithms, permutations, combinations, clocks, and calendars.
3. Able to recall and use the concepts to solve problems numerical estimation with respect to company specific and competitive tests
4. Interpret data using graphs and charts.

Module I:

Arithmetic ability:-Algebraic operations- BODMAS – Fractions – Number system - Divisibility rules LCM&GCD (HCF), Simplification

Ratio and Proportion: Ratio, Proportion, Variations, Problems on Ages

Module II:

Percentages, Simple Interest (SI) and Compound Interest (CI): Fundamentals of Percentage, Percentage change, SI and CI, Relation between SI and CI.

Profit and Loss, Partnerships: Basic terminology in profit and loss, Types of partnership, Problems related to partnership

Module III:

Time and Work, Pipe and Cistern, Speed, Time and Distance, Problems on trains & boats, Calendar problems, Clock problems. Average, Mixtures and Alligation: Averages, Weighted average, Difference between mixture and alligation, Problems on Mixtures and alligation

Module IV:
Data Interpretation: Introduction, Tabulation, Bar Graph, Pie Charts, Line Graphs, Combined Graphs, Geometry: Lines and Angles, Triangle, Trigonometry, Circle, Height and Distance, Quadrilateral and Polygon

Module V:
Permutations and Combinations: Fundamentals counting principle, Definition of Permutation, Seating arrangement, Problems related to alphabets, Rank of the word, Problems related to numbers, Circular permutation, Combination.Logarithms: Fundamental formulae of logarithms and problems, finding number of terms on expanding a given number.

Text Book:
1. Quantitative Aptitude for competitive examinations, .R.S Aggarwal,S.Chand,2017.

Reference Books
1. Quantitative Aptitude for competitive examinations, AbhijitGuha, 6th Edition, McGraw Hill Education.
2. Dinesh Khattar, The Pearson guide to Quantitative Aptitude for Competitive Examinations, 3rd Edition, Pearson Education.

Webresources:
1. www.m4maths.com
2. www.Indiabix.com

CO-PO/PSO Mapping Chart **(3/2/1 indicates strength of correlation)** **3 – High; 2 – Medium; 1 - Low**														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1						2					2	3		
CO2						2					2	3		
CO3						2					2	3		
CO4						2					2	3		

	L	T	P	C
B.Tech				
Subject Code: 21PE6CD21	**3**	**0**	**0**	**3**

Big Data Analytics

Prerequisite:

1. DBMS
2. Data warehousing and Data Mining

Course Objective:

1. To understand the Big data and its characteristics.
2. To compare distributed computing efficiency with Hadoop cluster computing.
3. To execute the commands and queries using Pig, Hive Hadoop ecosystem tools.
4. To analyze and interpret the data using Hadoop Ecosystem tools.

Module - I

Understanding Big Data, Defining Data, Types of Data: Structured, Unstructured and Semi-structured, Different sources of Data Generation, Different V's: Volume, Variety, Velocity, Veracity, Value, Traditional RDBMS approach.

Phases of Big Data Analytics, Types of Data Analytics, Apache Hadoop, Need for the Hadoop, Apache Hadoop Architecture, How Does Hadoop Work? Advantages of Hadoop, Apache Hadoop Ecosystem.

Module - II

Hadoop Distributed File System, Features of HDFS, HDFS Architecture, Commands and description of HDFS, Hadoop File system, Replication factor, Name Node, Secondary Name Node, Job Tracker, Task tracker, Data Node, FS Image, Edit-logs, Check-pointing Concept, HDFS federation, HDFS High availability, Architectural description for Hadoop Cluster, Hadoop – File Blocks and Replication Factor, read operation in HDFS, Write operation in HDFS.

Module - III

MapReduce, Internal architecture, Record Reader, Mapper Phase, Reducer Phase, Sort and Shuffle Phase, Data Flow, Counters, Combiner Function, Partition Function, Joins, Map Side Join, Reduce Side Join.

Writing a simple MapReduce program to Count Number of words, YARN, YARN Architecture, YARN Components, Resource Manager, Node Manager, Application Master, Difference between Hadoop 1.x and 2.x Architecture.

Module - IV

Apache Pig, Local Mode and MapReduce Mode, Pig's Data Model, Scalar, Complex, Load, Dump, Store, Foreach, Filter, Join, group, Order by, Distinct, Limit, Sample, Parallel, User Defined Function, Using different Join Implementations, Co-group, Union, Cross, Nonlinear Data flows.

Controlling Executions, Parameter Substitutions, Program for Word Count Job, Comparison Apache Pig and MapReduce.

Module - V

Apache Hive, Features of Apache Hive, History of Apache Hive, Hive Data Types & Files Formats, Creating Managed Table, External Table, Partitioned Table, Dropping Tables, Alter Table, Loading data into Managed Table, Inserting Data into Tables from Queries, Dynamic Partitions inserts, Exporting data, SELECT from clauses, WHERE Clauses, GROUP BY Clauses, JOIN Statements, ORDER BY, SORT BY, DISTRIBUTE BY, CLUSTER BY, bucketing, UNION ALL, View, Hive Metastore.

TEXT BOOKS:

1. Hadoop: The Definitive Guide, By: Tom White, O'REILLY, 4th Edition,2015.
2. Programming Hive, By: Edward Capriolo, Dean Wampler & Jason Rutherglen, Published by O'REILLY, 2012.

REFERENCE BOOKS:

1. Hadoop for Dummies, By: Dirk deRoos, Paul C. Zikopoulos, Bruce Brown, Rafael Coss, and Roman B. Melnyk, A Wiley brand.
2. Programming Pig, By: Alan Gates, Published by O'Reilly Media, Inc., 2016.

Web Resources & E-Books:

1. https://www.ibm.com/ae-en/analytics/hadoop/big-data-analytics
2. https://www.tableau.com/learn/articles/big-data-analytics

MOOCs Courses:

1. "Big Data Analytics", MOOCs
2. "Introduction to Big Data", Coursera

Course Outcomes:

Upon completing this course, the student will be able to

1. Describe the concept of big data and its features.
2. Explain the Hadoop distributed computing architecture for big data analysis.
3. Employ Pig, Hive queries for effective data analytics of big data.
4. Use the appropriate Hadoop Ecosystem tool for performing data processing operations.

CO-PO &PSO Mapping:

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low															
Course Outcomes (Cos)	**Program Outcomes (Pos)**												**Program Specific Outcomes***		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2														
CO2	2														
CO3	3	2			2										
CO4	3	2			2										

B.Tech	L	T	P	C
Subject Code: 21PE6CD22	**3**	**0**	**0**	**3**

Blockchain Technology

Prerequisites: 1. Knowledge in security and applied cryptography.
2. Knowledge in distributed databases.

Course Objective:

To Introduce block chain technology and Cryptocurrency

Course Outcomes:

1. Learn about research advances related to one of the most popular technological areas today.
2. Understand Extensibility of Blockchain concepts.
3. Understand and Analyze Blockchain Science.
4. Understand Technical challenges, Business model challenges.

Module I

UNIT - I Introduction: Block chain or distributed trust, Protocol, Currency, Cryptocurrency, How a Cryptocurrency works, Crowdfunding.

Module II

UNIT - II Extensibility of Blockchain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Blockchain Environment.

Module III

UNIT – III Blockchain Science: Gridcoin, Folding coin, Blockchain Genomics, Bitcoin MOOCs.

Module IV

UNIT - IV Currency, Token, Tokenizing, Campuscoin, Coindrop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency.

Module V

UNIT - V Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations.

TEXT BOOKS:

1. Melanie Swan, Blockchain Blueprint for Economy, O'reilly.

REFERENCE BOOKS:

1. Building Blockchain Apps, Michael Juntao Yuan, Pearson Education
2. Daniel Drescher, Blockchain Basics: A Non-Technical Introduction in 25 Steps 1st Edition
3. Bradley Lakeman, Blockchain Revolution: Understanding the Crypto Economy of the Future. A Non-Technical Guide to the Basics of Cryptocurrency Trading and Investing, ISBN: 1393889158

CO-PO &PSO Mapping:

CO-PO/PSOMappingChart (3/2/1indicatesstrengthofcorrelation) 3 – High; 2 – Medium; 1 – Low															
CO/PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO2**	**PSO3**
CO-1	**L**												**L**		
CO-2	**H**	**M**											**M**		**L**
CO-3	**H**	**M**											**M**		**L**
CO-4	**L**												**M**		**L**

B.Tech	L	T	P	C
Subject Code: 21PE6CD23	3	0	3	3

Information Retrieval Systems

Course Objective

- To learn the important concepts and algorithms in IRS
- To understand the data/file structures that are necessary to design, and implement information retrieval (IR) systems.

Course Outcomes:

1. Ability to apply IR principles to locate relevant information large collections of data

2. Ability to design different document clustering algorithms

3. Implement retrieval systems for web search tasks.

4. Design an Information Retrieval System for web search tasks.

Module I

Introduction to Information Retrieval Systems:

Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses

Information Retrieval System Capabilities:

Search Capabilities, Browse Capabilities, Miscellaneous Capabilities

Module II

Cataloging and Indexing:

History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction

Data Structure:

Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models

Module III

Automatic Indexing:

Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages

Document and Term Clustering:

Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters

Module IV

User Search Techniques:

Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext

Information Visualization:

Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies

Module V

Text Search Algorithms:

Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems

Multimedia Information Retrieval:

Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval

TEXT BOOKS:

1. Information Storage and Retrieval Systems – Theory and Implementation, Second Edition, Gerald J. Kowalski, Mark T. Maybury, Springer

REFERENCE BOOKS:

1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.

2. Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons.

3. Modern Information Retrieval By Yates and Neto Pearson Education.

CO-PO &PSO Mapping:

CO-PO/PSOMappingChart (3/2/1indicatesstrengthofcorrelation) 3 – High; 2 – Medium; 1 – Low															
CO/PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO2**	**PSO3**
CO-1	H	M											M		M
CO-2	H	M											M		M
CO-3	H	M											M		M
CO-4	H	M											M		M

B.Tech	L	T	P	C
SubjectCode: 21PE6CD24	3	0	0	3

Data Handling and Visualization

Course Objective:

- To apply the Data Wrangling techniques on the given data.
- To apply Data Visualization Techniques.
- To understand the difference between Univariate and Multivariate techniques.
- To employ the customization of plot.

Course Outcomes:

- Illustrate the Data Wrangling techniques with an example.
- Use the Static Graphical Techniques and Data visualization techniques for the various data analysis tasks.
- Differentiate between Bivariate and Multivariate Graphical Techniques with an example.
- Use the Plot and perform customization.

Module I

Data Wrangling: Introduction, need for data wrangling, Subsetting a dataset: Selecting columns, selecting rows, Selecting a combination of rows and columns, Creating new columns, Generating random numbers and their usage: Various methods for generating random numbers, Seeding a random number, Generating random numbers following probability distributions, Probability density function, Cumulative density function, Uniform distribution, Normal distribution, Generating a dummy data frame, Grouping the data – aggregation, filtering, and transformation, Random sampling – splitting a dataset in training and testing datasets, Concatenating and appending data, Merging/joining datasets, Outlier detection technique-Box and Whisker Plot.

Module II

Introduction to Data Visualization: Understanding Data Visualization Techniques, Benefits of good data visualization, Data Visualization Process Flow and Stages? classification of visualization techniques for qualitative and quantitative data Visualization tools, Scope of visualization with use cases.

Static Graphical Techniques – 1: Introduction to bar graph, grouping bars together, bar graphs on counts, customization of bar graphs by changing color, size, title, axis units, changing width and spacing of the bar chart, adding labels to bar graph. Heat Map, ggplot.

Module III

Static Graphical Techniques – 2: Introduction to line graph and scatter plot, making basic line graphs, adding points to line graph, combine line graphs with multiple lines, changing line texture

of line graphs, making line graph with density area, making staked area graph, introduction to pie chart, customization of pie chart, colors in the pie graph, changing label appearance in the pie graph.

Case Study- Implementation and analysis of bar graph, line graph, and pie graph on real time business data.

Module IV

Bivariate Graphical Techniques: Introduction to scatter plot, making basic scatter plots, grouping data points by a variable using shape or color, changing the shape of points in scatter plot, mapping of continuous variable using shape or color, labelling points, scatter plot matrix.

Multivariate Graphical Techniques: Introduction to correlation matrix, application of correlation matrix in the multivariate analysis, introduction to higher dimensional scatter plot, axis adjustment in the higher dimensional scatter plot, addition of prediction surface of higher dimensional scatter plot, Dendrogram, importance of dendrogram in grouping (cluster analysis).

Module V

Customization: Introduction to annotations – Adding : text, mathematical expression, lines, arrows, shaded shapes, highlighting the texts and items, adding error bars, introduction to axis, swapping x and y axis, changing the scaling ratio in the axis, positioning of axis and arranging tick marks and labels, changing the appearance of axis labels, circular graphs, using themes, changing the appearance of theme elements, creating the own themes, legends : removing the legends, position of legends, legend title, labels in legends.

TEXT BOOKS:

1. Data Visualization Principles and Practice, Second Edition - Alexandrutelea, Crc Press,2014.
2. Hand book of Data Visualization – Chun-houh Chen, Wolfgang Härdle, Antony Unwin, Springer Publication.

REFERENCE BOOKS:

1. Practical Tableau, First Edition, Ryan Sleeper, O'reilly Publications, 2018.
2. https://www.xenonstack.com/blog/data-visualization-techniques

CO-PO &PSO Mapping:

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low

CO/PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO-1	H	M													
CO-2			M	H											
CO-3			H	M											
CO-4			M	H											

HR 21

	L	T	P	C
B.Tech III Year – VI Sem				
Subject Code: 21OE6CS09	**3**	**0**	**0**	**3**

Object Oriented Programming Using Java

Prerequisites: Programming in C

Course Objectives:
1. Understand fundamental concepts and object oriented concepts in Java
2. Implementing the concept of packages and exception handling in Java.
3. Implement the concept of multithreading and inter process communication in Java.
4. Develop GUI applications.

Course Outcomes:
1. Solve the given problem using OOPS technique.
2. Explain the concept of Package and Exception Handling.
3. Implement Multi threading and Inter process communication in java
4. Develop GUI based applications using applet, AWT , Event handling and swing.

Module - I
History and Evolution of java: Java's lineage, Java and internet, Byte code, Java buzzwords, Evolution of java.
Object oriented programming - data, types, variables, Arrays,operators, control statements, type conversion and casting, Introduction to classes, objects, methods, constructor, this and static keywords , garbage collection, overloading methods, parameter passing, access control, command line arguments,exploring String class
Inheritance: member access and inheritance, Multilevel Inheritance, super and final keywords, method overriding, dynamic method dispatch, abstract classes and methods.

Module- II
Packages and Interfaces: Defining, Creating and Accessing a Package, understanding CLASSPATH, importing packages, Differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.
Exception handling: Concepts of exception handling and its benefits, usage of try, catch, throw, throws and finally, built in exceptions, creating own exceptions.

Module -III
Multithreading: Differences between multi-threading and multi programming, thread life cycle, creating threads using thread class and Run able interface, thread priorities, synchronization , inter thread communication.
I/O Streams: Stream classes, Byte and character streams, File class, reading and writing files,reading and writing from console, serialization.

Module -IV
Applets: Concepts of Applets, differences between applets and applications, life cycle of an applet, creating applets, passing parameters to applets.

AWT: class hierarchy, user interface components- labels, buttons, scrollbars, text components, checkbox, checkbox groups, choices, lists panels – scroll pane, dialogs, menu bar, Layout Managers- Flow Layout, Border Layout, Grid Layout, Card Layout, Grid Bag Layout.
Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes.

Module- V

Swings: Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- J Applet, J Frame and J Component, Image Icon, J Label, J Text field, J Button, J Checkbox, J List, J Radio button, J Combo Box, J Tabbed Pane, J Scroll Pane.
The Collections Framework (java.util)- Collections overview, Collection Interfaces, Generics The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array De-queue. Accessing a Collection via an iterator, Using an Iterator, The For-Each alternative, Map Interfaces and Classes, Comparators, Collection algorithms, Arrays, The Legacy Classes and Interfaces- Dictionary, Hash table, Properties, Stack, Vector More Utility classes, String Tokenizer, Date, Calendar, Random, Scanner

Text Books:
1. The Complete Reference JAVA 2, Author: Herbert Schield , ninth edition Publishers: TataMec-Hill
2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, PearsonEducation.

Reference Books:
1. An Introduction to JAVA Programming (Chapter 6) Author: Y.Daniel Liang , Publishers:Tata Mec-Hill.
2. Programming with JAVA (2nd Edition) Author: E. Balagurusamy Publishers: Tata Mec-Hill.
3. Internet and Java Programming, R.Krishna Murthu and S.Prabhu, New Age Publishers

CO-PO/PSO Mapping:

Course Outcomes(COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***		
	PO 1	**PO 2**	**PO 3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO3**
CO1	**2**														**1**
CO2	**2**														**1**
CO3	**2**														**1**
CO4	**3**	**1**	**1**	**1**	**3**										**3**

B. Tech III Year – VI Sem	**L**	**T**	**P**	**C**
Subject Code:21OE6EC02	3	0	0	3

Fundamentals of Digital Electronics

(Open Elective)

Prerequisite: Basic knowledge on computers

Course Objectives:

This course provides in-depth knowledge of Digital logic techniques of digital circuits, which is the basis for design of any digital circuit.

1. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
2. To impart the concepts of combinational, sequential logic circuits.
3. To learn the concepts of sequential circuits, enabling them to analyse sequential systems in terms of state machines.

Course Outcomes: Upon completion of the course, the student should be able to

1. Explain the numerical information in different forms and Boolean Algebra theorems
2. Solve Boolean expressions using Boolean Theorems-maps
3. Design and analyze combinational and sequential circuits
4. Implement logic families and realization of logic gates

Module I: Number Systems & Boolean Algebra:

Number Systems: Number base conversions: Binary, Octal, Decimal, Hexa-decimal, Complements of Numbers, Codes- Weighted and Non-weighted codes and its Properties, Parity check code and Hamming code.
Boolean algebra: Basic Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates. The Karnaugh Map Method, don't care map entries, Prime and Essential Implicants.

Module II: Combinational Logic Circuits:
Basic Arithmetic Circuits- Half adder, Full adder, Half subtractor, Full subtractor, 4-bit parallel adder/subtractor. BCD Adder
Combinational logic circuits: 2-bit comparator, Multiplexers, Implementation of Boolean functions using Multiplexers, Decoders, Implementation of Boolean functions using Decoder, Demultiplexers, Encoder, Priority Encoder, Code converters.

Module III: Sequential Circuits Fundamentals:
Introduction to Sequential Circuits: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops,
Flip flop Conversions: Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another.

Module IV: Sequential Logic Applications:

Sequential Logic Applications: Registers and Counters: Shift Registers – Left, Right and Bidirectional Shift Registers, Universal shift register, Applications of Shift Registers

Design of Counters: Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.

Module V: Design and Analysis of Sequential Machines: Introduction to Finite State Machines- Mealy Machine and Moore Machine, State diagram, State Assignment and minimization, Design Procedure and Realization using Flip-Flops.

Introduction to CMOS Technology: CMOS technology, Working states of CMOS, Types of CMOS, AND, OR and NOT Gates using CMOS.

Text Books:

1. Switching and Finite Automata Theory - Zvi Kohavi & Niraj K. Jha, 3rd Edition, Cambridge, 2010.
2. Modern Digital Electronics – R. P. Jain, 3rd Edition, Tata McGraw-Hill, 2007.

Reference Books:

1. Digital Design- Morris Mano, PHI, 4th Edition,2006
2. Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3rd Ed, John Wiley & Sons Inc.
3. Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5th, Edition, 2004.
4. Switching Theory and Logic Design – A Anand Kumar, PHI, 2013

Web Resources:

1. http://blog.digitalelectronics.co.in/
2. www.nesoacademy.org/electronics-engineering/digital-electronics/digital
3. https://www.slideshare.net/JournalsPubwwwjourna/international-journal-of-digital-electronics-vol-2-issue-2
2. https://lecturenotes.in/subject/203/switching-theory-and-logic-design-stld
3. http://www.infocobuild.com/education/audio-video-courses/electronics/DigitalCircuitsSystems
4. https://nptel.ac.in/courses/117105080/

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	**3**	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-
CO4	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-

B. Tech III Year–VI Sem	**L**	**T**	**P**	**C**
Subject Code: 21OE6ME02	**3**	**0**	**0**	**3**

TOTAL QUALITY MANAGEMENT & SIX SIGMA APPLICATIONS

Pre-requisite: Management Science &Production Technology, Machine Tools

Course Objectives:

1. To understand the quality concepts and tools
2. To discuss about techniques relating to total quality management.
3. To understand the Principles and Practices of TQM
4. To understand the implementation of ISO 9000 AND Six sigma in a system

Module I

Introduction: The concept of TQM, Quality and Business performance, attitude, and involvement of top management, communication, culture and management systems.
Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control.

Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

Module II

Customer Focus and Satisfaction: Process vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships.

Bench Marking: Evolution of Bench Marking, meaning of bench marking, benefits of bench marketing, the bench marking procedure.

Module III

Organizing for TQM**:** The systems approach, organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles, seven Tools

Seven Tools of TQM: Stratification, check sheet, Scatter diagram, lshikawa diagram, pane to diagram, Kepner& Tregoe Methodology.

Module IV

The Cost of Quality: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost information, Accounting Systems and Quality Management.

Use of Quality Cost information, Accounting Systems and Quality Management.

Module V

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQC Q- 90. Series Standards, benefits of ISO9000 certification, the third party audit.

Documentation ISO9000 and services, the cost of certification implementing the system.

Six sigma and applications of sixsigma.

Text Books:

1. Total Quality Management / Joel E. Ross/Taylor and Franscis Limited.
2. Total Quality Management/P. N. Mukherjee/PHI
3. "Lean Six Sigma: Combining Six Sigma with Lean Speed" by Michael L. George, David Rowlands, and Bill Kastle, published by McGraw-Hill Education
4.

Reference Books:

1. Beyond TQM / Robert L.Flood
2. Statistical Quality Control / E.L. Grant.
3. Total Quality Management:A Practical Approach/H. Lal
4.

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

1) Understand the fundamental principles of Total Quality Management.
2) Analyze the different quality approaches
3) Evaluate the different tools in Total Quality Management
4) Describe the importance and implementing of ISO9000 in the system and Six sigma

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2						1	2	2	2	2	2	
CO2	3	2	2					1	2	2	2	2	2	
CO3	3	2	2					1	2	2	2	2	2	
CO4	3	2	2					1	2	2	2	2	2	

** If more PSOs are there in a particular branch, required no of columns can be added.*

B.Tech III Year – VI Sem

Subject Code: 21OE6EE02

L	T	P	C
3	0	0	3

FUNDAMENTALS OF INDUSTRIAL ELECTRONICS
OPEN ELECTIVE II
ALL BRANCHES EXCEPT EEE

Pre-requisite: Basic Electrical and Electronics Engineering or Analog and Digital Circuits

Course Objectives:

1) To Design/develop suitable power converter for efficient control or conversion of power in drive applications.
2) To Design / develop suitable power converter for efficient transmission and utilization of power in Industrial applications.

Course Outcomes: At the end of course student will be able to do

1) CO1 – Understand the differences between signal level and power level devices.
2) CO2 – Analyze controlled rectifier circuits.
3) CO3 – Analyze the operation of DC-DC choppers.
4) CO4 – Analyze the operation of voltage source inverters.

Module I:Power Switching Devices and Protection Circuits

Power Switching Devices:

Types of power converters; Power semiconductor switches and their V-I characteristics - Power Diodes, Power BJT, Power MOSFET, Power IGBT. SCR VI Characteristics, Switching characteristics.

Thyristor voltage and current ratings and protection using Snubber Circuit.

Module II:Triggering and Commutation

Triggering Circuits: R, RC and UJT triggering circuits

Commutation Circuits: Types of Commutation circuits (Class A, B,C,D,E,F)

Module III:Rectifiers

Single Phase Rectifier: Principles of single-phase half-controlled converter with R, RL and RLE load. Principles of single-phase fully-controlled converter with RLE load. Problems on Single phase Rectifiers.

Three Phase Rectifier: Principles of three-phase fully-controlled converter operation with RLE load. Problems on Three phase Rectifiers.

Module IV:Choppers, AC Voltage Converters and Cycloconverters

DC-DC Converters (Choppers)
Introduction of Choppers, Control strategies in Choppers, Time Ratio Control, Step down and Step Up Choppers with problems.

AC Voltage Converters and Cycloconverters
Phase Controller (AC Voltage Regulator)-Introduction, principle of operation of single-phase voltage controllers for R, R-L loads.

Cyclo-converter- Principle of operation of single phase cyclo-converters: Mid Tap and Bridge type, relevant waveforms.

Module V:Inverters and Applications

DC-AC Converters (Inverters)
Introduction, principle of operation, performance parameters, single phase half and full bridge inverters with R, RL loads. Problems on single phase inverters.
Applications: UPS, SMPS, Battery Charger.

TEXT BOOKS:

1. Dr.P.S.Bimbhra, "Power Electronics", Khanna Publishers, New Delhi.
2. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.

Reference Books:

1.N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
2. MD Singh and KB Kanchandhani, " Power Electronics", Tata Mc Graw Hill Publishing Company Limited, New Delhi.

Web Resources: www.mathworks .com

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1											1	2
CO2	2	2	3		2								2	2
CO3	1	2	3		2								2	2
CO4	1	2	3		2								2	2

B. Tech III Year–VI Sem	L	T	P	C
Subject Code: 21OE6CM06	3	0	0	3

Expert Systems

Prerequisite:

1. Artificial Intelligence

Course Objectives:

1. Understand Expert Systems and their applications.
2. Illustrate Fuzzy Logic Concepts with an example.
3. Understand the Genetic Algorithm and its applications.
4. Explain the components of Expert System building and its tools.

Module-I

Overview of Expert Systems:

Introduction to Expert System: Characteristics of Expert System, Advantages and Disadvantages of Expert Systems, Different types of Expert Systems: Rule-based Expert Systems, Knowledge-based Expert Systems, Model-based, Case-based, and Hybrid Expert Systems, Working Architecture of Expert Systems, Components of Expert Systems, Applications of Expert Systems, Techniques for extracting the knowledge from Domain Experts.

Module – II

Knowledge Representation:

Representations and Mapping: General goal of Knowledge Representation, Approaches to Knowledge Representation: Simple Relational Knowledge, Inheritable Knowledge, Inferential Knowledge, Procedural Knowledge or Operational Knowledge, Classification of Knowledge Representation Systems: Logics (Predicate Logic, Description Logic, Nonmonotonic Logic); Procedural Schemas (Production rules), Structural Schemas (Weak slot-and-filler structures, Strong slot-and-filler structures), Knowledge-Based Systems.

Module - III

Fuzzy Logic:

Introduction to Fuzzy Logic, Fuzzy set theory, Fuzzy sets: Operation on Fuzzy sets, Scalar cardinality, fuzzy cardinality, union and intersection, complement, equilibrium points, aggregation, projection, composition, decomposition, cylindrical extension, fuzzy relation, Fuzzy membership functions, Fuzzy Expert Systems, Fuzzy Decision Making, Applications of Fuzzy System, De-fuzzification.

Module – IV

Genetic Algorithms:

Introduction to Genetic Algorithms (GA), Representation, Operators in GA, Fitness function, population, building block hypothesis and schema theorem; Genetic algorithms operators-methods of selection, crossover and mutation, Simple GA(SGA), Different types of GA, generation gap, steady state GA, Applications of GA.

Module – V

Development of Expert System:

Nature of Expert System tools, Types of tools available for expert system building, Stages in the development of expert system tools. Building an Expert system, Stages of Expert system development, Tasks in building the Expert System.

Text Books:

1. Principles of Expert Systems by Peter, J.F. Lucas & Linda C. van der Gaag, 2014.
2. Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering by Nikola K. Kasabov, 1998.
3. Introduction to Genetic Algorithms by S. N. Sivanandam and S. N. Deepa 2008.

Reference Text Books:

1. David Goldberg. V Genetic Algorithms in Search, Optimization, and Machine Learning, Pearson Education, 2009.
2. Zimmermann. H.J, "Fuzzy set theory-and its Applications"- Springer international edition, 2011.

Web Resources & E-Books:

1. https://www.geeksforgeeks.org/
2. https://www.sciencedirect.com/journal/expert-systems-with-applications/

MOOC's Courses:

1. NPTEL Course on "Introduction to Fuzzy Set Theory, Arithmetic and Logic".
2. NPTEL Course on "Fundamentals Of Artificial Intelligence"

Course Outcomes:

Upon completing this course, the student will be able to

1. Describe the Expert Systems and their applications.
2. Use Knowledge Representation to solve the problem.
3. Illustrate the Fuzzy Logic and Genetic Algorithms with an example.
4. Discuss the Expert System building and its tools.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – High; 2 – Medium; 1 - Low

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														
CO2	3	2													2
CO3	3	2													2
CO4	2														

B.Tech III – VI Sem	L	T	P	C
Subject Code: 21OE6CD02	3	0	0	3

Data Mining and Data Analytics

Course Objective

1. Understand the concepts of Data Mining
2. Familiarize with association rule mining
3. Familiarize various classification algorithms
4. Understand the concepts of Cluster analysis
5. Implement the Data mining concepts with various domains

Course Outcomes:

1. Discuss varies Data Mining Principles.
2. Analyze the impact of data analytics for business decisions and strategy.
3. Apply the Association, Clustering rules for mining the data.
4. Design various classification techniques.

Module I

Introduction to Data warehouse, Difference between operational database systems and data warehouses. Data warehouse Characteristics, Data warehouse Architecture.
Introduction: What is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Preprocessing, Data Cleaning, Missing data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binarization, Data Transformation; Measures of Similarity and Dissimilarity – Basics.

Module II

Data Analytics: Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and variables. Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

Module III

Regression – Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc.
Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

Module IV

Association Rule Mining & Classification: Mining Frequent Patterns–Associations and correlations – Mining Methods–Mining Various kinds of Association Rules– Correlation Analysis.
Classification: Classification and Prediction – Basic concepts–Decision tree induction– Bayesian classification, Lazy learner.

Module V

Clustering and Applications: Cluster analysis–Types of Data in Cluster Analysis– Categorization of Major Clustering Methods– Partitioning Methods.
Hierarchical Methods– Density–Based Methods, Grid–Based Methods, Outlier Analysis.

TEXT BOOKS:

1. Data Mining – Concepts and Techniques – Jiawei Han & Micheline Kamber, 3rd Edition Elsevier.
2. Data Mining Techniques – ArunKPujari

REFERENCE BOOKS

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addision Wisley, 2006.
2. Data Mining Analysis and Concepts, M. Zaki and W. Meira

CO-PO &PSO Mapping:

Course Name - Course Outcomes / Program Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	M												M		
CO2	M	H											H		
CO3	H		M											M	
CO4	M													H	

B.Tech III Year – VI Sem	L	T	P	C
Subject Code: 21OE6CO05	3	0	0	3

SENSORS AND DEVICES

Prerequisite: IoT, ADE

Course Objectives:

- To introduce the terminology, technology and its applications
- To introduce the concept of M2M (machine to machine) with necessary protocols
- To introduce the Python Scripting Language which is used in many IoT devices
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of web-based services on IoT devices

Course Outcomes:

- Understand the IoT value chain structure (device, data cloud), application areas and technologies involved.
- Analyse IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules
- Market forecast for IoT devices with a focus on sensors
- Explore Internet of Things with the help of preparing projects designed for Raspberry Pi

MODULE-I:

Introduction to Internet of Things- Definition and Characteristics of IoT, Sensors, Physical Design of IoT – IoT Protocols, IoT communication models, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems

Types: Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

MODULE-II:

IoT - Software defined networks, network function virtualization, difference between SDN and NFV for IoT

M2M Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

MODULE-III:

IoT Physical Devices and Endpoints- Introduction to Arduino and Raspberry Pi

Programming – Interfaces (serial, SPI, I2C), Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins.

MODULE-IV:

Controlling Hardware- Connecting LED, Buzzer, Switching High Power devices with transistors, speed control of DC Motor, unipolar and bipolar Stepper motors

Sensors- Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors

MODULE-V:

IoT Physical Servers and Cloud Offerings– Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT

Course project on IoT Application

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn W allace, O'Reilly (SPD), 2014, ISBN: 9789350239759
3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895

REFERENCE BOOKS:

1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan
2. Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014
3. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Program Outcomes (POs)													**Program Specific Outcomes***	
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO-1	3												1	
CO-2	3	1											2	
CO-3	3	1											2	
CO-4	3	1											1	

B. Tech III Year–VI Sem	L	T	P	C
Subject Code: 21OE6CC02	3	0	0	3

COMPUTER HARDWARE AND SYSTEM ESSENTIALS

Prerequisites: Nil

Course Objectives:

• Computer hardware essentials is designed to introduce students to a basic understanding of the different types of computing devices, computer components (CPU, memory, power supplies, etc.), and operating systems.
• It also introduces building a fully functional Linux and Installing applications.
• Understand the basic of circuit building.

Course Outcomes:

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

CO1: Understanding the working principles of different computing devices (desktop computers, laptops, etc.).
CO2: Understand connection interfaces between peripheral devices, storage devices, displays.
CO3: Understand the procedure for Installation of OS - Linux and supporting, upgrading and new applications.
CO4: Understand the concepts of number system and circuit building.

Module 1:

Components of Computer System: Computer Memory: Secondary storage device types, Basic Principles of operation: Sequential Access device, Direct Access device -Magnetic disks,Optical disks, memory storage devices, Ports: Serial and Parallel Ports, Specialized Expansion Ports: SCSI, USB, MIDI, Expansion Slots and Boards, PC Cards, Plug and Play, HDMI ports, networking ports. System software: bootstrap module, configuration.

Module 2:

OS loading: typical Linux virtual machine. Installing a Linux virtual machine. Using package manager to install/update software. Understanding disk partitions and obtaining partition information using system tools. Obtaining essential system resource utilization and information using system tools and proc file system: disk utilization, memory utilization, process information, CPU utilization.

Module 3:

Operating System: Introduction, Objectives, classification and functions of Operating System, Basics of popular operating system (LINUX, WINDOWS). Kernel prompt, Shell commands.

The User Interface: Task Bar, Icons, Menu, Running an Application. Operating System Simple Setting: Changing System Date and Time, Changing Display Properties, To Add or

Remove a Windows Component, Changing Mouse Properties, Adding and removing Printers. File and Directory Management: Creating and renaming of files and directories, Common utilities. Interrupts statements in various OS and its uses.

Module 4:

Number systems - Signed and Unsigned numbers arithmetic, Binary, Decimal, Octal, Hex, BCD etc. Introduction to logic circuits: Variables and functions, Inversion- Truth tables – Logic Gates and Networks - Boolean algebra - Synthesis using gates - Design examples – Optimized implementation of logic functions: Karnaugh map - Strategy for minimization – Minimization of product of sums forms - Incompletely specified functions - Multiple output circuits – Tabular method for minimization.

Module 5:

Combinational circuit building blocks: Multiplexers - Decoders - Encoders, Sequential circuit building blocks: Flipflops-SR, JK, D and T- Registers - Counters
- A simple sequential circuit design example from state diagram.

Textbook:

1. Brookshear JG. Computer science: an overview. Eleventh Edition, Addison-Wesley Publishing Company; 2011.
2. Givone DD. Digital Principles and Design.Tata McGraw Hill Publishing Company Limited; 2003.
3. Mano MM, Ciletti MD. Digital Design with Introduction to the Verilog HDL.Fifth Edition, Pearson Education; 2015.

References:

1. Norton, Peter. Introduction to computers. Sixth edition, Tata McGraw-HILL; 2008.
2. Wakerly JF. Digital Design Principles and Practices. Fourth Edition, Pearson Education; 2008.
3. Sinha, Pradeep K., and Priti Sinha. Computer fundamentals. BPB publications; 2010.

CO-PO/PSO Mapping:

CO-PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO2	PSO3
CO-1			2				3								
CO-2				2											
CO-3					2	2									
CO-4		1						3							