CURRICULUM
FOR THE ACADEMIC YEAR 2020-2021

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.E. V SEMESTER

POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING
(An autonomous college under VTU)
KALABURAGI

SCHEME OF TEACHING FOR V SEMESTER -2020-2021

B.E. (COMPUTER SCIENCE AND ENGINEERING)

Code No.	Course	Hours/Week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CIE	SEE	Total
SEMESTER V								
THEORY								
18CS51	Data Science	4	0	0	4	50	50	100
18CS52	Data Communication	3	2	0	4	50	50	100
18CS53	Data Base Management System	3	2	0	4	50	50	100
18CS54	Software Engineering and Tools	3	0	0	3	50	50	100
18CS55	Artificial Intelligence	3	0	0	3	50	50	100
18HU01	Recruitment Process Training - I	2	0	0	1	50	50	100
PRACTICAL								
18CSL56	Data Science with Python Lab	0	0	3	1	50	50	100
18CSL57	Software Testing and Tools Lab	0	0	3	1	50	50	100
18CSL58	Web Application Development Lab	0	1	2	2	50	50	100
	Total	**18**	**5**	**8**	**23**	**450**	**450**	**900**

Course Title: Data Science		
Subject Code : **18CS51**	Credit : 04	CIE: 50
Number of Lecture Hours/Week	4 Hrs	SEE: 50
Total Number of Lecture Hours	52	SEE Hours: 03
Prerequisites: Probability and Statistics		
Course Objectives: Learn the basics of Data and extract valuable information for use in strategic decision making, and trend analysis.		

MODULES	**Teaching Hours**
Module I **A Crash Course in Python:** The Zen of Python Getting Python, Virtual Environments Whitespace Formatting ,Modules ,Functions ,Strings ,Exceptions ,Lists, Tuples, Dictionaries, default dict, Sets, Control Flow, Truthiness, Sorting, List Comprehensions, Automated Testing and assert, Object-Oriented Programming, Iterables and Generators, Randomness, Regular Expressions ,Functional Programming ,zip and Argument Unpacking, args and kwargs, Type Annotations. Visualizing Data. Matplotlib, bar Charts,Line Charts, Scatterplot.	**11 Hrs**
Module II **Introduction:** AI, Machine Learning and Data Science, what is data science, Case for data science, Data science classification, Data science algorithms. **Data science process:** Prior knowledge Data preparation, Modeling, Application, knowledge.	**10 Hrs**
Module III **Data Exploration:** Objectives of Data exploration**,** Datasets, Descriptive statistics, Data Visualization, Roadmap for data exploration. **Classification-1 :** Decision Trees, Rule Induction.	**10 Hrs**
Module IV **Classification-2:** k-Nearest Neighbors, Naïve Bayesian, Artificial Neural Networks.	**10 Hrs**
Module V **Regression Methods:** Linear Regression, Logistic Regression, Conclusion.	**11 Hrs**
Question paper pattern: The question paper will have ten questions.	

There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module.

TEXT BOOKS:

1. **Data Science Concepts and Practice,** Second Edition, Vijay Kotu and Bala Deshpande, Elsevier Inc. 2019.

2. **Data Science from scratch,** First Principles with Python, by Joel Grus, Publisher(s) O'Reilly, 2015

REFERENCES:

1. **Doing Data Science** by Cathy O'Neil, Rachel Schutt**,** Released October 2013 Publisher(s): O'Reilly Media.
2. Foundation of Data Science by Avrim Blum, John Hopgroft and Ravindran Kannan, Cambridge University Press, 2020.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS51	CO1	Develop relevant programming abilities
	CO2	Develop the ability to build and assess data-based models.
	CO3	Demonstrate proficiency with statistical analysis of data.
	CO4	Apply classification algorithms to solve real world example.
	CO5	Analyze dataset and predicts futuristic values.

Course Title: DATA COMMUNICATION		
Subject Code : **18CS52**	Credit : 4	CIE: 50
Number of Lecture Hours/Week	3 (Theory)+2(Tut)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03

Prerequisites: Basic Electronics

Course Objectives:

- Learn the basic concepts of data communication, layered architecture of communication protocols.
- Learn fundamentals of digital transmission like encoding, multiplexing and error control techniques.
- Gain knowledge about functions of data link layer and related protocols.
- Describe working of simple LAN with hubs, bridges and switches.

MODULES	**Teaching Hours**
Module I Data Communications, Networks, Network Types, Network Models – Protocol layering TCP/IP Protocol Suite, The OSI Model, Physical layer: Transmission impairment, Date Rate Limits, Performance.	**08 Hrs**
Module II **Digital Transmissions** – Digital to Digital Conversion, Analog to Digital Conversion, Transmission Modes. Analog Transmission- Digital to Analog conversion, Analog to Analog conversion. Multiplexing and Spectrum Spreading-Multiplexing,, Spread Spectrum.	**08 Hrs**
Module III **Switching:-** Introduction, Circuit switched networks, Packet Switching, Structure of a Switch. Error Detection and Correction-Introduction, Block Coding, Cyclic Codes – CRC, Polynomials, Cyclic code encoder using Polynomials, Cyclic code analysis, Advantages of cyclic codes. Checksum, Forward Error Correction.	**09 Hrs**
Module IV **Data Link Layer:** Data Link Control –DLC services, Data link layer protocols, HDLC , Point to Point Protocol. Multiple Access Control – Random Access, Controlled access, Channelization Network Interface Adaptors: NIC Functions, NIC Features: Full Duplex, Bus Mastering, Parallel Tasking, Wake on LAN IEEE 802.p.	**09 Hrs**
Module V **Wired LAN**: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Wireless LANs- Introduction, IEEE 802.11-Bluetooth , Connecting Devices and Virtual LANs–Connecting Devices, Virtual LANs.	**08 Hrs**

Question paper pattern:
The question paper will have ten questions.

There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

TEXT BOOKS:

1. Data Communication and Networking, BehrouzA.Forouzan**,** McGraw Hill, 5th Edition, 2008.

REFERENCES:

1. Albert Leon- Garcia and IndraWidjaja,*"Networks-Fundamental concepts and Key Architectures",* Tata Mcgraw-hill 2nd edition, 2002.
2. Data and Computer Communication, William Stallings, 8th Edition, Pearson Education, 2007.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS52	**CO1**	Explain different types of network and describe the concept of layering and study OSI reference model and TCP/IP model.
	CO2	Describe fundamental principles of data transmission like signal encoding techniques, modulation and multiplexing.
	CO3	Apply error detection and control algorithms and study fundamental of switching
	CO4	Describe data link control protocols and compare different random Access Protocols
	CO5	Discuss Ethernet protocol its implementations and describe the concept of VLAN.

Course Title: DATABASE MANAGEMENT SYSTEM		
Subject Code : **18CS53**	Credit :	CIE: 50
Number of Lecture Hours/Week	**3 hrs (Theory)+2 (Tut)**	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03

Prerequisites: The Students should have the knowledge of C++ Programming Principles, Data Structures and Computer Organization.

Course Objectives:

To enable the students to obtain the knowledge of Data Base Management System in the following topics.

- Learn and practice data modelling using entity relationship and developing database design
- Understand the use of SQL
- Understand the functional dependency and Normalization Techniques.
- Understand the online transaction processing and recovery methods.

MODULES	**Teaching Hours**
Module I **Introduction:** An example, Characteristics of Database approach, Actors on the screen, Workers behind the scene, Advantages of using DBMS approach, A brief history of database applications, when not to use a DBMS. Data models, schemas and instances, Three-schema architecture and data independence, Database languages and interfaces. Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design, ER Diagrams, Naming Conventions and Design Issues, Relationship types of degree higher than two, Subclasses, Super Classes and Inheritance, Specialization and Generalization. **Relational Model:** Relational Model Concepts, Relational Model Constraints and Relational Database Schemas.	**08 Hours**
Module II **Introduction to SQL:** The SQL Language, The Role of SQL, SQL Features and Benefits, SQL and Networking (Centralized Architecture, File Server Architecture, Client/Server Architecture, Multi-Tier Architecture) The Relational Data Model: Tables, Primary Keys, Relationships, Foreign Keys, **SQL Basics:** Data Types, Constants, Expressions, Built-in Functions, Missing Data (NULL Values), Row Alias, Literals. **SQL Commands:DDL Statements:** Create, Alter, Drop, Truncate Tables, **DML Statements:** Insert, Update and Delete, **DCL Statements:** GRANT, REVOKE TCL Statements: COMMITT, ROLLBACK, SAVEPOINT, Simple Queries: The **SELECT Statement**, The SELECT Clause, FROM Clause, WHERE Clause, **SQL Operators :**Arithmetic, Comparison, Logical operations on columns, **Other Operators:** BETWEEN AND, LIKE, IS NULL, IN Compound Search Conditions (AND, OR, and NOT), **Order by Clause:** Sorting Query Results, Combining Query Results (UNION) *,Unions and Sorting *, **Joins:** Simple Joins (Equi-Joins), Natural Join, Joins with Row Selection Criteria, Multiple Matching Columns, Table Aliases, **OUTER JOINS :**, Left and Right Outer Joins *, Inner Joins in SQL2 ***Aggregate**	**10 hours**

Functions: Column Functions: SUM() computes the total of a column. • AVG() computes the average value in a column. • MIN() finds the smallest value in a column. • MAX() finds the largest value in a column. • COUNT() counts the number of values in a column. • COUNT(*) counts rows of query results, Grouped Queries (GROUP BY Clause).	
Module III **Database Design** - 1: Informal Design Guidelines for Relation Schemas, Functional Dependencies, And Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Code Normal Form. Database Design – 2: Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Multivalued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Inclusion Dependencies, Other Dependencies and Normal Forms.	**08 Hours**
Module IV **Transaction Processing Concepts:** Introduction to Transaction Processing, 12 Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Transaction Support in SQL. Concurrency Control Techniques: Two-Phase Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering, Multiversion Concurrency Control Techniques, Validation Concurrency Control Techniques, Granularity of Data items and Multiple Granularity Locking, Using Locks for Concurrency Control in Indexes.	**08 Hours**
Module V **Database Recovery Techniques :** Recovery Concepts, Recovery Techniques Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging, The ARIES Recovery Algorithm, Recovery in Multi database Systems, Database Backup and Recovery from Catastrophic Failures. Database Security and Authorization: Introduction to Database Security Issues, Discretionary Access Control Based on Granting and Revoking Privileges, Mandatory Access Control and Role-Based Access Control for Multilevel Security, Introduction to Statistical Database Security, Introduction to Flow Control, Encryption and Public Key Infrastructures.	**08 Hours**

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

Text books:

1. Fundamentals of Database Systems - Elmasri and Navathe, 5th Edition,Addison- Wesley, 2007
2. SQL – The Complete Reference- James R Groff, Paul N.Weinberg and Andrew J.Oppel, 3rd Edition,Mc-Graw Hill, 2009. (Module-II)

Reference Books:

1. Data Base System Concepts- Silberschatz, Korth and Sudharshan, 5th Edition, Mc-Graw Hill, 2006.
2. Database Management Systems -Raghu Ramakrishnanand Johannes Gehrke – 3rd Edition.

McGraw-Hill, 2003.

3. An Introduction to Database Systems - C.J. Date, A. Kannan, S. Swamynatham, 8th Edition, Pearson Education, 2006.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS53	CO1	Express the fundamentals and applications of data base management system.
	CO2	Implement and Interact database with SQL statements.
	CO3	Design data base by applying ER diagram, relational model, functional dependency and Normalization Techniques
	CO4	Illustrate the basic issues of transaction processing and concurrency control.
	CO5	Demonstrate different recovery techniques and security issues.

Course Title: SOFTWARE ENGINEERING AND TOOLS		
Subject Code : **18CS54**	Credits : 3	CIE: 50
Number of Lecture Hours/Week	**3Hrs (Theory)**	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Prerequisites: Any programming language		

Course objectives:

- Acquire knowledge of software development lifecycle
- Understand methodologies for designing the software
- Describe the development of efficient and cost effective software.
- Gain knowledge of Software Testing process.
- Perform various software testing and measurement.

MODULES	**Teaching Hours**
Module – I **Overview:** Introduction: FAQ's about software engineering, Professional and ethical responsibility. **Software Processes:** Software Processes: Models, Process iteration, Process activities, The Rational Unified Process, Computer-Aided Software Engineering. **Requirements:** Software Requirements: Functional and Non-functional requirements, User requirements, System requirements, Interface specification, and The software requirements document.	**09 Hrs**
Module - II **Software Design:** Architectural Design: Architectural design decisions, System organization, Modular decomposition styles, Control styles. Object-Oriented design: Objects and Object Classes, An Object-Oriented design process, Design evolution. **DEVELOPMENT:** Rapid Software Development: Agile methods, Extreme programming, Rapid application development, Software prototyping.	**08 Hrs**
Module - III **Verification And Validation:** Verification and Validation: Planning, Software inspections, Automated static analysis, Verification and formal methods. **Management**: Managing People: Selecting staff, Motivating people, Managing people, The People Capability Maturity Model. **Software Cost Estimation:** Productivity, Estimation techniques.	**08 Hrs**
Module – IV **A Perspective on Testing, Examples:** Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing. Examples: Generalized pseudo code, The triangle problem, The NextDate function, The commission problem, The SATM (Simple Automatic Teller Machine) problem, The currency converter, Saturn windshield wiper. **Boundary Value Testing:** Boundary value analysis, Robustness testing, Worst-case testing, Special value testing, Examples, Random testing, Guidelines for Boundary value Testing.	**09 Hrs**
Module – V **Path Testing:** DD paths, Test coverage metrics, Basis path testing, guidelines	

and observations. Define/Use testing, Slice-based testing, Guidelines and observations. **Levels of Testing:** Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing. **Integration Testing:** A closer look at the SATM system, Decomposition-based Integration, call graph-based Integration.	**08 Hrs**

8Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

Text book:

1. **Software Engineering** – Ian Somerville, 10th Edition, Pearson Education, 2016.
2. **Software Testing, A Craftsman's Approach** - Paul C. Jorgensen:, 4th Edition, Auerbach Publications, 2013.

Reference Books:

1. **Software Engineering: A Practitioners Approach -** Roger S. Pressman, 7th Edition, McGraw-Hill, 2007.
2. **Software Engineering Theory and Practice -** Shari Lawrence Pfleeger, Joanne M. Atlee, 3rd Edition, Pearson Education, 2006.
3. **Software Engineering Principles and Practice -** Waman S Jawadekar, Tata McGraw Hill, 2004.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS54	CO1	Describe software engineering process to account for quality issues and non-functional requirements.
	CO2	Translate specification into a design, and then realize that design practically, using an appropriate software engineering methodology.
	CO3	Explain and develop, maintain and evaluate large-scale software systems, To produce efficient, reliable, robust and cost-effective software solutions
	CO4	Discuss the fundamental principles of Software Testing with lifecycle and essential functional test methods.
	CO5	Perform Basic test design and measurement techniques.

Course Title: ARTIFICIAL INTELLIGENCE		
Subject Code : **18CS55**	Credit : 03	CIE: 50
Number of Lecture Hours/Week	3Hrs (Theory)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Prerequisites:		

Course Objectives:

- To Apply a given AI technique to a given concrete problem
- To Implement non-trivial AI techniques in a relatively large system
- To understand uncertainty and Problem solving techniques.
- To understand various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent.
- To understand different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification.
- To understand various learning techniques and agent technology.

MODULES	**Teaching Hours**
Module I **What is Artificial Intelligence:** The AI Problems, The Underlying assumption, What is an AI Technique? The Level of the model, Criteria for success. **Problems, problem spaces, and search:** Defining, the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs.	**09 Hrs**
Module II **Heuristic search techniques:** Generate-and-test, Hill climbing, Best-first search, Problem reduction, Mean-ends analysis. **Knowledge representation issues:** Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, the frame problem.	**08 Hrs**
Module III **Using predicate logic:** Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction **Representing Knowledge Using Rules:**Procedural versus Declarative knowledge, Logic programming, forward versus backward reasoning, matching, control knowledge.	**08 Hrs**
Module IV **Symbolic Reasoning Under Uncertainty:** Introduction to nonmonotonic	

reasoning, Logic for nonmonotonic reasoning, Implementation Issues, Augmenting a problem-solver, Implementation: Depth-first search, Implementation: Breadth-first search. **Statistical Reasoning:** Probability and bayes Theorem, Certainty factors and rule-based systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy logic.	**09 Hrs**
Module V **Natural Language Processing:** Language Models, Text Classification, Information Retrieval, Information Extraction. **ROBOTICS:** Introduction, Robot Hardware, Robot Perception, Planning to Move, Planning uncertain Movement, Moving, Robotics software Architectures.	**08 Hrs**

Question paper pattern:
The question paper will have ten questions.
There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module.

TEXT BOOKS:

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill, 3rd Edition 2008
2. Stuart Russell, Peter Norvig, "Artificial Intelligence", A Modern Approach, Pearson Education/Prentice Hall of India, 3rd Edition Dec 2009

REFERENCES:

1. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd.
2. George F. Luger, "Artificial Intelligence-Structures and Strategies for Complex Problem Solving", Pearson Education/ PHI.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS55	CO1	Describe artificial intelligence techniques, problem and heuristic search algorithm
	CO2	Apply knowledge representation techniques and predicate Logic rules to solve reasoning programs.
	CO3	Demonstrate the use of Predicate Logic and Knowledge Representation.
	CO4	Discuss the importance of maintaining intelligent systems and explain statistical reasoning.
	CO5	Design and develop Natural Language Processing and Robotics applications.

Course Title: Data Science with Python Lab		
Subject Code : **18CSL56**	Credit : 1	CIE: 50
Number of Lecture Hours/Week	3	SEE: 50
Total Number of Lecture Hours		SEE Hours: 03
Prerequisites: C Programming, Portability and Statistics		
Course Objectives: To learn Python Programming and learning basics of Data Science, Implementing Data Analytics Algorithms using Python programming.		

MODULES	**Teaching Hours**
1. Exercise programs on Lists: a) Finding the sum and average of given numbers using lists. b) To display elements of list in reverse order. c) Finding the minimum and maximum elements in the lists. 2. Exercise programs on tuples: a) Write a program which accepts a sequence of comma-separated numbers from console and generate a tuple. b) write a program to print the first half values in one line and the last half values in one line. 3. Exercises on Dictionaries: a) Create a dictionary with key:value pairs, ' salary' and amount in salary respectively. Find the total salary of ten persons. b) Create a dictionary for library. Search the author for a given book. 4. Exercises on Sets: a. Create a set of numbers. b. Search for given list from the set. 5. Write a python program demonstrating defining classes and use of constructors. 6. Write Python program to demonstrate exception handling. 7. Write a python program demonstrating inheritance. 8. Write a python program by importing matplot module and show the visualization of some sample data with bar charts, line charts and scatterplot. 9. Write Python program to read, display .csv file contents in the form of charts.(Use golf.csv file).	

10. Write a python program to read the data set load_breast_cancer from sklearn to classify The dataset the tumors into two categories (malignant and benign) using k-nearest neighbors algorithm. Show the results using matplot charts. 11. Write a python program to read the Iris flower data set (Iris.csv, having 150 observations and 4 features and 1 class) to classify the dataset as three flower categories (iris_setosa, iris_versicolor and iris_virginica) using Naïve bayesian algorithm. Interpret the results using matplot charts and explain performance parameters. 12. Write a python program to read the Iris flower data set (Iris.csv, having 150 observations and 4 features and 1 class) to classify the dataset as three flower categories (iris_setosa, iris_versicolor and iris_virginica) using Artificial Neural Networks algorithm. Interpret the results using matplot charts and explain performance parameters. 13. Write a python program to understand relationship between two variables and predict the unknown value using a known value using simple linear regression model.	

Question paper pattern:

For SEE, experiments similar to the above list will be asked .

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CSL56	**CO1**	Create python data structures like Lists, Tuples, Dictionaries and Sets for handling the data in python programs.
	CO2	Implement built-in and user-defined exception handling in python programs.
	CO3	Import standard data sets and implement classification algorithms like naïve bayes, k-nearest neighbor and artificial neural networks using python libraries.
	CO4	Implement linear regression algorithm to understand relation between two variables.
	CO5	Visualize data through plotting mechanisms using python's matplot and other libraries.

Course Title: SOFTWARE ENGINEERING & TESTING LAB		
Subject Code : **18CSL57**	**Credits: 1**	CIE: 50
Number of Practical Hours/Week/Batch	**3 Hrs**	SEE: 50
		SEE Hours: 03

Prerequisite: Programming Languages

Course Objectives :

- Write test cases for the given applications
- Learn modelling of the software using unified modelling language (UML)
- Use of testing tools

List of Programs

Software Engineering

1. Generate **Use Case** Diagram for Microwave oven / ATM System and identify their different features using Rational Rose Software or Visual Paradigm Software and generate the test cases for system testing
2. Generate **class diagram** and **sequence diagram** for Micro wave oven / ATM System and also generate its corresponding test cases.
3. Generate **state machine** and **Activity diagram** along with their corresponding test cases.
4. Generate **Component and Deployment** diagram for ATM System.

Software Testing

1. Write a 'C' program to demonstrate the working of the following constructs:
   a. do…while
   b. while…do
   c. if …else
   d. switch
   e. for Loops in C language.

   Write at least three test cases for each logic with a table that represent *Input, Expected ouput, Actual output and Remarks*
2. A program written in c language for matrix multiplication fails "Introspect the causes for its failure and write down the possible reasons for its failure".
3. Write the test cases for any known application (e.g. Automated Library application)
4. Create a test plan document for any application (e.g. Library Management System)

Working with Software Testing Tools (Selenium)

1. Perform web testing using selenium
2. Demonstrate the usage of selenium in JAVA and PHP
3. Write and test a program to login a specific web page.
4. Write and test a program to count the number of items present on desktop.

Question paper pattern:

For SEE, experiments similar to the above list will be asked using any testing tool.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CSL57	**CO1**	Generate a case diagram and class diagram for designing a real time application
	CO2	Design and develop dynamic system models using sequence, activity and component model
	CO3	Develop test-cases and perform software testing using fundamental testing approaches
	CO4	Perform and demonstrate usage of testing tool in Java and PHP
	CO5	Apply Software Testing methods to software developed for any real world application

Course Title: WEB APPLICATION DEVELOPMENT LABORATORY		
Subject Code : **18CSL58**	Credits : 2	CIE: 50
Number of Lecture Hours/Week	**2 Hrs (Practical) +1(Tut)**	SEE: 50
		SEE Hours: 03

Pre-requisite:
Java Object oriented concepts, Java Basics, Multithreading and Exception Handling, Java Annotations and IO, Generics and Collection Classes, HTML, CSS, PHP, Javascript, Mysql to start with web development.

Course objective:

- Provide the principles and practical programming skills of developing Internet and Web applications.
- Enables students to master the development skill for both client-side and server-side programming, especially for database applications.
- Students will have opportunity to put into practice the concepts through programming exercises based on various components of client/server web programming.

List of Programs	**Teaching Hours**
1. Create an XHTML documents to study various HTML tags like elements, attributes, heading, paragraphs, formatting, styles, colors, links, image, CSS, tables etc. 2. Create a XHTML page for "SEE Exam Registration Form for Students". The following fields are required in the form. Use external CSS. Semester (List box), VTU Number(Text box), Student name(Text Box), Subject code (List box) , Credits (text box), cellno(text box), email(text box). 3. Create a Java Script to validate above form data with appropriate alerts. 4. Create a Java Script to generate Scrolling Banner on web page. 5. Create a Java Script to count number of hits made on webpage. 6. Create a Java Script to demonstrate storing and using the cookies. 7. Develop a Java Script embedded XHTML file for Generating Sum of n numbers. Use alert window to display the result. 8. Develop a Java Script embedded XHTML file for Generating Sum of n numbers. Use alert window to display the result. 9. Develop a Java Script embedded XHTML file for Determine the roots of Quadratic Equation. Use document. write to produce Output. 10. Develop a Java Script embedded XHTML file for Find Standard Deviation when an array of numbers is input. Use prompt to read an array of names. Produce an alphabetical listing of names.	

11. Develop an XHTML document and corresponding JavaScript file to create four radio buttons that enables the user to choose information about a specific airplane. The click event is to be used to trigger a call to alert which presents a brief description of the selected airplane.

12. Modify the above example to have five buttons, labeled red, blue, green, yellow and orange. The EVENT HANDLER for these buttons must produce messages stating the chosen favorite color. The event handler must be implemented as a function whose name must be assigned to the on Click attribute of the radio button elements. The chosen color must be sent to the event handler as a parameter.

13. Develop, test and validate an XHTML document that collects the following information from the user: Last name, First name, middles initial, age (Restricted to be greater than 17), and weight(restricted to the range 0f 80-100). You must have event handlers for the form elements that collect this information that check he input data for correctness. Messages in alert windows must be produced when errors are detected.

14. Develop a XHTML document containing four short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can always be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible.

15. Write an XHTML document containing placed on the display so that they overlap. Define and use DOM addresses and zIndex value to keep track of current top image with the global variable top which is changed every time a new element is moved to the top with the toTop function.

16. Design an XML document to store information about a student. The information must include USN, Name, Branch, Year of Joining, email Id and Contact Number. Make up sample database of 5-10 students. Create a CSS style sheet and use it to display the document.

17. i) Write a Perl script to show server information like Server Name, Server Software, server protocol, CGI Revision etc.
ii) Write a Perl program to accept OS command and to display the output of the command executed.
iii) Write a Perl program to count number of Visitors visiting the web page using session variable. Display this count of visitors with proper headings.

18. i) Write a PHP program to store current data-time in a COOKIE and display the Last visited on‟ date-time on the web page upon reopening the same page. ii) Write a PHP program to count number of visits that increments and display after each refresh of the page. 19. Write a Perl program to insert given data (For example name and age information) into MySQL database and display the contents of the database table. 20. Using PHP and MySQL, develop a program to accept book information viz., Accession Number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings. Create a webpage with all the knowledge gained from the above exercises. (Example: develop a department webpage.)	

Note: 13th Exercise is for internal evaluation only not for final exam. 2nd & 9th exercise any two bits will be asked in the final examination

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CSL58	**CO1**	Demonstrate use of HTML tags in designing webpages.
	CO2	Create dynamic web pages by using CSS, JavaScript and XML with advanced Interactivity.
	CO3	Design and implement functional forms, control browser frames and windows using JavaScript.
	CO4	Design browser side scripting and server side scripting by using PHP and Perl.
	CO5	Develop and Demonstrate an Open Ended Program like a mini project.

CURRICULUM
FOR THE ACADEMIC YEAR 2020-2021

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.E. VI SEMESTER

POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING
(An autonomous college under VTU)
KALABURAGI

About the institution: The Hyderabad Karnataka Education (HKE) society founded by Late Shri MahadevappaRampure, a great visionary and educationist. The HKE Society runs 46 educational institutions. PoojyaDoddappaAppa College of Engineering, Gulbarga is the first institution established by the society in 1958. The college is celebrating its golden jubilee year, setting new standards in the field of education and achieving greater heights.The college was started with 50% central assistance and 50% state assistance, and a desire to impart quality technical education to this part of Karnataka State. The initial intake was 120 with degree offered in three branches of engineering viz, Civil, Mechanical and Electrical Engineering. Now, it houses 11 undergraduate courses, 10 post Graduate courses and 12 Research centers, established in Civil Engg., Electronics & Communication Engg, Industrial & Production Engg, Mechanical Engg, Electrical Engg., Ceramic Cement Tech., Information Science &Engg.,Instrumentation Technology, Automobile Engg., Computer Sc. and Engg., Mathematics and Chemistry All the courses are affiliated to Visveswaraya Technological University, Belgaum. At present the total intake at UG level is 980 and PG level 193.

The college receives grant in aid funds from state government. A number of projects have been approved by MHRD /AICTE, Govt. of India for modernization of laboratories. KSCST, Govt. of Karnataka is providing financial assistance regularly for the student's projects.

The National Board of Accreditation, New Delhi, has accredited the College in the year 2005-08 for 09 UG Courses out of which 08 courses are accredited for three years and 01 course is accredited for five years. And second time accredited for Six Course in the year 2009-2012

Our college is one among the 14 colleges selected under TEQIP, sponsored by World Bank. It has received a grant of Rs 10.454 Crores under this scheme for its development. The institution is selected for TEQIP phase II in year 2011 for four years. Institution is receiving a grant of Rs 12.50 Crores under TEQIP Phase -II scheme for its development and selected for TEQIP-III as mentoring Institute for BIET Jhansi(UP).

Recognizing the excellent facilities, faculty, progressive outlook, high academic standards and record performance, the VTU Belgaum reposed abundant confidence in the capabilities of the College and the College was conferred Autonomous Status from the academic year 2007-08, to update its own programme and curriculum, to devise and conduct examinations, and to evaluate student's performance based on a system of continuous assessment. The academic programmers are designed and updated by a Board of Studies at the department level and Academic Council at the college level. These statutory bodies are constituted as per the guidelines of the VTU Belgaum. A separate examination section headed by a Controller of Examinations conducts the examinations.

At present the college has acquired the Academic autonomous status for both PG and UG courses from the academic year 2007-08 and it is one among the six colleges in the state of Karnataka to have autonomous status for both UG and PG courses.

One of the unique features of our college is, it is the first college in Karnataka State to start the Electronics and Communication Engineering branch way back in the year 1967, to join NIT Surathkal and IISc, Bangalore. Also, it is the only college in the state and one among the three colleges across the country, offering a course in Ceramic and Cement Technology. This is the outcome of understanding by faculty and management about the basic need of this region, keeping in view of the available raw material and existing Cement Industries.

Bharatiya Vidya Bhavan National Award for an Engineering College having Best Overall Performance for the year 2017 by ISTE (Indian Society for Technical Education). In the year 2000, the college was awarded as Best College of the year by KSCST, Bangalore in the state level students projects exhibition.

The college campus is spread over 71 acres of land on either side of Mumbai-Chennai railway track and has a sprawling complex with gardens and greenery all around.

About the department: The Computer Science and Engineering department was started in the year 1984 with an intake of 40 students for UG. The department has seen phenomenal growth and now the department has increased UG intake to 120 students and offering two Post Graduation programmes : PG (Computer Science and Engineering with an intake of 25 students) and PG(Computer Network and Engineering with an intake of 18 students). The department is offering research program under its recognized research center. The department is having state-of-the-art computing facilities with high speed internet facilities and laboratories. The department library provides useful resources like books and journals. The department has well qualified and experienced teaching faculty. The department has been conducting several faculty development programs and student training programs.

Vision of the institute:

To be an institute of excellence in technical education and research to serve the needs of the industry and society at local and global levels.

Mission of the institute:

- Toprovideahigh-qualityeducationalexperienceforstudentswithvaluesandethicsthatenablesthemtobecomeleadersintheirchosenprofessions.
- To explore, create and develop innovations in engineering and science through research and development activities.
- To provide beneficial service to the national and multinational industries and communities through educational, technical and professional activities.

Department Vision

To become pioneers in computer education and research and to prepare highly competent IT professionals to serve Industry and Society at local and global levels.

Department Mission

- To impart high quality professional education to become a leader in Computer Science and Engineering.
- To achieve excellence in Research for contributing to the development of the society.
- To inculcate professional and ethical behavior to serve the Industry.

Program Educational Objectives (PEOs) of the department

PEO1: To prepare graduates with core competencies in mathematical and engineering fundamentals to solve and analyze computer science and engineering problems.

PEO2: To adapt to evolving technologies and tools for serving the Society.

PEO3: To perform as team leader, effective communicator and socially responsible computer professional in multidisciplinary fields following ethical values.

PEO4: To encourage students to pursue higher studies and engage in research and entrepreneurship.

Program Specific Outcomes (PSOs) of the department

PSO1: Acquire competency in hardware and software working principles to analyze and solve computing problems.

PSO2: Design quality software to develop scientific and business applications following Software Engineering practices.

PSO3: Apply cutting edge technologies using modern tools to find novel solutions ethically to existing problems.

Program Outcomes

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2**. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Code No.	Course	Hours/Week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CIE	SEE	Total
SEMESTER VI								
18HU61	Entrepreneurship, Management and Finance	3	0	0	3	50	50	100
18CS62	Computer Networks	4	0	0	4	50	50	100
18CS63	Machine Learning	3	2	0	4	50	50	100
18CS64X	Elective- I	3	0	0	3	50	50	100
18CS65X	Industrial Elective	3	0	0	3	50	50	100
18CS66	Open Elective- I	3	0	0	3	50	50	100
18HU02	Recruitment Process Training – II	0	2	0	1	50	50	50
18CSL67	Machine Learning Lab	0	0	3	1	50	50	100
18CSL68	Computer Network Lab	0	0	3	1	50	50	100
18CSMP69	Mini-project	0	0	3	2	50	50	100
	Total	**19**	**6**	**9**	**25**	**500**	**500**	**1000**

ELECTIVES OFFERED:	
Elective – I	
18CS641	Finite Automata and Formal Language
18CS642	Computer Graphics
18CS643	Cryptography and Information Security
18CS644	Digital Image Processing
Industry Elective	
18CS651	Building Enterprise Application
18CS652	Embedded System
18CS653	Data Analytics
18CS654	Robotic Process Automation
Open Elective –I	
18CS661	Python Programming
18CS662	Advanced Java and J2EE
18CS663	Internet of Things (IOT)
18CS664	Web Systems and Technologies

Course Title :**ENTREPRENEURSHIP, MANAGEMENT AND FINANCE**		
Subject Code :18HU61	Credit : 3	CIE: 50
Number of Lecture Hours/Week	3	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03

Prerequisites:

Course Objectives :

To enable the students to obtain the basic knowledge about Entrepreneurship and Management and finance in the following topics:-

- The Meaning, Functions, Characteristics, Types, Role and Barriers of Entrepreneurship,. Government Support for Entrepreneurship
- Management – Meaning, nature, characteristics, scope , functions, role etc and Engineers social responsibility and ethics
- Preparation of Project and Source of Finance
- Fundamentals of Financial Accounting
- Personnel and Material Management, Inventory Control

MODULES	**Teaching Hours**
Module I **ENTREPRENEUR :** Meaning of Entrepreneur; Functions of an Entrepreneur; Characteristics of an entrepreneur , Types of Entrepreneur; Intrapreneurs – an emerging class ; Role of Entrepreneurs in economic development; Barriers to entrepreneurship, Government Support for Innovation and Entrepreneurship in India - Startup-India, Make-in-India, PMMY, AIM , STEP, BIRAC, Stand-up India, TREAD	**8 Hrs**
Module II **MANAGEMENT:** Introduction – Meaning – nature and characteristics of Management, Scope and functional areas of management, Roles of Management, Levels of Management, Henry Fayol - 14 Principles to Management , Engineers Social responsibility and Ethics	**8 Hrs**
Module III **PREPARATION OF PROJECT AND SOURCE OF FINANCE:** **PREPARATION OF PROJECT:** Meaning of project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; **SOURCE OF FINANCE**: Long Term Sources(Equity, Preference, Debt Capital, Debentures, loan from Financial Institutions etc) and Short Term Source(Loan from commercial banks, Trade Credit, Customer Advances etc)	**8 Hrs**
Module IV	

FUNDAMENTALS OF FINANCIAL ACCOUNTING: Definition, Scope and Functions of Accounting , Accounting Concepts and Conventions: Golden rules of Accounting, Final Accounts - Trading and Profit and Loss Account, Balance sheet	**9 Hrs**
Module V **PERSONNEL MANAGEMENT, MATERIAL MANAGEMENT AND INVENTORY CONTROL:** **PERSONNEL MANAGEMENT**: Functions of Personnel Management, Recruitment, Selection and Training, Wages, Salary and Incentives **MATERIAL MANAGEMENT AND INVENTORY CONTROL:** Meaning, Scope and Objects of Material Management. Inventory Control- Meaning and Functions of Inventory control ; Economic Order Quantity(EOQ) and various stock level (Re-order level, Minimum level, Maximum level, Average level and Danger level)	**9 Hrs**

Question paper pattern:
The question paper will have ten questions.
There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

Text Books :

1. Financial Accounting -B S RAMAN- United Publishers Manglore, Maheswar S N & Maheswari S K-Vikas Publishing House.
2. Management & Entrepreneurship- K R Phaneesh- Sudha Publications ,Prof Manjunatha & Amit kumar G – laxmi Publication, Veerbhadrappa Havina l-New Age International Publications.
3. Principles of Management First Edition (English, G. Murugesan), Laxmi Publications – New Delhi

Reference Books :
1. Industrial Organization & Engineering Economics-T R Banga & S C Sharma- Khanna Publishers, Delhi

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18HU61	**CO1**	Develop Entrepreneurship skills
	CO2	Apply the concepts of management and Engineers Social responsibility & Ethics practice
	CO3	Prepare project report & choose different Source of Finance.
	CO4	Apply Fundamentals of Financial Accounting and interpret the final accounts
	CO5	Apply personnel management skills, Material and inventory control techniques

Course Title: COMPUTER NETWORKS		
Subject Code : **18CS62**	Credit : 4	CIE: 50
Number of Lecture Hours/Week	4 Hrs (TH)	SEE: 50
Total Number of Lecture Hours	52	SEE Hours: 03
Prerequisites: Data Communication, Mathematical Foundations of Computer Science		
Course Objectives: • Introduces the underlying concepts and principles of modern computer networks and Internet with emphasis on protocols, architectures, and implementation issues. • Build network applications using TCP/IP model.		
MODULES		**Teaching Hours**
Module I **NETWORK LAYER DESIGN ISSUES:** Store-and-Forward Packet Switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection-Oriented Service, Comparison of Virtual-Circuit and Datagram Networks, **ROUTING ALGORITHMS:** The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Routing for Mobile Hosts, Multicast Routing, Routing in Ad Hoc Networks, Node Lookup in peer-to peer Networks. **CONGESTION CONTROL ALGORITHMS**: General principle of Congestion Control, Congestion Prevention Policies, Congestion Control in virtual-circuit subnets, Congestion Control in Datagram subnets, Load shedding, Jitter Control.		**11 Hrs**
Module II **QUALITY OF SERVICE:** Requirements, Techniques for achieving good quality of service, Integrated Services, Differentiated Services, Label Switching and MPLS. **INTERNETWORKING**: How Networks Differ, How Networks Can Be Connected, Concatenated Virtual Circuit, Connectionless Internetworking, Tunneling, Internetwork Routing, Fragmentation. **THE NETWORK LAYER IN THE INTERNET**: The IP Version 4 Protocol, IP Addresses, Internet Control Protocols, OSPF- The Interior Gateway Routing Protocol, BGP-The Exterior Gateway Routing Protocol, Internet Multicast, Mobile IP, IPv6		**10Hrs**
Module III **THE TRANSPORT LAYER:** Services Provided to the Upper Layers, Transport Service Primitives, Berkeley Sockets, An example of Socket Programming: An Internet File Server. **ELEMENTS OF TRANSPORT PROTOCOLS:** Addressing, Connection Establishment, Connection Release,		**10Hrs**

Flow Control and Buffering, Multiplexing, Crash Recovery. **A simple Transport protocols:** The example Service Primitives, The example Service Primitives, The example Transport entity, The example as a Finite State Machine. **THE INTERNET TRANSPORT PROTOCOLS:** Introduction to UDP, Remote Procedure Call, The Real- Time Transport Protocol.	
Module IV **THE INTERNET TRANSPORT PROTOCOLS:** TCP**,** Introduction to TCP**,** The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, Modeling TCP connection Management, TCP Transmission Policy, TCP Congestion control, TCP Timer Management, Wireless TCP and UDP, Transactional TCP. **Performance Issues:** Performance Problems in Computer Networks, Network Performance measurement, System Design for Performance, Fast TPDU Processing, Protocols for Gigabit Networks.**DNS**: The Domain name system: The DNS Name Space, Resource Records, Name servers.	**11 Hrs**
Module V **Electronic Mail:** Architecture and services, The User Agent, message Formats, Message Transfer, Final Delivery. The World Wide Web : Architectural overview, Static Web Documents, Dynamic web documents, HTTP- The Hypertext Transfer Protocol, Performance Enhancements, The wireless.	**10Hrs**

Question paper pattern:
The question paper will have ten questions.
There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

TEXT BOOKS:

1. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks , 5th Edition, Sept 2010.

REFERENCES:

1. **Larry** L. **Peterson** and Bruce S. Davie, Computer Networks- A system approach, 5th edition , 2011
2. James F Kurose and Kith W Ross, Computer network , 5th edition

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS62	CO1	Analyze Routing algorithm and explain congestion control mechanism.
	CO2	Demonstrate the working principles of internetworking and discuss quality of service mechanism.
	CO3	Illustrate TCP service and protocols
	CO4	Discuss TCP connection and performance issues.
	CO5	Describe working of application layer protocols.

Course Title: MACHINE LEARNING		
Subject Code : **18CS63**	Credits :4	CIE: 50
Number of Lecture Hours/Week	**3Hrs (Theory) +2 Hrs(Tut)**	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03

Prerequisite: Data Science, Artificial Intelligence

Course Objectives:

- Acquiring the fundamentals of machine learning
- Usage of various learning methods to develop an intelligent machine.

Modules	**Teaching Hours**
Module – I **Introduction:** Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. **Concept Learning:** Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.	**08 Hrs**
Module - II **Decision Tree Learning:** Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space searching decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.	**09 Hrs**
Module - III **Artificial Neural Networks:** Introduction, Neural Network representation, Appropriate problems, Perceptron, Multilayer networks and the Back-propagation algorithm.	**08 Hrs**
Module - IV **Evaluating Hypothesis:** Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. **Instance Based Learning:** Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning.	**08 Hrs**
Module – V **Bayesian Learning:** Introduction, Baye's theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm.	**09 Hrs**

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

Text book:

1. Tom M. Mitchell, Machine Learning, Indian Edition Paperback 2017, McGraw Hill Education.

Reference Books:

1. Trevor , The Elements of Statistical Learning, 2nd edition, 2017, Springer series in statistics.

Hastie, Robert Tibshirani, Jerome Friedman

2. Ethem Alpaydın, "***Introduction to machine learning"***, Third Edition, PHI Learning Pvt. Ltd. 2016

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)	Blooms Level
18CS63	**CO1**	Identify the problems for machine learning.	**C1**
	CO2	Differentiate between supervised and unsupervised learning for the given problem.	**C3**
	CO3	Apply concepts of ANN for machine designing.	**C2**
	CO4	Estimate target function using Instance based learning.	**C4**
	CO5	Investigate concept learning and Baye's classifier.	**C3**

ELECTIVE –I

Course Title: **FINITE AUTOMATA AND FORMAL LANGUAGES**		
Subject Code :**18CS641**	Credit :3	CIE: 50
Number of Lecture Hours/Week	**03Hrs(Theory)**	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Pre-requisites: Mathematical Foundations of Computer Science		
Course objectives: • To gain an understanding of automata theory principles • Familiarize applications of automata theory in compiler construction and text processing.		
Modules		**Teaching Hours**
Module-I **Introduction to finite automata:** Introduction to Finite Automata, The central concepts of Automata theory; Deterministic finite automata, Nondeterministic finite automata, An application of finite automata, Finite automata with Epsilon-transitions.		**09 Hrs**
Module-II **Regular expressions, Regular languages and Properties:** Regular expressions; Finite Automata and Regular Expressions; Applications of Regular Expressions. **Regular languages and properties:** Regular languages; Proving languages not to be regular languages, Closure properties of regular languages.		**08 Hrs**
Module-III **Properties of regular languages contd. , Context free grammars:** Decision properties of regular languages, Equivalence and minimization of automata. **Context-free grammars and languages:** Context –free grammars; Parse trees; Applications; Ambiguity in grammars and Languages.		**08 Hrs**
Module-IV **Pushdown automata:** Definition of the Pushdown automata; The languages of a PDA; Equivalence of PDA's and CFG's; Deterministic Pushdown Automata. Properties of context-free languages: Normal forms for CFGs; The pumping lemma for CFGs; Closure properties of CFL.		**09 hrs**
Module-V **Introduction to Turing machine:** Problems that Computers cannot solve; The turning machine; Programming techniques for Turning Machines; Extensions to the basic Turning Machines; Turing Machine and Computers. **Undecideability: A** Language that is not recursively enumerable; An Undecidable problem that is RE; Post's Correspondence problem; Other undecidable problems.		**08 Hrs**
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module, covering all the topics from a module. The students will have to answer 5 full questions, selecting one full question from each module**.**		

Text books:

1. Introduction to Automata Theory, Languages and Computation – John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman:, 3rd Edition, Pearson education, 2007.

Reference Books:

1. Raymond Greenlaw, H.JamesHoove, Morgan Kaufmann, Fundamentals of the Theory of Computation: Principles and Practice –, 1998.
2. John C Martin, Introduction to Languages and Automata Theory –3rd Edition, Tata McGraw-Hill, 2007.
3. Daniel I.A. Cohen, Introduction to Computer Theory –2nd Edition, John Wiley & Sons, 2004.
4. Thomas A. Sudkamp,An Introduction to the Theory of Computer Science, Languages and Machines –3rdEdition, Pearson Education, 2006.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS641	CO1	Design Deterministic and non Deterministic finite automata for a given language and identify related applications in text processing.
	CO2	Construct Regular expressions for given language and describe properties of regular language.
	CO3	Develop Context Free Grammar and illustrate with its applications
	CO4	Design PDA, discuss equivalence of CFG and PDA and explain properties of Context Free Languages.
	CO5	Discuss Turing machine and its variants and the notion of undecidability.

Course Title: **COMPUTER GRAPHICS**		
Subject Code :**18CS642**	Credit : 3	CIE: 50
Number of Lecture Hours/Week	**3 Hrs**	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03

Prerequisites: Mathematics, C/C++ .

Course Objectives:

- Identify and explain the core concepts of computer graphics.
- Apply graphics programming techniques to design, and create computer graphics scenes.
- Create effective OpenGL programs to solve graphics programming issues, including 3D transformation, objects modeling, color modeling, lighting, textures.

MODULES	Teaching Hours
Module –I **Introduction**: Applications of computer graphics, A graphics system, Images: Physical and synthetic, The human visual system, The pinhole camera, The synthetic camera Model, The programmer‘s interface, Graphics architectures, Input devices. **Graphics programming:** The Sierpinski gasket, The OpenGL API, Primitives and attributes, Color, Viewing, Control functions, The Gasket program, Polygons and recursion, The three-dimensional gasket.	**08 Hrs**
Module-II **Raster Graphics Algorithms:** Overview, Scan converting lines, Scan converting circles, Filling rectangles, Filling polygons, Filling Ellipse arcs, Thick primitives, Clipping in a raster world, Clipping lines, Clipping circles and ellipses, Clipping polygons, Generating characters, Antialiasing. **Input and Interaction:** Interaction, Input devices, Clients and servers, Display lists, Display lists and modeling, Programming event-driven input, Menus, Picking, Building interactive models, Animating interactive programs, Design of interactive programs.	**09 Hrs**
Module-III **Geometric Objects and Transformations :**Scalars, points, and vectors, Three-dimensional primitives, Coordinate systems and frames, Modeling a colored cube, Affine transformations, Rotation, translation and scaling, Transformation in homogeneous coordinates, Concatenation of transformations, OpenGL transformation matrices, Interfaces to three-dimensional applications, Quaternions.	**08 Hrs**
Module- IV **Viewing:** Classical and computer viewing, Positioning of the camera, Simple projections, Projections in OpenGL, Hidden-surface removal, Walking through a scene, Parallel projection matrices, Perspective-projection matrices, **Lighting**	**09 Hrs**

and Shading : Light and matter, Light sources, The Phong reflection model, Computation of vectors.	
Module – V **Lighting and Shading - Contd:** Polygonal shading, Approximation of a sphere by recursive subdivisions, Light surfaces in OpenGL, Specification of materials in OpenGL. **Curves and Surfaces :**Representation of Curves and Surfaces, Design Criteria, Parametric Cubic Polynomial Curves, Interpolation, Hermite Curves and Surfaces, Bezier Curves and Surfaces.	**08 Hrs**

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

Text books:

1. Edward Angel, "Interactive Computer Graphics A Top-Down Approach with OpenGL", 2nd Edition, Addison-Wesley,2000.
2. Foley, Van Dam, Feiner, Hughes, "Computer Graphics: Principles and Practice", Addison Wesley, ISBN0-201-12110-7.

Reference Books:

1. D. Hearn, M.P. Baker, Computer Graphics , 3rd Edition, Prentice Hall,2004.
2. Edward Angel, Interactive Computer Graphics A Top-Down Approach with OpenGL - 5th Edition, Addison-Wesley,2008
3. F.S. Hill,Jr, Computer Graphics Using OpenGL 2nd Edition, Pearson Education, 2001
4. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics –Addison-wesley1997.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS642	**CO1**	Describe the basics of Computer Graphics, Graphical input devices and graphics programming
	CO2	Implement Raster Graphics Algorithms for primitive operation clipping, filling using interactive programs.
	CO3	Investigate three dimensional transformations and its Interfaces using OpenGL
	CO4	Explain types of projection, rendering, lighting and shading
	CO5	Analyse generation of curves and surfaces through their mathematical representation

Course Title: **Cryptography and Information Security**		
Subject Code :**18CS643**	Credit : 3	CIE: 50
Number of Lecture Hours/Week	**3 Hrs**	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Pre-requisite: Mathematics.		
Course Objectives: • To Gain knowledge of secure network architecture • Explain the mathematics and theory behind different cryptographic algorithms.		
MODULES		**Teaching Hours**
Module –I **Introduction:** Security goals, Attacks, Services and Mechanism, Techniques. **Mathematics of Cryptography:** Integer arithmetic, Modular arithmetic, Linear congruence. **Traditional Symmetric Key Ciphers:** Introduction, Substitution Ciphers, Transposition Ciphers, Stream and Block Ciphers.		**09 Hrs**
Module-II **Mathematics of Cryptography:** Algebraic structures, GF(2^n) Fields. **Introduction to modern Symmetric-Key Ciphers:** Modern Block Ciphers, Modern Stream Ciphers. **Data Encryption Standard(DES):** Introduction, DES Structure, DES Analysis, Multiple DES, Security of DES.		**09 Hrs**
Module-III **Advanced Encryption Standard:** Introduction, Transformations, Key Expansion, Ciphers, Examples, Analysis of AES. **Encipherment Using Modern Symmetric-Key Ciphers:** Use of Modern Block Ciphers, Use of Stream Ciphers, Other issues. **Mathematics of Asymmetric key Cryptography:** Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation and Logarithm.		**08 Hrs**
Module- IV **Asymmetric-Key Cryptography:** Introduction, RSA Cryptosystem, Elliptic Curve Cryptosystem. **Message Integrity and Message Authentication:** Message Integrity, Random Oracle Model, Message Authentication. **Cryptographic Hash Functions:** Introduction, SHA-512.		**08 hrs**
Module – V **Digital Signature:** Comparison, Process, Services, Attacks on Digital Signature, Digital Signature Schemes, Variations and Applications. **Entity Authentication:** Introduction, Passwords, Challenge-Response, Zero-Knowledge, Biometrics.		**08 Hrs**
Question paper pattern: The question paper will have ten questions.		

There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

Text books:

1. Forouzan, B.A., Cryptography and Network Security, Tata McGraw-Hill, 2007

Reference Books:

1. William Stallings, Cryptography and Network Security, Pearson Education, 2006
2. Atul Kahate, Cryptography and Network Security, Tata McGraw-Hill, 2008

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS643	**CO1**	Describe basic concepts of Cryptography and information security
	CO2	Apply algebraic structures to design encryption algorithms.
	CO3	Demonstrate AES algorithms and illustrate mathematical concepts behind design of asymmetric key cryptography and encipherment algorithms
	CO4	Discuss various algorithms for asymmetric key cryptography and message authentication.
	CO5	Explain digital signatures and entity authentication.

Course Title: DIGITAL IMAGE PROCESSING		
Subject Code :**18CS644**	Credit :3	CIE: 50
Number of Lecture Hours/Week	3	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03

Prerequisites:

Course Objectives:

- Define the fundamental concepts in image processing
- Evaluate techniques followed in image enhancements
- Illustrate image segmentation and compression algorithms

MODULES	**Teaching Hours**
Module I **Introduction** Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Applications of Image Processing: medical imaging, Robot vision, Character recognition, Remote Sensing.	9 Hrs.
Module II **Image Enhancement in The Spatial Domain:** Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.	**8 Hrs.**
Module III **Image Enhancement In Frequency Domain:** Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT, Discrete Cosine Transform (DCT), Image filtering in frequency domain.	**8 Hrs.**
Module IV **Image Segmentation**: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.	**8 Hrs.**
Module V **Image Compression**: Introduction, coding Redundancy, Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.	9 Hrs.

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

TEXT BOOKS:

1. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 3rd edition, 2008.

REFERENCES:

1. Milan Sonka, Image Processing, analysis and Machine Vision, Thomson Press India Ltd, Fourth Edition.
2. Anil K. Jain, Fundamentals of Digital Image Processing- 2nd Edition, Prentice Hall of India.
3. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS644	CO1	Explain fundamentals of image processing
	CO2	Compare transformation algorithms
	CO3	Contrast enhancement techniques
	CO4	Perform segmentation of images using different techniques
	CO5	Deploy compression techniques for application development

Industry Elective

Course Title**: BUILDING ENTERPRISE APPLICATIONS**		
Subject Code :**18CS651**	Credits :3	CIE: 50
Number of Lecture Hours/Week	**3 Hrs (Theory)**	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03

Pre-requisites: Basics of software Engineering.

Course Objectives:

- To familiarize with different application frameworks.
- To acquire knowledge about software architecture and design at enterprise level
- To get practical aspects of planning and estimation in enterprise application rollout.
- To get acquainted with code review, code analysis and build process.

MODULES	Teaching Hours
Module I **Introduction** to enterprise applications and their types, software engineering methodologies, life cycle of raising an enterprise application, introduction to skills required to build an enterprise application, key determinants of successful enterprise applications, and measuring the success of enterprise applications. Inception of enterprise applications, enterprise analysis, business modeling, requirements elicitation, use case modeling, prototyping, non functional requirements, requirements validation, planning and estimation. **Architecture, Views and Viewpoints: Enterprise Application:** An Enterprise Architecture Perspective, Enterprise Triangle and Enterprise Architecture, Enterprise Architecture frameworks, Blueprint of an Enterprise Application.	**09 Hrs**
Module II **Logical Architecture: Technical Architecture and Design:** Mapping Logical Architecture to Technical Architecture, Object-Oriented Analysis and Design, Infrastructure Services Layer, Presentation Layer, Business Layer, External Systems Layer, Integration Layer, Technical Solution Ecosystem.	**08 Hrs**
Module III **Data Architecture Design:** Relational Data modeling, XML modeling , other Structured data representation, unstructured data representation . **Infrastructure Architecture and Design:** Infrastructure Architecture and Design, Networking, Internetworking , Internetworking and Communication Protocols, IT Hardware and Software, Middleware, Policies for Infrastructure Management Deployment Strategy, **Architecture and Design Documentation:** System Architecture Documentation, System Architecture Documentation , Design Documentation. **Construction Readiness:** Defining a Construction Plan, Defining a Package Structure, Setting Up a Configuration Management Plan, Setting Up a Development Environment.	**08 Hrs**

Module IV **Introduction to Software Construction Map, Constructing the Solution Layers:** Infrastructure Services Layer Components, Presentation Layer	**08 Hrs**
Components, Business Layer Components, Data Access Layer Components, Integration Layer Components. **Code Review**: Objectives, Process. **Static Code Analysis**: Coding Style, Logical Bugs, Security Vulnerabilities, Code Quality. **Building Process and Unit Testing:** Building Process, Unit Testing. **Dynamic Code Analysis:** Code Profiling, Code Coverage.	
Module V **Testing and Rolling Out Enterprise Applications: Testing Enterprise Applications:** Types and Methods of Testing, Testing Levels, Testing Approach, Enterprise Application Environments, Integration Testing. **System Testing:** Performance Testing, Penetration Testing Usability Testing, Usability Testing, Globalization Testing, And Interface Testing. User Acceptance Testing. Rolling Out Enterprise Applications.	**09 Hrs**

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

Text book:

1. Anubhav, Pradhan, Satheesha B Nanjappa, Senthi K Nallasamy, Veerakumar Esakimuthu, Raising Enterprise Applications, John Wiley,2015

Reference Books:

1. Software Requirements: Styles & Techniques – published by Addison – Wesley Professional.
2. Software Systems Requirements Engineering in Practice – published by McGraw- Hill/ Osborne Media.
3. Managing Software Requirements: A use Case Approach, 2/e – published by Pearson.
4. Software Architecture : A Case based Approach – published by Pearson
5. Brett McLaughlin , Building Java Enterprise Applications – Published by O'Reilly Media

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS651	**CO1**	Explain Enterprise Applications and its architecture.
	CO2	Describe the design of Logical and Technical architecture.
	CO3	Discuss design of data and infrastructure architecture.
	CO4	Develop Construction plan and Perform Code review,Code analysis.
	CO5	Employ testing methods.

Course Title: EMBEDDED SYSTEMS		
Subject Code :**18CS652**	Credits : 3	CIE: 50
Number of Lecture Hours/Week	**3 Hrs (Theory)**	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Prerequisite: Digital Electronics. Microprocessor and Microcontroller ,Computer organization, C programming.		

Course Objectives

- Illustrate components of an embedded system.
- Describe Real Time operating systems, device drivers, interrupt service mechanisms.
- Learn program modeling concepts and embedded software development tools.

MODULES	**Teaching Hours**
Module -I **Introduction To Embedded Systems:** Embedded systems; Processor embedded into a system; Embedded hardware units and devices in a system; Embedded software in a system; Examples of embedded systems; Embedded System-on-Chip (SoC) and use of VLSI circuit design technology; Complex systems design and processors; Design process in embedded system. Formalization of system design; Design process and design examples; Classification of embedded systems; Skills required for an embedded system designer. **Device Drivers And Interrupts Service Mechanism**: I/O types and examples; Serial communication devices; Parallel device ports; Sophisticated interfacing features in device ports.	**08 Hrs**
Module –II **Cont:** Wireless devices; Timer and counting devices; Watchdog timer; Real time clock; Networked embedded systems; Serial bus communication protocols; Parallel bus device protocols; Internet enabled systems; Wireless and mobile system protocols. **Device Drivers and Interrupts Service Mechanism :**Device access without interrupts; ISR concept; Interrupt sources; Interrupt servicing mechanism; Multiple interrupts; Context and the periods for context-switching, interrupt latency and deadline; Classification of processors‘ interrupt service mechanism from context-saving angle; Direct memory access; Device drivers programming.	**08 Hrs**
Module –III **Program Modeling Concepts, Processes, Threads, And Tasks:** Program models; DFG models; State machine programming models for event controlled program flow; Modeling of multiprocessor systems. Multiple processes in an application; Multiple threads in an application; Tasks and task states; Task and data; Distinctions between functions, ISRs and tasks.	**08 Hrs**

Module –IV Real-Time Operating Systems : Operating System services; Process management; Timer functions; Event functions; Memory management; Device, file and I/O sub-systems management; Interrupt routines in RTOS environment and handling of interrupt source calls. Real-Time Operating Systems; Basic design using an RTOS; RTOS task scheduling models, interrupt latency and response times of the tasks as performance metrics; OS security issues.	**08 Hrs**
Module –V Embedded Software Development, Tools: Introduction; Host and target machines; Linking and locating software; getting embedded software in to the target system; Issues in hardware-software design and co-design; Testing on host machine; Simulators; Laboratory tools.	**10 Hrs**

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

Text book:

1. Embedded Systems Architecture: Programming and Design **–** Rajkamal, 2nd Edition, Tata McGraw Hill, 2008.

Reference Books:

1. Wayne Wolf, Computers as Components: Principles of Embedded Computer System Design – Elsevier,2005.
2. Tammy Noergaard, Embedded Systems Architecture –Elsevier,2005.
3. Steve Heath, Embedded Systems Design –2nd Edition, Elsevier,2003.
4. Dr. K.V.K.K. Prasad, Embedded/Real-Time Systems: Concepts, Design and Programming: The Ultimate Reference –Dream tech Press,2004.
5. Michael J.Point, Embedded C Pearson Education,2002.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS654	**CO1**	Describe the Design of embedded system and Device drivers
	CO2	Explain different components of Interrupt Service Mechanism
	CO3	Describe the program modeling concepts, processes, threads, and Tasks
	CO4	Discuss key concepts of real time operating systems and inter-task Communication
	CO5	Apply software tools used for embedded system development

Course Title: DATA ANALYTICS		
Subject Code :18CS653	Credit : 3	CIE: 50
Number of Lecture Hours/Week	3Hrs	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Prerequisites: Data Science, Machine Learning		
Course Objectives : Introduce student to data analytic on distributed platform		

MODULES	Teaching Hours
Module I **Big data processing and Distributed architectures** -Types of data: Structured, semi structured, unstructured **,** Data Pre-processing: Data cleaning, Data Integration, Data Reduction, Data Transformation and discretization, data cleaning, validation, modifications, enhancements. Distributed Architectures : Hadoop, spark, HPCC Systems VsHadoop	**08 Hrs**
Module II **HPCC Systems architecture :**HPCC System functions, Data Lake Architecture, The HPCC Systems design, Thor Vs ROXIE **ECL the programming language &Structures :**ECL Watch, ECL Cloud IDE / VS Code, Simple ECL programs and Data Types explained, Data flow graphs (diagrams), Declarative programming, Declarative vs Imperative programming, the ECL Compiler, The ECL program deployment and execution.	**09 Hrs**
Module III **ECL the programming language &Structures :**An Activity, An Activity Declaration, A Record Declaration, Schema on Read (RECORD) explained, A Function Declaration, A MODULE, ECL File(s), Importing files, Spraying and Reading a file **Data Shaping (Transforming) :**Function, Module And Project, Iterate And Rollup ,Sort, Join And Dedup ,Normalize And Denormalize ,Distribute And Reading The Execution Graph	**09 Hrs**
Module IV **Data Aggregation** GROUP and functions (SUM, AVE, COUNT…), TABLE and AGGREGATE **HPCC Systems Machine Learning Library- Part I** ML_Core, PBblas- Parallel Block Linear Algebra Subsystem, Supervised Learning Bundles- Linear Regression, Logistic Regression, Support Vector Machines, Learning Trees	**08 Hrs**
Module V **HPCC Systems Machine Learning Library- Part II** Supervised Learning Bundles- GLM, Generalized Neural Network, Unsupervised Learning Bundles- K-Means, DBSCAN, Natural Language Processing Bundles-TextVectors	**08 Hrs**

Question paper pattern

The question paper will have ten questions.
There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module.

TEXT BOOKS:

1. Big Data and Analytics, Seema Acharya and Subhashini C, 1st Edition Wiley India Private Limited, 2015, ISBN 978-8126554782. Module 1
2. Detailed handouts with references to material available on the web will be handed out every week.
https://hpccsystems.com/training/documentation/learning-ecl
https://github.com/hpcc-systems/Solutions-ECL-Training, Module 2 and 3
3. Data Mining – Concepts and Techniques, Jiawei Han and Micheline Kamber, Jian Pei, 3rd Edition, Morgan Kaufmann, 2012, ISBN 978-0-12-381479-1. module 1, module 4 & 5
4. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar:, Pearson Education, 2007, ISBN 978-81-317-1472-0.

REFERENCE BOOKS:

1. Paulraj Ponnaiah John Wiley & Sons, "Data Warehousing Fundamentals –Inc ", Student Edition, 2001.
2. Margaret H Dunham, "Data Mining Introductory and advanced topics" –Pearson education, 2003.
3. Arun K Pujari, "Data Mining Techniques" –University Press, Private Limited, 2013.
4. C.C. Aggarwal, "Data Mining" Springer International Publishing Switzerland 2016.
5. Douglas Eadline,"Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1stEdition, Pearson Education, 2016. ISBN: 978- 9332570351
6. Joey Echeverria, Ben Spivey, "Hadoop Security", O'Reilly Media, Inc., *2016*.ISBN: 981491900987

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS653	CO1	Understand and explore the concepts of data processing, distributed systems
	CO2	Explore HPCC systems, ECL processing languages and structures
	CO3	Apply ECL processing and structure and process of data shaping
	CO4	Describe data and analysis and machine algorithm on HPCC platform
	CO5	Implement HPCC systems machine learning library

Course Title: Robotic Process Automation		
Subject Code :**18CS654**	Credit : 3	CIE: 50
Number of Lecture Hours/Week	42	SEE: 50
Total Number of Lecture Hours	3	SEE Hours: 03
Prerequisites: Problem Solving with Programming , Object Oriented Programming with Java and Operating Systems .		
Course Objectives: 1. Discuss the concepts of Robotics Process automation 2. Describe the sequence, flowchart and control flow in automation tool 3. Demonstrate the data manipulation techniques 4. Demonstrate the usage of UI Explorer and Screen scraping.		
MODULES		**Teaching Hours**
Module I **What Is Robotic Process Automation**: Scope and techniques of automation, Robotic process automation, About UiPath, Future of Automation. **Record and Play**: UiPath stack, Downloading and installing UiPath Studio, Learning UiPath Studio, Task recorder, Step-by-step examples using the recorder.		**9 Hrs**
Module II **Sequence. Flowchart and Control Flow**:Sequencing the Workflow, Activities, Control Flow, various types of loops, and decision making, Step-by-step example using Sequence and Flowchart, Step-by-step example using Sequence and Control Flow		**9 Hrs**
Module III **Data Manipulation:** Variables and Scope, Collections, Arguments-Purpose and use, Data table usage and examples, Clipboard management, File operation with step-by-step example, CSV/Excel to data table and vice versa with a step-by-step example		**8 Hrs**
Module IV **Taking Control of the Controls:** Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls-mouse and keyboard activities		**8 Hrs**
Module V Working with UI Explorer, Handling events, Screen Scraping, When to use OCR, Types of OCR available, How to use OCR.		**8 Hrs**
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module, covering all the topics from a module. The students will have to answer 5 full questions, selecting one full question from each module**.**		

TEXT BOOKS:

1. Alok manitripathi, Learning Robotic Process Automation Kindle Edition, Published by Packet Publishing .

2.E. Turban, R. Sharda, D. Delen, David King, Business Intelligence, 2nd ed. Pearson India, 2010.

REFERENCES:

1. Marlon Dumas et. al., Fundamentals of Business Process Management, Springer, ebook, 2012.
2. Van der Aalst, Process Mining: Discovery, Conformance and Enhancement of Business Processes, Third edition, 2011.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS654	CO1	Identify the Robotics Process automation tools
	CO2	Implement the sequence, flowchart and control flow in UiPath Studio
	CO3	Implement the data manipulation techniques in UiPath Studio
	CO4	Discuss the UI Explorer and Screen scraping techniques
	CO5	Implement the concepts learnt for real world applications

Open Elective –I

Course Title: **PYTHONPROGRAMMING**		
Subject Code :**18CS661**	Credit :3	CIE: 50
Number of Lecture Hours/Week	3	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Prerequisites:		
Course Objectives: • To know the basics of algorithmic problem solving • To read and write simple Python programs. • To develop Python programs with conditionals and loops. • To define Python functions and call them. • To use Python data structures –- lists, tuples, dictionaries. • To do input/output with files in Python.		
MODULES		**Teaching Hours**
Module I The way of the program, What is a program? Running Python, The first program, Arithmetic, operators, Values and types, Formal and natural languages. **Variables, expressions and statements**: Assignment statements, Variable names, Expressions and statements, Script mode, Order of operations, String operations, Comments. **Functions**: Function calls, Math functions, Composition, Adding new functions, Definitions and Uses, Flow of execution, Parameters and arguments , Variables and parameters are local, Stack diagrams, Fruitful functions and void functions, Why functions?. **Case study:** interface design, The turtle module, Simple repetition, Encapsulation.		**8 Hrs**
Module II Data Generalization, Interface design, Refactoring, A development plan, "docstring". Conditionals and recursion, Floor division and modulus, Boolean expressions, Logical Operators, Conditional execution, Alternative execution, Chained conditionals, Nested. Conditionals, Recursion, Stack diagrams for recursive functions, Infinite recursion, Keyboard Input. Fruitful functions: Return values, Incremental development, Composition, Boolean functions, More recursion, Leap of faith, One more example, Checking types Iteration: Reassignment, Updating variables, The while statement, break, Square roots, Algorithms. **Strings:** A string is a sequence, len, Traversal with a for loop, String slices, Strings are immutable Searching, Looping and counting, String methods, The in operator, String comparison. **Case study:** word play, Reading word lists, Search, Looping with indices.		**8 Hrs**

Module III **Lists:** A list is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List Methods, Map, filter and reduce, Deleting elements, Lists and strings, Objects and values, Aliasing, List arguments. Dictionaries : A dictionary is a mapping, Dictionary as a collection of counters, Looping and Dictionaries, Reverse lookup, Dictionaries and lists, Memos, Global variables. **Tuples:** Tuples are immutable, Tuple assignment, Tuples as return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples, Sequences of sequences. **Case study:** data structure selection, Word frequency analysis, Random numbers, Word, Histogram, Most common words, Optional parameters, Dictionary subtraction, Random words, Markov analysis, Data structures.	**9 Hrs**
Module IV Files, Persistence, Reading and writing, Format operator, Filenames and paths, Catching, Exceptions, Databases, Pickling, Pipes, Writing modules. Classes and objects: Programmer-defined types, Attributes, Rectangles, Instances as return, Values, Objects are mutable, Copying Classes and functions: Time, Pure functions, Modifiers, Prototyping versus planning. Classes and methods, Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation.	**9 Hrs**
Module V Inheritance, Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation. The Goodies, Conditional expressions, List comprehensions, Generator expressions, any and all Sets, Counters, defaultdict, Named tuples, Gathering keyword args. Debugging, Syntax errors, Runtime errors, Semantic errors. Analysis of Algorithms, Order of growth, Analysis of basic Python operations, Analysis of search Algorithms, Hashtables.	**8 Hrs**
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module, covering all the topics from a module. The students will have to answer 5 full questions, selecting one full question from each module**.**	
TEXT BOOKS: 1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/) 2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd.,2011.	

REFERENCES:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition,2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press ,2013
3. KennethA.Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, PragmaticProgrammers,LLC,2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd.,2016.
6. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,,2015.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS661	CO1	Develop algorithmic solutions to simple computational problems. Read, write, execute by hand simple Python programs.
	CO2	Structure simple Python programs for solving problems.
	CO3	Decompose a Python program into functions.
	CO4	Represent compound data using Python lists, tuples and dictionaries.
	CO5	Read and write data from/to files in Python Programs.

Course Title: Advanced Java and J2EE		
Subject Code : **18CS662**	Credit : 3	CIE: 50
Number of Lecture Hours/Week	3	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Prerequisites: Object oriented programming		
Course Objectives: Learn the development of web pages using GUI , Database connectivity to front end and write the Scripting.		

MODULES	**Teaching Hours**
Module I **Enumerations, Autoboxing and Annotations(metadata):** Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations.	9Hrs
Module II **The collections and Framework:** Collections Overview, Recent Changes to **8 Hours** Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Why Generic Collections?, The legacy Classes and Interfaces, Parting Thoughts on Collections.	**9** Hrs
Module III String Handling **:**The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString( ) Character Extraction, charAt( ), getChars( ), getBytes( ) toCharArray(), String Comparison, equals( ) and equalsIgnoreCase( ), regionMatches( ) startsWith( ) and endsWith( ), equals( ) Versus == , compareTo( ) Searching Strings, Modifying a String, substring( ), concat( ), replace( ), trim( ), Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer , StringBuffer Constructors, length( ) and capacity( ), ensureCapacity( ), setLength( ), charAt( ) and setCharAt( ), getChars( ),append( ), insert( ), reverse( ), delete( ) and deleteCharAt( ), replace( ), substring( ), Additional StringBuffer Methods, StringBuilder	**8**Hrs

Module IV Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects	8Hrs
Module V The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.	8Hrs

Question paper pattern:
The question paper will have ten questions.
There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

Text Books:

1. Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007.
2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007.

Reference Books:

1. Y. Daniel Liang: Introduction to JAVA Programming, 7thEdition, Pearson Education, 2007.
2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education,2004.
3. Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015.

Course Code	CO #	Course Outcome (CO)
18CS662	CO1	Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs
	CO2	Build client-server applications and TCP/IP socket programs
	CO3	Illustrate database access and details for managing information using the JDBC API
	CO4	Describe how servlets fit into Java-based web application architecture
	CO5	Build client-server applications and TCP/IP socket programs

Course Title: Internet of Things (IoT)		
Subject Code : **18CS663**	Credit : 3	CIE: 50
Number of Lecture Hours/Week	3	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Prerequisites: Microprocessor and microcontroller		
Course Objectives: Acquire the data with sensors and perform data analysis		

MODULES	**Teaching Hours**
Module I What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.	8 Hrs
Module II Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.	**8** Hrs
Module III IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.	**8** Hrs
Module IV Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment	8 Hrs
Module V IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing	10 Hrs

Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture,	

Question paper pattern:
The question paper will have ten questions.
There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

Text Books:
1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1stEdition, Pearson.
2. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017 .

Reference Books:
1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands -on-Approach)", 1 st Edition, VPT, 2014.
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1 st Edition, McGraw Hill Education, 2017.

Course Code	CO #	Course Outcome (CO)
18CS663	**CO1**	Illustrate the impact and challenges posed by IoT networks leading to new architectural models.
	CO2	Compare and contrast the deployment of smart objects and the technologies to connect them to network.
	CO3	Demonstrate the role of IoT protocols for efficient network communication.
	CO4	Describe the need for Data Analytics and Security in IoT.
	CO5	Analyze different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

Course Title: Web Systems and Technologies		
Subject Code :**18CS664**	Credit : 3	CIE: 50
Number of Lecture Hours/Week	**3 Hrs**	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03

Prerequisites: Java Object oriented concepts, Java Basics, Multithreading and Exception Handling, Java Annotations and IO, Generics and Collection Classes, HTML, CSS, PHP, Javascript, Mysql to start with web development

Course Objectives:

- Provide the principles and practical programming skills of developing Internet and Web applications.
- Enables students to develop skills for client / server programming and database applications.

MODULES	**Teaching Hours**
Module I: Basic Internet Protocols, HTTP Request Message, HTTP Response Message, Web Clients, Web Servers.	**8 Hrs**
Module II: **HTML:** Fundamental HTML Elements, Basic XHTML Syntax and Semantics, CSS: Introduction, features, syntax, style properties of text, box, layout, list, table, cursor.	**8 Hrs**
Module III: **Client- Side Programming:** JavaScript :Basic Syntax, Variables and Data Types, Statements, Operators, Literals ,Functions, JavaScript objects: Properties, References ,Methods, Constructors, Arrays, Debuggers, Host objects, Document object model, document tree, DOM event handling, browsers.	**9Hrs**
Module IV: **Server-Side Programming**: Servlet Architecture Overview, Servlets Generating Dynamic Content, Servlet Life Cycle, Sessions, Parameter Data, Cookies, URL Rewriting, Other Servlet Capabilities, Data Storage, XML :XML Name spaces ,JavaScript and XML: Ajax.	**8 Hrs**
Module V: **Web Services:** Web Service Concepts, Describing Web Services: WSDL, Representing Data Types: XML Schema, Communicating Object Data: SOAP.	**9Hrs**

Question paper pattern:
The question paper will have ten questions.
There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

TEXT BOOKS:

1. Jeffrey C.Jackson Web technologies: "A Computer Science Perspective", Second Edition.

REFERENCES:

1. M Deitel, P.J. Deitel, A.B Goldberg, "Internet & World Wide Web How to H Program"- 3 rd Edition, Pearson Education/PHI, 2004 2.
2. Chris Bates, "Web Programming Building Internet Applications"- 3 rd Edition, Wiley India, 2006.
3. Xue Bai Et al, Thomson, "The Web Warrior Guide to Web Programming"- 2003.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CS664	CO1	Describe the working of world wide web and HTTP protocol
	CO2	Design static web pages by applying HTML and CSS elements
	CO3	Develop Client side Javascripts.
	CO4	Design Servlet and develop server side scripts
	CO5	Discuss web services and SOAP.

Course Title: MACHINE LEARNING LAB		
Subject Code :**18CSL67**	Credit :1	CIE: 50
Number of Lecture Hours/Week	3 Hrs	SEE: 50
		SEE Hours: 03
Prerequisites: Probability & Statistics, Java/Python Programming		
Course Objectives: • Learn implementation and applications of Machine Learning Algorithms. • Understand the usage of various datasets for implementing ML Algorithms.		
1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file**.** 2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples. 3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. 4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets. 5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets. 6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set. 7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API 8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using *k*-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program. 9. Write a program to implement *k*-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem. 10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your	

experiment and draw graphs.	

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CSL67	CO1	Understand the implementation procedures for the machine learning algorithms.
	CO2	Design Python programs for various Learning algorithms.
	CO3	Apply appropriate data sets to the Machine Learning algorithms.
	CO4	Perform Classification and clustering of Data using ML algorithms.
	CO5	Apply Machine Learning algorithms to solve real world problems.

Course Title: COMPUTER NETWORKS LAB		
Subject Code : **18CSL68**	Credit : 1	CIE: 50
Number of Lecture Hours/Week	3Hrs	SEE: 50
Total Number of Lecture Hours		SEE Hours: 03

Prerequisites: Data Communication

Course Objectives:

1. Build local area network
2. To understand the physical topology of LAN, components
3. Understand TCP/IP protocol stack

List Of Programs	**Teaching Hours**

PART - A

1. Study CAT6 UTP EIA/TIA568A/B straight and cross-over cable crimp and test and/verify its connectivity
2. Install and configure network devices like hub,switch,and router and create a LAN and perform connectivity test.
3. Configure host IP,subnet mask and gateway in LAN
4. Study of basic Network configuration commands and utilities to debug the network issues.
5. Case Study of Campus Network Operation Center
6. Packet capture and header analysis by wire-shark (TCP,UDP,IP) USING WIRESHARK or any other tool

PART - B

Fallowing simulation experiment shall be conducted using qualnet simulator

1. Simulate a three nodes point - to – point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four node point-to-point network with the links connected as follows: N0-n2,n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n

Apply relevant applications over TC and UDP agents changing the parameter and determine the number of packets sent by TCP / UDP.

3. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
4. Simulate an Ethernet LAN using n nodes (6-10), change error rate and data rate and compare throughput.
5. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source/ destination.

6. Simulate simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets	

Question paper pattern:
The question paper will have ten questions.
There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CSL68	**CO1**	Demonstrate the use of different network cabling components.
	CO2	Design Local Area Network .
	CO3	Use Simulation tools for designing and study routing protocols.
	CO4	Analyze the performance of Ethernet LAN
	CO5	Evaluate the network traffic and analysis the performance of congestion control algorithm.
	CO6	Design a wireless network and study its performance.

Course Title: Mini Project		
Subject Code : **18CSMP69**	Credit : 2	CIE: 50
Number of Practical Hours/Week	3	SEE: 50
		SEE Hours: 03

Course Objectives:

- To understand the project development methods
- Apply technical knowledge and develop using software development life cycle.
- Understand the importance of documentation and presentation of Mini-Project.

Guidelines for mini project:

- Student has to design an application and implement using programming languages/tools which the student has already studied.
- Project groups comprising of maximum of 3 students can be formed.
- Timely evaluation of the mini project will be conducted by concerned guide for CIE assessment.
- At the end of the semester students have to prepare and submit a project report.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18CSMP69	CO1	Demonstrate skills to identify and formulate the given problems
	CO2	Apply basic engineering knowledge learnt in developing system individually or in group
	CO3	Evaluate current research status by conducting literature survey
	CO4	Design and develop real time applications
	CO5	Apply the programming language using software development life cycle model for the implementation of the project and prepare well organized report