HYDERABAD INSTITUTE OF TECHNOLOGY AND MANAGEMENT									
B.TECH. HR-21 COURSE STRUCTURE									
CSE-ARTIFICIAL INTELIGENCE & MACHINE LEARNING									
(Applicable for the batch admitted from 2021-22 onwards)									
V – Semester (III – Year)									
S. No.	**Course 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	21PC5CS07	Design and Analysis of Algorithms	3	-	-	3	30	70	100
3	21PC5CM03	Machine Learning	3	-	-	3	30	70	100
4	**Professional Elective-I**		3	-	-	3	30	70	100
5	**Open Elective-I**		3	-	-	3	30	70	100
6	21PC5CS23	Design and Analysis of Algorithms-Lab	-	-	3	1.5	30	70	100
7	21PC5CD05	Software Engineering & Testing Methodologies-LAB	-	-	3	1.5	30	70	100
8	21PC5CM04	Machine Learning-Lab	-	-	3	1.5	30	70	100
9	21PR5IN02	Evaluation of Summer Internship-II	-	1	2	2	100	0	100
TOTAL						**21.5**	**340**	**560**	**900**
Non Credit Courses									
10	21MC5HS03	Analytical Reasoning	2	-	-	0	100	0	100
VI – Semester (III – Year)									
S. No.	**Course code**	**Subject**	**Hours Per Week**			**Credits**	**Scheme of Evaluation**		
							Maximum Marks		
			L	**T**	**P**		**Int.**	**Ext.**	**Tot.**
1	21PC6CS08	Formal Languages and Automata Theory	3	-	-	3	30	70	100
2	21PC6CM05	Neural Networks and Deep Learning	3	1	-	4	30	70	100
3	21PC6CM06	Expert Systems	3	-	-	3	30	70	100
4	21ES6MT08	Descriptive Statistics-Lab	-	1	1	1.5	30	70	100
5	**Professional Elective-II**		3	-	-	3	30	70	100
6	**Open elective-II**		3	-	-	3	30	70	100
7	21PC6CM07	Expert Systems-Lab	-	-	2	1	30	70	100
8	21PC6CM08	Neural Networks and Deep Learning - Lab	-	-	3	1.5	30	70	100
9	21HS6EG05	Advanced English Communication Skills-Lab	-	-	2	1	30	70	100
10	21PR6CD02	**Doing Engineering-2**	-	1	1	1.5	30	70	100
TOTAL						**22.5**	**300**	**700**	**1000**
11	21MC6HS04	Quantitative Aptitude	2	-	-	0	100	0	100

Subject Code	Professional Elective-I
21PE5CD21	Big Data Analytics
21PE5CO12	Virtual Reality
21PE5CM13	Text Mining and Analytics
21PE5CS13	Computer Graphics

Subject Code	Professional Elective-II
21PE6CM21	Fundamental of Robotics
21PE6CM22	Predictive Analytics
21PC6CS14	Computer Networks
21PE6CD62	Data 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. III Year I Sem.	L T	P C
Subject Code: 21PC5CS07	3 0	0 3

DESIGN AND ANALYSIS OF ALGORITHMS

Prerequisites:

1. A course on "Computer Programming and Data Structures".
2. A course on "Advanced Data Structures".

Course Objectives:

1. Introduces the notations for analysis of the performance of algorithms.
2. Introduces the data structure of disjoint sets.
3. Describes major algorithmic techniques (divide-and-conquer, backtracking, dynamic Programming, greedy, branch and bound methods) and mention problems for which eachtechnique is appropriate
4. Describes how to evaluate and compare different algorithms using worst-, average-, and bestcase analysis.
5. Explains the difference between tractable and intractable problems, and introduces theProblems that are P, NP and NP complete.

Course Outcomes:

1. Ability to analyze the performance of algorithms
2. Ability to choose appropriate data structures and algorithm design methods for a specified application
3. Ability to understand how the choice of data structures and the algorithm design methodsImpact the performance of programs

UNIT - I

Introduction: Algorithm, Performance Analysis-Space complexity, Time complexity, AsymptoticNotations- Big oh notation, Omega notation, Theta notation and Little oh notation.

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen'smatrix multiplication.

UNIT - II

Disjoint Sets: Disjoint set operations, union and find algorithms

Backtracking: General method, applications, n-queen's problem, sum of subsets problem, graphcoloring

UNIT - III

Dynamic Programming: General method, applications- Optimal binary search trees, 0/1 knapsackproblem, All pairs shortest path problem, Traveling sales person problem, Reliability design.

UNIT - IV

Greedy method: General method, applications-Job sequencing with deadlines, knapsack problem,Minimum cost spanning trees, Single source shortest path problem.

UNIT - V

Branch and Bound: General method, applications - Travelling sales person problem, 0/1 knapsackproblem - LC Branch and Bound solution, FIFO Branch and Bound solution.

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard andNP-Complete classes, Cook's theorem.

TEXT BOOK:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharan,University Press.

REFERENCE BOOKS:

1. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.
2. Introduction to Algorithms, second edition, T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C.Stein, PHI Pvt. Ltd./ Pearson Education.
3. Algorithm Design: Foundations, Analysis and Internet Examples, M.T. Goodrich and R. Tamassia, John Wiley and sons.

B. Tech III Year–I Sem	L	T	P	C
Subject Code: 21PC5CM03	3	1	0	4

Machine Learning

Prerequisite:

1. Linear Algebra and Calculus
2. Knowledge of statistics

Course Objectives:

1. To introduce the basic concepts and techniques of Machine Learning.
2. To apply feature engineering techniques to the given data.
3. To apply machine learning concepts to solve problems.
4. To apply clustering techniques to the given problem.

Module-I

Introduction to Machine Learning and Pre-processing: 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.

Data Collection (Sources), Types of missing data, Missing data handling using Imputation Technique.

Module – II

Data Engineering: Different types of data distribution: Normal distribution, Skewed distribution, Data transformations, Handling Imbalanced data, Outlier detection, Different types of Feature selection techniques in machine learning.

Module - III

Linear Algorithms: Linear Regression, Logistic Regression, Logistic Regression using Maximum Likelihood Estimation, Gradient Descent for Machine Learning, Batch Gradient Descent, Stochastic Gradient Descent, lasso and ridge regression, Parametric machine learning techniques, Performance metrics for Linear algorithms.

Module – IV

Non-Linear Algorithms: Decision Trees: ID3, CART, Naive Bayes, K-Nearest Neighbour's, Support Vector Machines: Maximal-Margin Classifier, Soft Margin Classifier, Kernels, non-parametric machine learning techniques, 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. Python: Deeper Insights into Machine Learning by David Julian, John Hearty, and Sebastian Raschka, 2016.
2. Machine Learning with Python, Coding Mark, Charlie Creative Lab, 2020.

Reference Text Books:

1. U Dinesh Kumar Manaranjan Pradhan, Machine Learning Using Python, Wiley India Pvt. Ltd, 2019.
2. Mark Fenner, Machine Learning with Python for Everyone, Addison-Wesley Professional, 2019.

Web Resources & E-Books:

1. https://machinelearningmastery.com/
2. https://www.kdnuggets.com/

MOOC's Courses:

1. "Introduction to Machine Learning", NPTEL
2. "Machine Learning for Engineering and Science applications", NPTEL

Course Outcomes:

Upon completing this course, the student will be able to

1. Describe the different types of machine learning techniques.
2. Use different feature engineering techniques on the given data.
3. Classify the given data using machine learning techniques.
4. Employ clustering techniques to handle unlabelled 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)												Program Specific Outcomes*		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2														
CO2	3	2											2		
CO3	3	2											2		1
CO4	3	2											2		1

B.Tech II Year – IV Sem	**L**	**T**	**P**	**C**
Subject Code: 21PC4CS23	**0**	**0**	**3**	**1.5**

DESIGN AND ANALYSIS OF ALGORITHMS – LAB

Course Objectives:

1. Design and implement various algorithms in C / JAVA / Python
2. Employ various design strategies for problem solving.
3. Measure and compare the performance of different algorithms

Course Outcomes: The students should be able to:

1. Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
2. Develop variety of algorithms such as sorting, graph related, combinatorial, etc., in a high level language.
3. Analyze and compare the performance of algorithms using language features.
4. Apply and implement learned algorithm design techniques and data structuresto solve real- world problems.

List of Programs:

1. Sort a given set of elements using the quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the 1st to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Implement merge sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3. Write a C program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.
4. Implement a C Program to implement the **0/1 Knapsack** problem using (a) Dynamic Programming method (b) Greedy method.
5. Write a program, fom a given vertex in a weighted connected graph, find shortest paths to other vertices using **Dijkstra's algorithm**.
6. Find Minimum Cost Spanning Tree of a given connected undirected graph using **Kruskal'salgorithm**. Use Union-Find algorithms in your program.
7. Find Minimum Cost Spanning Tree of a given connected undirected graph using **Prim's algorithm**.
8. Write C programs to (a) Implement All-Pairs Shortest Paths problem using **Floyd's**

algorithm.

(b) Implement **Travelling Sales Person problem** using Dynamic programming.

9. Design an algorithm and implement a program to find a **subset** of a given set **S** = {Sl, S2,. ,Sn} of n positive integers whose SUM is equal to a given positive integer d. For example, if S ={1, 2, 5, 6, 8} and d= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem instance doesn't have a solution.
10. Design and implement in Java to find all **Hamiltonian Cycles** in a connected undirected Graph G of n vertices using backtracking principle.

TEXT BOOKS

1. Fundamentals of Computer Algorithms,2nd Edition, Ellis Horowitz, Satraj Sahni and S. Rajasekharam, Universities Press,2008.
2. Foundations of Algorithms,4th edition,R.Neapolitan and K.Naimipour,Jones and Barlett Learning.
3. Design and Analysis of Algorithms, P.H. Dave, H.B. Dave,Pearson Education,2008.

CO-PO/PSO Mapping:

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				3	1								3	3	
CO2				2	2								3	3	
CO3				3	2								3	3	
CO4				3	1								3	3	

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 III Year–I Sem	L	T	P	C
Subject Code: 21PC5CM04	0	0	3	1.5

Machine Learning Lab

Prerequisite:

1. Python Programming
2. Knowledge of statistics

Course Objectives:

1. To implement the machine learning techniques on a given dataset.
2. To use various data preprocessing techniques on the given data.
3. To compare different machine learning techniques.
4. To select suitable model parameters for different machine learning techniques.

Lab Programs:

1. Working with the dataset.
   a) Download any dataset from the repository and import it as an input.
   b) Summarize the imported dataset: no of samples, no of features, target vector using python programming.
   c) Split the dataset into training, testing and validation dataset using Python Programming.
2. Consider any dataset and apply suitable imputation technique to handle the missing data.
   a) Summarize the dataset and also determine the missing values present in the dataset.
   b) Based on the missing values, use a suitable technique to handle the missing data.
   c) Summarize the dataset after the imputation of missing values.
3. Apply Linear Regression on a given dataset and comment on its efficiency and performance.
   a) Implement linear regression using Sklearn library.
   b) Split the obtained dataset into training and testing: ratio of 80-20, 70-30.
   c) Evaluate the model using metrics: Mean Squared Error, Absolute Error and Root Mean Squared Error.
4. Apply Linear Regression to the given dataset.

a) Evaluate the model performance after L1 Regularization.

b) Evaluate the model performance after L2 Regularization.

5. Apply Logistic Regression on the given dataset and perform the model evaluation using confusion matrix.

   a) Download the dataset from the repository and import it as input.

   b) Build Logistic Regression Model and train the dataset.

   c) Evaluate the model performance using AUC-ROC curve, Confusion Matrix: Accuracy, Precision, Recall, F score.

6. Apply Decision tree (ID3) technique to the given data set for classification.

   a) Build the decision tree for the training dataset.

   b) Use the different hyperparameters to improve the model.

   c) Evaluate the model performance on the test dataset.

7. Use Support Vector Machine to perform the classification and regression on a dataset.

   a) Import the dataset and perform the classification and regression using SVM.

   b) Evaluate the model's performance on testing dataset and validation dataset.

   c) Use Sklearn's Grid Search CV method to find the best-fit Model.

8. Apply K-Means Clustering on the collected dataset.

   a) Implement K-Means clustering using sklearn.

   b) Check for the best k-value.

9. 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.

10. 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.

Text Books:

1. Python: Deeper Insights into Machine Learning by David Julian, John Hearty, and Sebastian Raschka, 2016.

2. Machine Learning with Python, Coding Mark, Charlie Creative Lab, 2020.

Reference Text Books:

1 U Dinesh Kumar Manaranjan Pradhan, Machine Learning Using Python, Wiley India Pvt. Ltd, 2019.
2 Mark Fenner, Machine Learning with Python for Everyone, Addison-Wesley Professional, 2019.

Web Resources & E-Books:

1. https://machinelearningmastery.com/
2. https://www.kdnuggets.com/

MOOC's Courses:

1. "Introduction to Machine Learning", NPTEL
2. Machine Learning for Engineering and Science applications: NPTEL

Course Outcomes:

Upon completing this course, the student will be able to

1. Summarize the data.
2. Employ the different data preprocessing operations on the given dataset.
3. Demonstrate the Regression and Classification technique on the given data.
4. Use K-means clustering algorithm to handle the real-world problem.

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	3	2			3				1	1			2		2
CO2	3	2			3				1	1			2		2
CO3	3	2			3				1	1			3		2
CO4	3	2			3				1	1			3		2

B.Tech III Year I Sem **L T P C**
Subject Code: 21MC5HS03 **1 0 0 0**

Analytical Reasoning

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:

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, SimboNuga, 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 III Year–I Sem	L	T	P	C
Subject Code: 21PE5CD21	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	PSO1	PSO2	PSO3
CO1	2														
CO2	2														
CO3	3	2			2										
CO4	3	2			2										

B. Tech III Year–V Sem	L	T	P	C
Subject Code: 21PC5CO12	3	0	0	3

VIRTUAL REALITY

Pre requisite: Basic Mathematics, Computer knowledge

Course Objectives:

1. Introducing the concepts of Computer Graphics, VR systems and Virtual Environment.
2. Introducing the concepts of Augmented Reality.
3. Applying Augmented and Virtual Reality for various applications.

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

1. Comprehend the basics of computer graphics, modelling and Geometric Transformations.
2. Comprehend Virtual Environment, VR systems and VR Hardware.
3. Develop a Prototype, a Product for automotive/ any applications.
4. Apply augmented and virtual reality to solve challenging problems.

MODULE I

Virtual Reality and Virtual Environment: Introduction, Computer graphics, Real time computer graphics, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark.

3D Computer Graphics: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, Simple 3D modelling, Illumination models, Reflection models, Shading algorithms, Radiosity, Hidden Surface Removal, Realism -Stereographic image.

MODULE II

Geometric Modelling: Introduction, From 2D to 3D, 3D space curves, 3D boundary representation Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection.

Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems.

VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems.

MODULE III:

Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Non-linear interpolation, the animation of objects, linear and non-linear translation, shape & object inbetweening, free from deformation, particle system.

Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.

MODULE IV

Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.

Automotive Design Process: Development of concept in 3D - Design the process - VR-based collaborative environment creation, Virtual Prototyping for vehicle design: Modeling the process - Modifying concepts and overcoming the inherent limitations and demands on resources associated with physical modelling - VR-based visualization of idea and Validation of a new vehicle's entire electronic system.

MODULE V

AR and Product Development: Repairing existing models and designing new ones - AR-based remote assistance in real-time - AR-based visualization of new components fit into existing vehicle designs, AR and VR in Vehicle Manufacturing: Virtual assembly line: reconfiguration and optimization of the manufacture assembly lines - AR-based retrofitting - Creation of immersive environment for designers, researchers and engineers, VR and Digital Training: Efficient and cost-effective training delivery methods - Simulation-based training - Learning outcomes while reducing risk and training costs.

Textbooks:

1. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.
2. 2. Ella Hassanien, Deepak Gupta, Ashish Khanna, Adam Slowik, "Virtual and Augmented Reality for Automobile Industry: Innovation Vision and Applications",Springer International Publishing, 2022

Reference books:

2. Alan B. Craig, "Understanding Augmented Reality, Concepts andApplications", Morgan Kaufmann, 2013.
3. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.
4. Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley Inter Science, 2nd Edition, 2016.
5. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application and Design", Morgan Kaufmann, 2008.

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													
CO2		3			3										
CO3	2	2	3												
CO4	2			3	3										

B. Tech III Year–I Sem	L	T	P	C
Subject Code: 21PE5CM13	3	0	0	3

Text Mining and Analytics

Prerequisite:

1. Data Mining
2. Natural Language Processing

Course Objectives:

1. **Describe the various techniques to extract insights from the text.**
2. **Apply the different Classification techniques to text data.**
3. **Apply the different Clustering techniques to text data.**
4. **Interpret the given data using the Visualization technique.**

Module-I

Text Mining and Analytics: Overview Text Mining and Analytics, Language and Computation, Language as Data, A Computational Model of Language, Language Features, Contextual Features, Structural Features, Building a Custom Corpus: What is a Corpus? Domain-Specific Corpora, The Baleen Ingestion Engine, Corpus Data Management, Corpus Disk Structure, Corpus Readers-Streaming Data Access with NLTK, Reading an HTML Corpus.

Module – II

Corpus Pre-processing and Wrangling: Breaking Down Documents, Identifying and Extracting Core Content, Deconstructing Documents into Paragraphs, Segmentation: Breaking Out Sentences, Tokenization: Identifying Individual Tokens, Part-of-Speech Tagging.

Text Vectorization and Transformation Pipelines, Words in Space, Frequency Vectors, One-Hot Encoding, Term Frequency–Inverse Document Frequency, Distributed Representation.

Module - III

Text-Classification: Logistic Regression, Naïve Bayes, Gaussian Naïve Bayes, Multinomial Naïve Bayes, Support Vector Machine: Stochastic Gradient Classifier, Neural Network, Long Short-Term Memory.

Module – IV

Text Clustering: Clustering by Document Similarity, Distance Metrics, Partitive Clustering, k-means clustering, Hierarchical clustering, Balanced Iterative Reducing and Clustering using Hierarchies (BIRCH), Topic Modelling Techniques: Latent Dirichlet Allocation (LDA), Latent Semantic Analysis (LSA), and Non-Negative Matrix Factorization (NNMF).

Module – V

Text Visualization: Visual Feature Analysis: n-gram viewer, Network visualization, Co-occurrence plots, Visualizing Clusters, Visualizing Classes, Silhouette Scores and Elbow Curves for k means Clustering.

Text Books:

1. **Applied Text Analysis with Python by Benjamin Bengfort, Rebecca Bilbro, and Tony Ojeda, O'Reilly.**
2. **Hand Book of Natural Language Processing, Second Edition – NITIN INDURKHYA FRED J. DAMERAU, CRC Press, 2010.**

Reference Text Books:

1. **Aggarwal, C. C., & Zhai, C. (Eds.). (2012). Mining text data. Springer Science & Business Media.**
2. **Liu, B. (2012). Sentiment analysis and opinion mining. Synthesis lectures on human language technologies, 5(1), 1-167.**

Web Resources & E-Books:

1. **https://www.analyticsvidhya.com/blog/2015/06/quick-guide-text-data-cleaning-python/**
2. **https://www.kaggle.com/c/sentiment-analysis-on-movie-reviews**

MOOC's Courses:

1. **Coursera Course on "text-mining"**
2. **Udemy Course on "text-mining-and-natural-language-processing-in-python"**

Course Outcomes:

Upon completing this course, the student will be able to

1. **Discuss the concepts of Text mining and Analytics.**
2. **Apply the different Text pre-processing techniques.**
3. **Use different classification and clustering techniques on the given text data.**
4. **Explain different visualization techniques 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)												Program Specific Outcomes*		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	1												1		
CO2	3	2											2		1
CO3	3	2											2		1
CO4	1												2		1

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
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 IIIYear–VI Sem	L	T	P	C
Subject Code: 21PC6CS08	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 III Year–II Sem	L	T	P	C
Subject Code: 21PC6CM05	3	1	0	4

Neural Networks and Deep Learning

Prerequisite:

1. Python Programming
2. Machine Learning

Course Objectives:

1. Understand the neural network system and its components.
2. Compare Single Layer and Multi-layer perceptron.
3. Explain Convolutional Neural Network, LSTM.
4. Describe Unsupervised Deep Learning models.

Module-I

Introduction to biological neurons and their artificial models, Single Layer Perceptron, Multilayer Perceptron, Optimization Techniques: Gradient Descent, Batch Optimization.
Overview of Convolution Neural Network, Recurrent Neural Network, Unsupervised Deep Learning. Real-time examples.

Module – II

Multi-Layer Perceptron: Learning rules: perceptron rule, Out star learning rule, Hebb's rule, Delta learning rule, Backpropagation.

Associative Memory Network: Algorithm for pattern association, Hetero Associative Memory Neural Network, Auto Associative Memory Network, Comparison of Single Layer and Multi-Layer neural network.

Module - III

Convolutional Neural Networks: History, CNN Architectures: Convolution layer, pooling, Padding, filters, Activation functions, dropout, optimizers.

Module – IV

Recurrent Neural Networks (RNNs): Sequence modeling using RNNs, Exploding and Vanishing Gradients, Long Short-Term Memory (LSTM), Gated Recurrent Units, Bidirectional LSTMs.

Module – V

Unsupervised Deep Learning: Autoencoder, Deep Belief Nets, Generative Adversarial Networks.
Applications: Applications of Single Layer Perceptron, Multi-Layer neural network, CNN, LSTM.

Text Books:

1. **Deep Learning by Ian Goodfellow and Yoshua Bengio and Aaron Courville (MIT press), 2016**

2. **Neural Networks and Learning Machine – by Simon Haykin, Third Edition, Pearson Education, 2014**

Reference Text Books:

1. **Chris Bishop's Pattern recognition and machine learning, Springer, 2010**
2. **Deep Learning Methods and Applications by Deng & Yu's monograph, now publishers Inc, 2014.**
3. **Deep Learning for Natural Language Processing, Develop Deep Learning Models for Natural Language in Python, Jason Brownlee, 2017.**

Web Resources & E-Books:

1. **http://cs231n.stanford.edu/**
2. **https://machinelearningmastery.com/what-is-deep-learning.**

MOOC's Courses:

1. **"Deep Learning", NPTEL.**
2. **"Deep Learning: Convolutional Neural Networks in Python", Udemy.**

Course Outcomes:

Upon completing this course, the student will be able to

1. Explain the concept of the Neural Network and different optimization techniques.
2. Demonstrate the multi-layer neural network and Associative Memory Neural Network for solving the given problem.
3. Comprehend Convolutional Neural Network, LSTM and its hyperparameter.
4. Describe Unsupervised Deep Learning models.

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**												**2**		
CO2	**3**	**2**											**2**		
CO3	**2**												**2**		
CO4	**2**												**2**		

B. Tech III Year–II Sem	L	T	P	C
Subject Code: 21PC6CM06	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 IIIYear–VI Sem	L	T	P	C
Subject Code: 21ES6MT08	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–II Sem	L	T	P	C
Subject Code: 21PC6CM07	0	0	2	1

Expert Systems Lab

Prerequisite:

1. Artificial Intelligence
2. Discrete Mathematics

Course Objectives:

1. Create Expert Systems and their applications.
2. The course enables students to understand the concept of Fuzzy Logic with an example.
3. The course enables students to understand the application of Genetic Algorithms.
4. The course enables students to use tools to create an Expert System.

Lab Programs

1. Implement DFS for tic-tac-toe problem using Python.
2. Implement BFS for water jug problem using Python.
3. Build an Expert System with forward chaining using Python.
4. Build an Expert System with backward chaining using Python.
5. Write a Python Code to perform basic operations (Union, Intersection, Complement, Difference) of Fuzzy Logic.
6. Write a Python Code to perform the following Fuzzy composition: a. Max-Min Composition; b Max-Product Composition.
7. Develop Fuzzy Control Systems (the Tipping Controller) using the skfuzzy control API.
8. Develop an Expert System using ‘fuzzy logic’ package in python.
9. Write a Python Code to implement Simple Genetic Algorithm using single-point crossover.
10. Write a Python Code to implement Simple Genetic Algorithm using two-point crossover.

Text Books:

1. Principles of Expert Systems Peter by J.F. Lucas & Linda C. van der Gaag, 2014.
2. Zimmermann. H.J, “Fuzzy set theory-and its Applications”- Springer international edition, 2011.

Reference Text Books:

1. David Goldberg. V Genetic Algorithms in Search, Optimization, and Machine Learning, Pearson Education, 2009.
2. Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering by Nikola K. Kasabov, 1998.

Web Resources & E-Books:

1. https://towardsdatascience.com/fuzzy-inference-system-implementation-in-python-8af88d1f0a6e

2. https://www.geeksforgeeks.org/common-operations-on-fuzzy-set-with-example-and-code/?ref=lbp
3. https://algodaily.com/lessons/introduction-to-genetic-algorithms-in-python#implementation-of-ga-using-python
4. What is Fuzzy Inference System and How it works? - CodeCrucks
5. Fuzzy Control Systems: The Tipping Problem — skfuzzy v0.2 docs (pythonhosted.org)
6. https://github.com/amogorkon/fuzzylogic/blob/master/docs/Showcase.ipynb
7. https://data-flair.training/blogs/python-genetic-algorithms-ai/ --- simple example

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. Implement the small Expert Systems.
2. Implement the Fuzzy Logic Concepts.
3. Illustrate the Genetic Algorithms and their applications.
4. Illustrate 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	3	2		2										2
CO2	3	3	2		2										2
CO3	3	3	2		2										2
CO4	2	2	2		2										2

B. Tech III Year–II Sem	L	T	P	C
Subject Code: 21PC6CM08	0	0	3	1.5

Neural Networks and Deep Learning Lab

Prerequisite:

1. Python Programming
2. Machine Learning

Course Objectives:

1. Design an ANN Model.
2. Develop a Convolutional Neural Network model for classification.
3. Study the impact of Hyperparameters on the model's performance.
4. Evaluate the performance of the models.

Lab Programs:

1. Develop ANN model for the given dataset (csv format) when the value of learning rate, epoch, no of hidden layer and neurons of hidden layer change in ANN.
2. Analyze the performance of the ANN Model.
    a) Study the impact of learning rate.
    b) Similarly, change the value of epoch, no of hidden layer and neurons of hidden layer and evaluate the performance.
2. Analyse the performance of ANN regression on the Boston housing dataset.
3. Compare the performance of ANN with Decision Tree on the dataset using following metrics:
    a) Confusion Matrix, Accuracy, Precision, Recall, F1 Score.
    b) Error Metrics: MSE, RMSE and MAE.
4. Analyse the performance of Classification models - ANN on FashionMNIST dataset (in image format).
    a) Load the dataset as input.
    b) Normalize the given range of pixel values and show the training images along with class labels.
    c) Analyze its performance.
5. Analyse the performance of CNN model on MNIST dataset (in image format).
    a) Load the dataset.
    b) Normalize the given range of pixel values and show the training images along with class labels.
    c) Evaluate the model by using metrics – classification accuracy and Cross Entropy Loss.
6. Study the impact of filter size and activation function on the performance of CNN model.
    a) Load the dataset.
    b) Change the hyper-parameters (Varying filter size, activation function) and compare the model's performance.
7. Study the impact of number of convolutional layers and pooling layer (Average pooling, Max pooling).
    a) Load the dataset.
    b) Change the hyper-parameters (number of convolutional layers and pooling layer) and compare the model's performance.

8. Perform the time series prediction (Airline Passengers dataset) using LSTM.
    a) Load the dataset.
    b) Pre-process the dataset.
    c) Evaluate the model and plot the graph.
9. Train a sentiment analysis model on the IMDB dataset, use RNN layers with LSTM/GRU notes.
10. Compare the performance of CNN and RNN model using a given dataset.

Text Books:

1. Deep Learning: A Practical Approach,by Rajiv Chopra, Second edition.
2. Learn Keras for Deep Neural Networks: A Fast-Track Approach to Modern Deep Learning with Python, 2019.

Reference Text Books:

1. Hands-On Deep Learning for Images with TensorFlow: Build intelligent computer vision applications using TensorFlow and Keras, 2018, by Will Ballard
2. Deep Learning by Ian Goodfellow and Yoshua Bengio and Aaron Courville (MIT Press), 2016.

Web Resources & E-Books:

1. https://playground.tensorflow.org/
2. https://matlab.mathworks.com/

MOOC's Courses:

1. "Deep Learning", NPTEL.
2. "Deep Learning: Convolutional Neural Networks in Python", Udemy.

Course Outcomes:

Upon completing this course, the student will be able to
1. Develop an ANN Model for classification and regression.
2. Develop a Convolutional Neural Network model for classification.
3. Analyze the Model's performance by varying Hyperparameters.
4. Evaluate the performance of the models.

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	**3**	**3**	**3**		**3**								**2**		**2**
CO2	**3**	**3**	**3**		**3**								**2**		**2**
CO3	**3**	**3**	**3**		**3**								**2**		**2**
CO4	**3**	**3**	**3**		**3**								**2**		**2**

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
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		

B. Tech III Year–II Sem	L	T	P	C
Subject Code: 21PE6CM21	3	0	0	3

Fundamentals of Robotics

Prerequisite:

1. Python Programming
2. Matrix Algebra

Course Objectives:

1. To understand the concepts of robotics and automation systems, the basic components of robot manipulator and its working principle.
2. To classify the types of sensors, actuators and industrial robots based on kinematic structure, DOF, control system.
3. To analyse and evaluate the motion analysis such as Robot kinematics, Motion dynamics, trajectory planning & Robot work envelopes etc.
4. To apply and analyse the acquired knowledge for designing the robot, Robot Programming methods for motion planning, gripper force analysis for specific applications.

Module - I

Introduction: Automation and Robotics, An overview of Robotics – present and future applications, classification by coordinate system and control system.

Components of Industrial Robotics: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

Module - II

Actuators: Introduction, Characteristics of actuating systems, Comparison of actuating systems, Hydraulic devices, Pneumatic devices, Electric motors and stepper motors, Microprocessor control of electric motors.

Robot Manipulator: Introduction, General description of Robot Manipulator, Mathematical preliminaries on Vectors & Matrices, Homogenous representation of Objects, Robotic Manipulator Joint Co-Ordinate System.

Module - III

Transformations of a Robot Manipulator: Euler Angle & Euler Transformations, Roll-Pitch-Yaw (RPY) Transformation, Relative Transformation, Direct & Inverse Kinematics' Solution, D H Representation & Displacement Matrices for standard configurations, Geometrical approach to inverse kinematics.

Sensors: Introduction to Sensors and their characteristics, Types of sensors and their Classification, Use of Sensors and Sensor-based system in Robotics, Position sensors, Velocity sensors, Acceleration sensors, Force and pressure sensors, Torque sensors, Micro-switches, Light and Infrared sensors, Touch and Tactile sensors, Proximity sensors, Range-finders.

Module - IV

WEBOT Robot Simulator: Introduction to WEBOT, Starting of WEBOT, The User Interface, The 3D Window, The Scene Tree, The Console, Computer Peripherals.

WEBOT Applications: Python programming fundamentals with respect to Line Follower Robot, How to program a Robot through Python in WEBOT.

Module - V

Tower of Hanoi Algorithm: Understanding the Algorithm, Building the flow Chart, and Components used in the building of the Gantry Robot.

Shaft Couplings & Rigid couplings: Build & Programme Gantry Robot Gripper for Tower of Hanoi Algorithm in WEBOT Robotic Simulator.

Text Books:

1. FU K S, Gonzalez RC, Lee CSG; Robotics –Control, sensing, TMH Publ.
2. Saeed B. Niku, Introduction to Robotics, Analysis, Systems, Applications, PHI Publications

Reference Text Books:

1. S R Dev, Robotics Technology and Flexible Automation, Tata McGraw Hill
2. Spong Mark and Vidyasagar; Robot Modelling and control; Wiley India
3. Ghosal Ashitava; Robotics Fundamental concepts and analysis; Oxford

Web Resources & E-Books:

1. https://www.cyberbotics.com/
2. http://academicearth.org/courses/introduction-to-roboticsVideo references

MOOC's Courses:

1. "Robotics" in NPTEL
2. "Autonomous mobile robots" in NPTEL

Course Outcomes:

Upon completing this course, the student will be able to

1. Explain basic components of robotics, classification of robots and their applications.
2. Apply basic transformations related to the movement of the manipulator.
3. Describe various types of sensory devices, working and their applications.
4. Write a program to design a given simple robot application.

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										
CO3	2														
CO4	3				2										

B. Tech III Year–II Sem	L	T	P	C
Subject Code: 21PE6CM22	3	0	0	3

Predictive Analytics

Prerequisite:

1. Basics of Programming and statistics.
2. Machine Learning

Course Objectives:

1. To understand the basic concepts of predictive analytics.
2. To apply the different regression techniques on the given data.
3. To implement logistic regression, decision tree and random forest on the given data.
4. To perform the prediction and time series analysis on the time series data.

Module-I

Introduction to predictive analytics: History and Evolution, Scope of predictive analytics, Ensemble of statistical algorithms, Statistical tools, Historical data, Mathematical function, Business context, Different Types of Data Analytics, Applications of Predictive Analytics, Statistics vs Data Mining vs Data Analytics vs Data Science, machine learning packages: Data Analysis Packages, Machine Learning Core Libraries, Packages for predictive modelling.

Module – II

Simple Linear Regression: Linear Regression with Python: Definition and overview of linear regression analysis, Linear regression using simulated data, Fitting a linear regression model and checking its efficacy, Finding the optimum value of variable coefficients, Making sense of result parameters, p-values, F-statistics, Residual Standard Error, Implementing linear regression with Python, Linear regression using the stats model library, Model validation, Training and testing data split, Summary of models, Linear regression with scikit-learn.

Module - III

Different Types of Regression: Multiple Linear Regression, Multi-collinearity: Variance Inflation Factor, Regularization methods: Lasso, Ridge and Elastic nets, Polynomial Regression, Regression tree algorithm, implementing a regression tree using Python, SVM regression, ANN for Regression.

Module – IV

Classification Techniques: Introduction and definition to classification techniques, Contingency tables, conditional probability, odds ratio, Moving on to logistic regression from linear regression, Estimation using the Maximum Likelihood Method, Making sense of logistic regression parameters, Wald test, Likelihood Ratio Test statistic, Chi-square test, Implementing logistic regression with Python: Model validation and evaluation, Model validation, ROC Curve, Confusion Matrix, Introduction to decision trees, Understanding the mathematics behind decision trees and Random Forest: Homogeneity, Entropy, Information gain, Gini index, Reduction in Variance, Pruning a tree.

Module – V

Time Series Analysis and Forecasting: Time Series Patterns: Trend Pattern, Seasonal Pattern, Cyclic Forecast Accuracy, Moving Averages, Weighted Moving Averages, Exponential Smoothing, Linear Trend Regression, Holt's Linear Exponential Smoothing,

Holt's Winter seasonal method, Arima Models, Errors in forecasting: Mean Average Deviation (MAD), Mean Absolute Percentage Error, Mean Percentage Error, Root Mean Square, Root Percent Mean Square.

Text Books:

1. Learning Predictive Analytics with Python– Ashish Kumar, First Edition, PACKT Publishing, 2016.
2. Mastering Machine Learning with Python in Six Steps- Manohar Swamynathan, Apress.

Reference Text Books:

1. Mastering Predictive Analytics with Python - Joseph Babcock, PACKT Publishing.
2. Predictive Analytics for dummies by Anasse Bari, 2nd Edition, Wiley, 2017.

Web Resources & E-Books:

1. https://www.analyticsvidhya.com/blog/2022/06/time-series-forecasting-using-python/.
2. https://www.analyticsvidhya.com/blog/2022/05/a-comprehensive-guide-to-time-series-analysis-and-forecasting/

MOOC's Courses:

1. NPTEL Course on "Predictive Analytics".
2. Coursera Course on "introduction-predictive-modeling".

Course Outcomes:

Upon completing this course, the student will be able to

1. Describe the basic concepts and significance of predictive analytics.
2. Employ the different Regression techniques on the data.
3. Apply different Classification techniques to classify the data.
4. Illustrate different Time Series Analysis and Forecasting techniques with examples.

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	**1**												**1**		**1**
CO2	**3**	**2**											**2**		**2**
CO3	**3**	**2**											**2**		**2**
CO4	**3**	**2**											**2**		**2**

B.Tech III Year – V Sem

	L	T	P	C
Subject Code: 21PC5CS14	**3**	**0**	**0**	**3**

COMPUTER NETWORKS

Pre requisites:

1. A course on "Programming for problem solving"

2. A course on "Data Structures"

Course Objective

1. The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computer networks.

2. Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers

Course Outcomes:

At the end of the course student will be able to

1. Gain the knowledge of the basic computer network technology.
2. Gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model.
3. Obtain the skills of subnetting and routing mechanisms.
4. Familiarity with the essential protocols of computer networks, and how they can be applied in network design and implementation.

Module I

Introduction: Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet.

Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless transmission.

Module II

Data link layer: Design issues, framing, Error detection and correction. Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel.

Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat

Module III

Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Wireless LANs, Data link layer switching.

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms

Module IV

Transport Layer: Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols.

Application Layer –Domain name system, SNMP, Electronic Mail; the World WEB, HTTP

Module V

Wireless and Mobile Networks: Cellular Internet Access: An Overview of Cellular Network Architecture, Cellular Data Networks (3G & 4 G)

Mobile Ad-Hoc Networks: Overview of Wireless Ad-Hoc Networks, Routing in Ad-Hoc Networks.

TEXT BOOKS:

1. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI
2. Holger Karl , Andreas willig, ―Protocol and Architecture for Wireless Sensor Networks‖, John wiley publication, Jan 2006

REFERENCE BOOKS:

1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education
2. Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH
3. Vijay Garg, ―Wireless Communications and networking‖, First Edition, Elsevier 2007

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									

B.Tech	L	T	P	C
Subject Code: 21PE8CD62	3	0	0	3

Data Visualization

Course Objective

To understand various data visualization techniques.

Course Outcomes:

1. Visualize the objects in different dimensions.

2. Design and process the data for Virtualization.

3. Apply the visualization techniques in physical sciences, computer science, applied mathematics and medical science.

4. Apply the virtualization techniques for research projects. (K1, K3).

Module I

Introduction and Data Foundation: Basics - Relationship between Visualization and Other Fields - The Visualization Process - Pseudo code Conventions - The Scatter plot. Data Foundation - Types of Data - Structure within and between Records - Data Preprocessing - Data Sets

Module II

Foundations for Visualization: Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables - Historical Perspective - Taxonomies - Experimental Semiotics based on Perception Gibson‘s Affordance theory – A Model of Perceptual Processing.

Module III

Visualization Techniques: Spatial Data: One-Dimensional Data - Two-Dimensional Data – ThreeDimensional Data - Dynamic Data - Combining Techniques. Geospatial Data: Visualizing Spatial Data - Visualization of Point Data -Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial Data Visualization Multivariate Data: Point-Based Techniques - Line-Based Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks- Displaying Arbitrary Graphs/Networks.

Module IV

Interaction Concepts and Techniques: Text and Document Visualization: Introduction - Levels of Text Representations - The Vector Space Model - Single Document Visualizations -Document Collection Visualizations - Extended Text Visualizations Interaction Concepts: Interaction Operators - Interaction Operands and Spaces - A Unified Framework. Interaction Techniques: Screen Space - Object-Space -Data Space -Attribute Space- Data Structure Space - Visualization Structure - Animating Transformations -Interaction Control

Module V

Research Directions in Virtualizations: Steps in designing Visualizations – Problems in designing effective Visualizations- Issues of Data. Issues of Cognition, Perception, and Reasoning. Issues of System Design Evaluation, Hardware and Applications

TEXT BOOKS:

1. Matthew Ward, Georges Grinstein and Daniel Keim, "Interactive Data Visualization Foundations, Techniques, Applications", 2010.

2. Colin Ware, "Information Visualization Perception for Design", 2nd edition, Margon Kaufmann Publishers, 2004.

REFERENCE BOOKS:

1. Robert Spence "Information visualization – Design for interaction", Pearson Education, 2nd Edition, 2007.

2. Alexandru C. Telea, "Data Visualization: Principles and Practice," A. K. Peters Ltd, 2008

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		M
CO2	M	H											H		M
CO3	H		M											M	H
CO4	M													H	M

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							