POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING, KALABURAGI

Choice Based Credit System (CBCS)

Scheme of Teaching and Examination 2021 – 22 - (Effective from the academic year 2021 – 22)

Artificial Intelligence and Machine Learning

V Semester

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/Drawing	Self-Study	Duration in	CIE Marks	SEE Marks	Total Marks	
1.	PC	21AI51	Automata Theory and Computability	Respective Dept.	2	2	0		3	50	50	100	3
2.	IPCC	21AI52	Database Management System	Respective Dept.	3	0	2		3	50	50	100	4
3.	PC	21AI53	Machine Learning	Respective Dept.	2	2	0		3	50	50	100	3
4.	PC	21AI54	Software Engineering	Respective Dept.	2	2	0		3	50	50	100	3
5.	PCL	21AIL55	AIML Lab	Respective Dept.	0	0	2		3	50	50	100	1
6.	AEC	21RMI56	Research Methodology and IPR	Respective Dept.	1	2	0		3	50	50	100	2
7.	HSMS	21CIV57	Environmental Studies	Civil/Mech	0	2	0		2	50	50	100	1
8.	AEC	21AIAE581	Ability Enhancement Course (Principles of Operating System)	Respective Dept.	0	2	0		2	50	50	100	1
Total										**400**	**400**	**800**	**18**

Ability Enhancement Course		
Sl.No.	Course code	Course Title
1	21AIAE581	Principles of Operating System

Note: **HSMC: Humanity and Social Science & Management Courses: The course is made mandatory for the Non Circuit Branches during the ODD Cycle and for the Circuit Branches during the EVEN Cycle.** ., IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course ,INT –Internship, L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). Theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE.

For more details the regulation governing the Degree of Bachelor of Engineering/Technology (BE/B.Tech.) 2021-22 may be referred.

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VI Semester

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1.	HSMC	21HU61	Entrepreneurship, Management and Finance	Respective Dept.	2	2	0		3	50	50	100	3
2.	IPCC	21AI62	Deep Learning	Respective Dept.	3	0	2		3	50	50	100	4
3.	PC	21AI63	Data Science and its Applications	Respective Dept.	2	2	0		3	50	50	100	3
4.	PEC	21AI64X	Professional Elective-I	Respective Dept.	2	2	0		3	50	50	100	3
5.	OEC	21AI65OEX	Open Elective – I	Respective Dept.	2	2	0		3	50	50	100	3
6.	PCCL	21AIL66	Data Science and Application Lab	Respective Dept.	0	0	2		3	50	50	100	1
7.	MP	21AIMP67	Mini Project	Respective Dept.	Two contact hours /week for interaction between the faculty and student					50		50	2
8.	INT	21INT68	Innovation/Entrepreneurship /Societal Internship		Completed during the intervening period of IV and V semesters.					50		50	3
Total										**400**	**300**	**700**	**22**

PROFESSIONAL ELECTIVE – 1		
Sl.No.	**Course**	**Course-ID**
1	CG and Fundamentals of Image Processing	21AI641
2	Business Intelligence	21AI642

OPEN ELECTIVE - 1		
Sl.No.	**Course**	**Course-ID**
1	Software Testing & Tools	21AI65OE1
2	Management Information System	21AI65OE2
3	Cyber Security	21AI65OE3

Note: HSMC: (Humanity and Social Science & Management Courses)The course is made mandatory for the Non Circuit Branches during the ODD Cycle and for the Circuit Branches during the EVEN Cycle.

IPCC: Integrated Professional Core Course, **PCC:** Professional Core Course,
PEC: Professional Elective Courses, OEC–Open Elective Course, **MP** –Mini Project, INT –Internship.
L –Lecture, T – Tutorial, P - Practical / Drawing, S – Self Study Component,
CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech) 2021-22 may be referred.

Professional Elective Courses (PEC):A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course out of five courses. The minimum students' strength for offering professional electives is 10.

However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, they can opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.

Selection of an open elective shall **not be allowed** if,

(i) The candidate has studied the same course during the previous semesters of the program.

(ii) The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.

(iii)A similar course, under any category, is prescribed in the higher semesters of the program.

In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications.

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates. **No SEE component for Mini-Project.**

P D A College of Engineering, Kalaburagi
Autonomous College under VTU
Fifth semester

AUTOMATA THEORY AND COMPUTABILITY		
Subject Code	**21AI51**	Credits: 3
CIE:50	SEE:50	SEE: 03 hrs
Hours/Week: 3hrs (Theory)		Total Hours: 42 Hrs

Prerequisite: The primary prerequisite for this course is reasonable "mathematical sophistication." That is, you should feel comfortable with mathematics and proofs.

Course Objectives:

- Prove or disprove theorems in automata theory using its properties. Determine the decidability and intractability of computational problems.

Modules	**Teaching Hours**
Module I **Why study the Theory of Computation, Languages and Strings:** Strings, Languages. A Language Hierarchy, Computation, **Finite State Machines (FSM):** Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs, From FSMs to Operational Systems, Simulators for FSMs, Minimizing FSMs, Canonical form of Regular languages, Finite State Transducers, Bidirectional Transducers. Textbook 1: Ch 1,2, 3,4, 5.1 to 5.10 RBT: L1, L2	**8 Hours**

Module II **Regular Expressions (RE):** what is a RE?, Kleene's theorem, Applications of REs, Manipulating and Simplifying REs. Regular Grammars: Definition, Regular Grammars and Regular languages. Regular Languages (RL) and Non-regular Languages: How many RLs, To show that a language is regular, Closure properties of RLs, to show some languages are not RLs. Textbook 1: Ch 6, 7, 8: 6.1 to 6.4, 7.1, 7.2, 8.1 to 8.4 RBT: L1, L2, L3	**8 Hours**
Module III **Context-Free Grammars(CFG):** Introduction to Rewrite Systems and Grammars, CFGs and languages, designing CFGs, simplifying CFGs, proving that a Grammar is correct, Derivation and Parse trees, Ambiguity, Normal Forms. Pushdown Automata (PDA): Definition of non-deterministic PDA, Deterministic and Non-deterministic PDAs, Nondeterminism and Halting, alternative equivalent definitions of a PDA, alternatives that are not equivalent to PDA. Textbook 1: Ch 11, 12: 11.1 to 11.8, 12.1, 12.2, 12,4, 12.5, 12.6 RBT: L1, L2, L3	**9 Hours**
Module IV **Algorithms and Decision Procedures for CFLs:** Decidable questions, Un-decidable questions. **Turing Machine:** Turing machine model, Representation, Language acceptability by TM, design of TM, Techniques for TM construction. Variants of Turing Machines (TM), The model of Linear Bounded automata. Textbook 1: Ch 14: 14.1, 14.2, Textbook 2: Ch 9.1 to 9.8 RBT: L1, L2, L3	**8 Hours**

Module V	
Decidability: Definition of an algorithm, decidability, decidable languages, Undecidable languages, halting problem of TM, Post correspondence problem. **Complexity:** Growth rate of functions, the classes of P and NP, Quantum Computation: quantum computers, ChurchTuring thesis. **Applications:** G.1 Defining syntax of programming language, Appendix J: Security Textbook 2: 10.1 to 10.7, 12.1, 12.2, 12.8, 12.8.1, 12.8.2 Textbook 1: Appendix: G.1(only), J.1 & J.2 RBT: L1, L2, L3 **Course Outcomes:** The student will be able to : • Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation • Learn how to translate between different models of Computation (e.g., Deterministic and Non-deterministic and Software models). • Design Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers. • Develop skills in formal reasoning and reduction of a problem to a formal model, with an emphasis on semantic precision and conciseness. • Classify a problem with respect to different models of Computation.	**9 Hours**

Question paper pattern:

1. The question paper will have TEN questions.
2. There will be TWO questions in each module, covering all the topics.
3. The student need to answer FIVE full questions, selecting ONE full question from each module.

Text books:

1. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson education,2012/2013

2. K L P Mishra, N Chandrasekaran , 3rd Edition, Theory of Computer Science, PhI, 2012.

Reference Books:

1. John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, Introduction to AutomataTheory, Languages, and Computation, 3rd Edition, Pearson Education, 2013

2. Michael Sipser : Introduction to the Theory of Computation, 3rd edition, Cengage learning,2013

3. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw –Hill Publishing Company Limited, 2013

4. Peter Linz, "An Introduction to Formal Languages and Automata", 3rd Edition, Narosa Publishers, 1998

5. Basavaraj S. Anami, Karibasappa K G, Formal Languages and Automata theory, Wiley India, 2012

6. C K Nagpal, Formal Languages and Automata Theory, Oxford University press, 2012.

Faculty can utilize open source tools (like JFLAP) to make teaching and learning more interactive.

DATABASE MANAGEMENT SYSTEM		
Subject Code	**21AI52**	Credits: 4
CIE:50	SEE:50	SEE: 03 hrs
Hours/Week: 3hrs (Theory) Practical :2Hrs/week		Total Hours: 40 Hrs Hours : 12 Hrs

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

Course Objectives:

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

- Understand the Data Base Management Principles and relational models.
- Understand the relational algebraic approach and data base implementation and interaction techniques using SQL.
- Understand the functional dependency and Normalization Techniques.
- Understand the online transaction processing and recovery methods.

Modules	Teaching Hours
Module I **Introduction:** 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; The database system environment; Centralized and client-server architectures; Classification of Database Management systems.	**8 Hours**
Module II **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.	**8` Hours**

Module III **Relational Model and Relational Algebra:** Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational. Operations: JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping. **SQL:** SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries .Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL.	**8 Hours**
Module IV **Database Design:** Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form. Properties of Relational Decompositions; Algorithms for Relational Database Schema Design; Multivalued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form.	**8 Hours**
Module V **Transaction Management:** The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock – Based Concurrency Control; Performance of locking; Transaction support in SQL. Introduction to Crash Recovery; 2PL, Serializability and Recoverability; Lock Management; Introduction to ARIES; The log; Other recovery-related structures; The write-ahead log protocol; Check pointing; Recovering from a System Crash.	**8 Hours**
Question paper pattern: 4. The question paper will have TEN questions. 5. There will be TWO questions in each module, covering all the topics. 6. The student need to answer FIVE 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.** Database Management Systems - Raghu Ramakrishnan and Johannes Gehrke – 3rd Edition. McGraw-Hill, 2014.	

Reference Books:

1. Data Base System Concepts- Silberschatz, Korth and Sudharshan,6th Edition, Mc-GrawHill,2010.
2. 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)
	CO1	Express the fundamentals and applications of data base management system.
	CO2	Apply good database design principles for the design of ER diagram and relational models.
	CO3	Implement and interact data base using SQL and relational algebra.
	CO4	Design data base by applying the functional dependency and Normalization techniques
	CO5	Demonstrate the data base transaction and recovery management process.

DATABASE MANAGEMENT SYSTEMS LABORATORY

Prerequisite : The Students should have the knowledge of Data structure and C++

Course Objectives: To enable the students to obtain the knowledge of Databasemanagement systems in the following topics.

- Understand the Data Base Management System Environment
- Understand the techniques to design the data base and populate there cords
- Understand the DML operations.
- Understand the query optimization and error handling techniques.
- Understand the DCL and TCL statements

DATA BASE LABORATORY

PART-A

Consider the following relations :

Student (Stud_number: integer, class: integer,

major:char)Course (Course_name: Char,

Course_number: varchar, Credit_hours:int,

Department: char) Section(Secton_id:varchar,

Course_number:varchar, Semester:char, Year:int,

Instructor:char)

Grade_Report (Stud_number:varchar, Section_id:int, Grade:char)

Write the following queries in SQL. No duplicates should be printed in any of the answers.

i) What are the referential integrity constraints that should hold on the schema.

ii) Retrieve the names of all senior students majoring in‘CS’

iii) Retrieve the names of all courses thought by particular professor in year 2017 and2018

iv) For each section taught by particular professor, retrieve the course number,semester,year and number of students who took the section.

v) Retrieve the names and major of all students who do not have a grade of A in any of their courses

vi)Insert a new student in the database

vii) Change the class of particular student.

viii)Insert a new course to the database

ix) Delete the record of the student whose name start with‘S’

x) Delete the record of the students whose name contains ‘a’ and‘e’

xi) Delete the record of the students whose name ends with‘a’

xii)Count the total number of students with Grade and Major wise.

xiii) Remove all the referential integrity constraints on the schema

xiv) Delete all the rows from thetables

xv) Drop all the tables.

PART-B

1. Consider the followingrelations:

Student (snum: integer, sname: string, major: string, level:
string, age: integer)Class (name: string, meets at: string,
room: string, d: integer)
Enrolled (snum: integer, cname: string)
Faculty (fid: integer, fname: string, deptid: integer) The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class. Level is a two character code with 4 different values (example: Junior: JR etc) Write the following queries in SQL. No duplicates should be printed in any of the answers. Find the names of all Juniors (level = JR) whoare enrolled in a class taught by Prof. Harshith.

i. Find the names of all classes that either meet in room R128 or have five or more Studentsenrolled.

ii. Find the names of all students who are enrolled in two classes that meet at the sametime.

iii. Find the names of faculty members who teach in every room in which some class istaught.

iv. Find the names of faculty members for whom the combined enrollment of the coursesthat they teach is less than five

2. The following relations keep track of airline flight information:Flights (no: integer, from: string, to: string, distance: integer, Departs: time, arrives: time, price: real) Aircraft (aid: integer, name: string, cruising range:
Certified (eid: integer, aid: integer)
Employees (eid: integer, ename: string, salary: integer)
Note that the Employees relation describes pilots and other kinds of employees as well;bbnmbcfEvery pilot is certified for someaircraft, and only pilots are certified to fly.Write each of the following queries in SQL.

i. Find the names of aircraft such that all pilots certified to operate them have salaries morethan Rs.80,000.

ii. For each pilot who is certified for more than three aircrafts, find the eid and themaximum cruising range of the aircraft for which she or he iscertified.

iii. Find the names of pilots whose salary is less than the price of the cheapest route fromBengaluru toFrankfurt.

iv. For all aircraft with cruising range over 1000 Kms, .find the name of the aircraft andthe average salary of all pilots certified for thisaircraft.

v. Find the names of pilots certified for some Boeingaircraft.

vi. Find the aids of all aircraft that can be used on routes from Bengaluru to NewDelhi.

3. Consider the following database of student enrollment in courses & books adopted foreachcourse.

STUDENT (regno: string, name: string, major: string, bdate:date)COURSE (course #:int, cname:string, dept:string)

ENROLL (regno:string, course#:int, sem:int, marks:int) BOOK _ ADOPTION (course# :int, sem:int, book-ISBN:int)

TEXT (book-ISBN:int, book-title:string, publisher:string, author:string)

i. Create the above tables by properly specifying the primary keys and the foreignkeys.

ii. Enter at least five tuples for eachrelation.

iii. Demonstrate how you add a new text book to the database and make this book beadopted by some department.

iv. Produce a list of text books (include Course #, Book-ISBN, Book-title) in the alphabetical order for courses offered by the 'CS' department that use more than twobooks.

v. List any department that has all its adopted books published by a specificpublisher.

vi. Generate suitablereports.

vii. Create suitable front end for querying and displaying the results

4. The following tables are maintained by a book dealer. AUTHOR (author-id:int, name:string, city:string,country:string)

PUBLISHER (publisher-id:int, name:string, city:string, country:string) CATALOG (book-id:int, title:string, author-id:int, publisher-id:int,category-id:int, year:int, price:int)

CATEGORY (category-id:int, description:string)

ORDER-DETAILS (order-no:int, book-id:int, quantity:int)

i. Create the above tables by properly specifying the primary keys and the foreign keys.

ii. Enter at least five tuples for each relation.

iii. Give the details of the authors who have 2 or more books in the catalog and the price ofthe books is greater than the average price of the books in the catalog and the year of publication is after2000.

iv. Find the author of the book which has maximum sales.

v. Demonstrate how you increase the price of books published by a specific publisher by10%.

vi. Generate suitable reports.

vii. Create suitable front end for querying and displaying the results.

5. Consider the following database for a banking enterprise BRANCH(branch-name:string, branch-city:string, assets:real)ACCOUNT(accno:int, branch-name:string, balance:real) DEPOSITOR(customer-name:string, accno:int) CUSTOMER(customer-name:string, customer-street:string, customer-city:string) LOAN(loan-number:int, branch-name:string, amount:real) BORROWER(customer-name:string, loan-number:int)

i. Create the above tables by properly specifying the primary keys and the foreign keys

ii. Enter at least five tuples for eachrelation

iii. Find all the customers who have at least two accounts at the Main branch.

iv. Find all the customers who have an account at all the branches located in a specificcity.

v. Demonstrate how you delete all account tuples at every branch located in a specificcity.

vi. Generate suitable reports.

vii.Create suitable front end for querying and displaying the results.

MACHINE LEARNING		
Subject Code	**21AI53**	Credits: 3
CIE:50	SEE:50	SEE: 03 hrs
Hours/Week: 3hrs (Theory)		Total Hours: 42 Hrs

Prerequisite: Machine Learning Crash Course does not presume or require any prior knowledge in machine learning. However, to understand the concepts presented and complete the

exercises, we recommend that students meet the following prerequisites:
You must be comfortable with variables, linear equations, graphs of functions, histograms, and statistical means.
You should be a good programmer. Ideally, you should have some experience programming in Python because the programming exercises are in Python. However, experienced programmers without Python experience can usually complete the programming exercises anyway.

Course Objectives:

The main objective of this course is to enabling the student with basic knowledge on the techniques to build an intellectual machine for making decisions behalf of humans. This course covers the techniques on how to make learning by a model, how it can be evaluated, what are all different algorithms to construct a learning model.

Modules	Teaching Hours
Module I 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. Text Book1, Sections: 1.1 – 1.3, 2.1-2.5, 2.7	**8 Hours**
Module II **Decision Tree Learning:** Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning. Text Book1, Sections: 3.1-3.7	**8 Hours**

Module III **Artificial Neural Networks:** Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm. Text book 1, Sections: 4.1 – 4.6	**9 Hours**
Module IV **Bayesian Learning:** Introduction, Bayes 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 Text book 1, Sections: 6.1 – 6.6, 6.9, 6.11, 6.12	**8 Hours**
Module V **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, **Reinforcement Learning:** Introduction, Learning Task, Q Learning Text book 1, Sections: 5.1-5.6, 8.1-8.5, 13.1-13.3	**9 Hours**

Course Outcomes:

After studying this course, students will be able to

• Identify the problems for machine learning. And select the either supervised, unsupervised or reinforcement learning.

• Explain theory of probability and statistics related to machine learning

• Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q,

Question paper pattern:

1. The question paper will have TEN questions.
2. There will be TWO questions in each module, covering all the topics.
3. The student need to answer FIVE full questions, selecting ONE full question from each module.

Text books:

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.

2. EthemAlpaydın, Introduction to machine learning, second edition, MIT press.

Course outcomes:

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

Course Code	CO #	Course Outcome (CO)
	CO1	**Demonstrate the designing of a learning system and issues in machine learning**
	CO2	**Apply decision tree learning to solve machine learning problems**
	CO3	**Apply neural network technique for solve complex problems**

	CO4	**Analysis Bayesian learning technique predicting probabilities**
	CO5	**Analyze and evaluate the hypothesis accuracy using sampling and probability theory**

SOFTWARE ENGINEERING		
Subject Code	**21AI54**	Credits: 3
CIE:50	SEE:50	SEE: 03 hrs
Hours/Week: 3 hrs (Theory)		Total Hours: 42 hrs

Prerequisite: The students should have the knowledge of Computer Organization, C, Programming Principles, Data Structure and Algorithms.

Course Objectives:

To enable the students to obtain the knowledge on.

- Software engineering principles and activities involved in building large software programs.
- Identify ethical and professional issues and explain why they are of concern to software engineers.
- Recognize the importance of software maintenance and describe the intricacies involved in software evolution.
- Apply estimation techniques, schedule project activities and compute pricing.

Modules	**Teaching Hours**
Module I Overview Introduction: FAQ's about software engineering, Professional and ethical responsibility. Socio-Technical systems: Emergent system properties; Systems engineering; Organizations, people and computer systems. Critical System, Software Processes : Critical Systems: A simple safety-critical system; System dependability; Availability and reliability.	**9 Hours**
Module II 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; the software requirements document. Requirements Engineering Processes: Feasibility studies; Requirements elicitation and analysis; Requirements validation	**8 Hours**

Module III System models, Project Management: System Models: Context models; Behavioral models; Data models; Object models; Structured methods. Project Management: Management activities; Project planning. Software Design: Architectural Design: Architectural design decisions; System organization; Modular decomposition styles; Control styles.	**8 Hours**
Module IV Object-Oriented design: Objects and Object Classes; An Object-Oriented design process. Development: Rapid Software Development: Agile methods; Extreme programming; Rapid application development. Software Evolution: Program evolution dynamics; Software maintenance; Evolution processes**.**	**8 Hours**
Module V Verification and Validation: Verification and Validation: Planning: Software inspections; Automated static analysis; Verification and formal methods. Software testing: System testing; Component testing. Management: Managing People: Selecting staff; Motivating people; Managing people; The People Capability Maturity Model. Software Cost Estimation: Productivity; Estimation techniques; Algorithmic cost modeling.	**9 Hours**

Question paper pattern:

1. The question paper will have TEN questions.
2. There will be TWO questions in each module, covering all the topics.
3. The student need to answer FIVE full questions, selecting ONE full question from each module.

Text books:

1. Software Engineering by Ian Sommerville, 9th Edition, Pearson Education, 2012

Reference Books:

1. **Roger.S.Pressman:** Software Engineering-A Practitioners approach, 7th Edition, Tata McGrawHill
2. **PankajJalote**: An Integrated Approach to Software Engineering, WileyIndia

Course outcomes:

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

Course Code	CO #	Course Outcome (CO)
	CO1	Describe software development life cycle processes.
	CO2	Analyze software requirements and generate SRS.
	CO3	Describe design concepts and develop design document
	CO4	Describe SQA tasks, goals, and metrics, and test strategies.
	CO5	Demonstrate Project management concepts and metrics.

AIML LABORATORY		
Subject Code	**21AIL55**	Credits:1
CIE:50	SEE:50	SEE: 03 hrs
Hours/Week: 2 hrs (LABORATORY)		Total Hours:28 Hrs

Experiments

1. Implement breath first search algorithm.
2. Implement depth first search algorithm.
3. Implement travel salesman problem.
4. Implement water jag problem.
5. Implement A * search algorithm.
6. Implement AO* Search algorithm.
7. 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.
8. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm. Output a description of the set of all hypotheses consistent with the training examples.
9. 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.

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

CO1	Understand artificial intelligence, its characteristics and its application areas.
CO2	Formulate real-world problems as state space problems, optimization problems or constraint Satisfaction problems.
CO3	Select and apply appropriate algorithms and AI techniques to solve complex problems.
CO4	Design and implement using various search algorithms.
CO5	Design and develop an expert system by using appropriate tools and techniques.

Research Methodology and IPR		
Subject Code	**21RMI56**	Credits: 2
CIE:50	SEE:50	SEE: 03 hrs

Hours/Week: 2hrs	Total Hours: 28 Hrs

Prerequisite: Among then of great importance are first, the actuality of the theme of the research; second-the choice of adequate research instruments and taxonomy to the chosen object field, and third, availability of a research capacity of the author.

Course Objectives:

- To give an overview of the research methodology and explain the technique of defining a research
- problem
- • To explain the functions of the literature review in research.
- • To explain carrying out a literature search, its review, developing theoretical and conceptual frameworks
- and writing a review.
- • To explain various research designs and their characteristics.
- • To explain the details of sampling designs, measurement and scaling techniques and also different
- methods of data collections.
- • To explain several parametric tests of hypotheses and Chi-square test.
- • To explain the art of interpretation and the art of writing research reports.
- • To explain various forms of the intellectual property, its relevance and business impact in the changing
- global business environment.
- • To discuss leading International Instruments concerning Intellectual Property Rights.

Modules	Teaching Hours
Module I Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.	6 Hrs.
Module II Defining the research problem - Selecting the problem. Necessity of defining the problem Techniques involved in defining the problem- Importance of literature review in defining a problem Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet.	6 Hrs.

Module III Research design and methods - Research design - Basic principles. Need of research design Features of good design- Important concepts relating to research design -Observation and Facts Attributions and Citations: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments.	6 Hrs.
Module IV Basic Concepts of Intellectual Property (IP), Classification of IP, Need for Protection of IP, International regime of IPRs - WIPO , TRIPS. Patents: Meaning of a Patent – Characteristics/ Features . Patentable and Non-Patentable Invention. Procedure for obtaining Patent. Surrender of Patent, revocation &restoration of Patents, Infringement of Patents and related remedies (penalties) . Different prescribed forms used in Patent Act. Patent agents qualifications and disqualifications Case studies on patents - Case study of Neem petent, Curcuma (Turmeric)patent and Basmati rice patent, Apple inc.v Samsung electronics co.Ltd	5 Hrs.
Module V Industrial Design: Introduction to Industrial Designs. Essential requirements of Registration. Designs which are not registrable, who is entitled to seek Registration, Procedure for Registration of Designs Copy Right Meaning of Copy Right. Characteristics of Copyright. Who is Author, various rights of owner of Copyright. Procedure for registration. Term of copyright, Infringement of Copyright and Its remedies. Software Copyright.	5 Hrs.

Question paper pattern:

1. The question paper will have TEN questions.
2. There will be TWO questions in each module, covering all the topics.
3. The student need to answer FIVE full questions, selecting ONE full question from each module.

Text books:

1. Research Methodology: Methods and Techniques C.R. Kothari, GauravGarg New Age International 4th Edition, 2018
2. ResearchMethodologyastep-bystepguideforbeginners. (For the topic Reviewing the literature under module 2) Ranjit Kumar SAGE PublicationsLtd 3rd Edition, 2011
3. Study Material (For the topic Intellectual Property under module 5) Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013

Reference Books:

1. Research Methods: the concise knowledge base Trochim Atomic Dog Publishing 2005
2. Conducting Research Literature Reviews: From the Internet to Paper Fink A Sage Publications 2009

Environmental Studies		
Subject Code	**21CIV57**	Credits:01
CIE:50	SEE:50	SEE: 02hrs
Hours/Week: 02hrs (Theory)		Total Hours:25 Hrs

Prerequisite:

Course Objectives:

- To identify the major challenges in environmental issues and evaluate possible solutions. 2. Develop analytical skills, critical thinking and demonstrate socio-economic skills for sustainable development. 3. To analyze an overall impact of specific issues and develop environmental management plan.

Modules	Teaching Hours
Module-I Introduction: Environment - Components of Environment Ecosystem: Types & Structure of Ecosystem, Balanced ecosystem Human Activities – Food, Shelter, And Economic & Social Security. 2 Hours Impacts of Agriculture & Housing Impacts of Industry, Mining & Transportation Environmental Impact Assessment, Sustainable Development. 3 Hours	**5 Hours**
Module-II Natural Resources, Water resources – Availability & Quality aspects, Water borne diseases & water induced diseases, Fluoride problem in drinking water Mineral resources, Forest Wealth Material Cycles – Carbon Cycle, Nitrogen Cycle &Sulphur Cycle. 2 Hours Energy – Different types of energy, Conventional sources &Non Conventional sources of energy Solar energy, Hydro electric energy, Wind Energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy. 3 Hours	**5 Hours**
Module-III Environmental Pollution – Water Pollution, Noise pollution, Land Pollution, Public Health Aspects. 2 Hours Global Environmental Issues: Population Growth, Urbanization, Land Management, Water & Waste Water Management3 Hours	**5 Hours**
Module-IV Air Pollution & Automobile Pollution: Definition, Effects – Global Warming, Acid rain & Ozone layer depletion, controlling measures. 3 Hours Solid Waste Management, E - Waste Management & Biomedical Waste Management - Sources, Characteristics & Disposal methods. 2 Hours	**5 Hours**

Module-V	
Introduction to GIS & Remote sensing, Applications of GIS & Remote Sensing in Environmental Engineering Practices. 2 Hours Environmental Acts & Regulations, Role of government, Legal aspects, Role of Nongovernmental Organizations (NGOs) , Environmental Education & Women Education. 3 Hours	**5 Hours**

Course Outcome: Students will be able to,
1. Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
2. Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment,
3. Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components
4. Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Text Books: 1. Benny Joseph (2005), "Environmental Studies", Tata McGraw – Hill Publishing Company Limited. 2. R.J.Ranjit Daniels and JagadishKrishnaswamy, (2009), "Environmental Studies", Wiley India Private Ltd., New Delhi. 3. R Rajagopalan, "Environmental Studies – From Crisis to Cure", Oxford University Press, 2005, 4. Aloka Debi, "Environmental Science and Engineering", Universities Press (India) Pvt. Ltd. 2012.

Reference Books: 1. Raman Sivakumar, "Principals of Environmental Science and Engineering", Second Edition, Cengage learning Singapore, 2005 2. P. Meenakshi, "Elements of Environmental Science and Engineering", Prentice Hall of India Private Limited, New Delhi, 2006 3. S.M. Prakash, "Environmental Studies", Elite Publishers Mangalore, 2007 4.ErachBharucha, "Text Book of Environmental Studies", for UGC, University press, 2005 5.G.Tyler Miller Jr., "Environmental Science – working with the Earth", Tenth Edition, Thomson Brooks /Cole, 2004 6.G.Tyler Miller Jr., "Environmental Science – working with the Earth", Eleventh Edition, Thomson Brooks /Cole, 2006 7.Dr.Pratiba Sing, Dr.AnoopSingh and Dr.PiyushMalaviya, "Text Book of Environmental and Ecology", Acme Learning Pvt. Ltd. New Delhi.

PRINCIPLES OF OPERATING SYSTEM		
Subject Code:	21AIAE581	Credits:1
CIE: 50 Marks	SEE: 50 Marks	SEE: 02 Hrs.
Hours/Week:02Hrs (Practical)		Total Hours:28 Hrs.

Prerequisite:
Students should have the knowledge of C, Data Structure and Algorithm.

Course Learning Objectives
To enable the students to obtain the knowledge of Operating System laboratory in the following topics.

- To implement CPU scheduling algorithms
- To develop bankers algorithm used for deadlock avoidance and prevention.
- To implement page replacement and memory management algorithms.

Sl. No	Experiments
1.	Write the commands for the following: a) Concatenate or type out a file

	b) Change current directory c) List the files in the current directory d) Create directory
2.	Write the commands for the following: a) Print the number of files b) To save and exit from vi editor c) Change file protection d) Delete directory
3.	Write the commands for the following: a) Display date and time b) Rename file c) find string in a file d) get help
4.	Write a shell script to display the calendar for current month with current date replaced by * or ** depending on whether the date has one digit or two digits.
5.	Write a shell script takes a valid directory name as an argument and recursively descend all the sub directories. Find the maximum length of any file in that hierarchy and write this maximum value to the standard output.
6.	Write a shell script that accepts two file names as arguments, checks if the permissions for these files are identical and if the permissions are identical, output common permissions and otherwise output each file name followed by its permissions.
7.	Write a C program to compute average waiting time and average turnaround time for First-Come First-Served (FCFS) Scheduling algorithm, the program should accept the arrival time and burst time as input.
8.	Write a C program to compute average waiting time and average turnaround time for Shortest-Job-First Scheduling algorithm, the program should accept the arrival time and burst time as input.
9.	Write a C program to compute average waiting time and average turn around time for Priority Scheduling algorithm, the program should accept the arrival time and burst Time and priority as input.
10.	Write a C program to compute average waiting time and average turn around time for Round- Robin Scheduling algorithm, the program should accept the arrival time and burst time and assume suitable time quantum as input.
11	Write a program for the Banker's algorithm.
12	Simulate page replacement algorithm LRU.

Question paper pattern:
In SEE, students will be asked to execute the programs which may be related to the above topics.

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

CO#	**Course Outcome**
CO1	Write a c program to implement process Scheduling algorithms.
CO2	Implement process synchronization techniques using C Program.
CO3	Write a c program to implement deadlock handling techniques.

CO4	Implement page replacement algorithms using C program.
CO5	Write a C program to implement disk scheduling techniques, Thread synchronization using mutual exclusion and condition variables..

P D A College of Engineering, Kalaburagi
Autonomous College under VTU
Sixth semester

ENTREPRENEURSHIP, MANAGEMENT AND FINANCE		
Subject Code	**21HU61**	Credits:03
CIE:50	SEE:50	SEE: 03 hrs
Hours/Week: 03 hrs (Theory)		Total Hours:42 hrs
Prerequisite: None		

Course Objectives:

To enable the students to obtain the knowledge of Operating System 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 Hours**
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 Hours**
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 Hours**
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 Hours**
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 Hours**

Question paper pattern:

1.The question paper will have TEN questions.
2.There will be TWO questions in each module, covering all the topics.
3.The student need to answer FIVE full questions, selecting ONE full question from each module.

Reference Books:

1. Industrial Organization & Engineering Economics-T R Banga& S C Sharma- Khanna Publishers, Dehli.

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

Course Code	CO #	Course Outcome (CO)
	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

DEEP LEARNING		
Subject Code	**21AI62**	Credits: 4
CIE:50	SEE:50	SEE: 03 hrs
Hours/Week: 3hrs (Theory)		Total Hours: 52 Hrs

Prerequisite: As deep learning is among the most advanced concepts in the tech sector, it has plenty of prerequisites. we'll be discussing the various subjects you should be familiar with before you begin studying deep learning. Some of them are branches of mathematics while some others are separate disciplines.

Course Objectives:
The main objective of this course is to make students comfortable with tools and techniques required in handling large amounts of datasets. They will also uncover various deep learning methods in NLP, Neural Networks etc. Several libraries and datasets publicly available will be used to illustrate the application of these algorithms. This will help students in developing skills required to gain experience of doing independent research and study.

Modules	**Teaching Hours**

Module I **Introduction to machine learning-** Linear models (SVMs and Perceptron's, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates	**8 Hours**
Module II **Deep Networks:** History of Deep Learning- A Probabilistic Theory of Deep LearningBackpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow NetworksConvolutional Networks- Generative Adversarial Networks (GAN), Semisupervised Learning	**8 Hours**
Module III **Dimentionally Reduction:** Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization	**9 Hours**
Module IV **Optimization and Generalization** Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networksSpatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience	**9 Hours**
Module V **Case Study and Applications** Imagenet- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection BioInformatics- Face Recognition- Scene UnderstandingGathering Image Captions	**9 Hours**

Question paper pattern:

1. The question paper will have TEN questions.
2. There will be TWO questions in each module, covering all the topics.
3. The student need to answer FIVE full questions, selecting ONE full question from each module.

Text books:

CosmaRohillaShalizi, Advanced Data Analysis from an Elementary Point of View,2015.

Course outcomes:

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

1. Demonstrate the basics of deep learning for a given context.
2. Implement various deep learningmodels for the given problem
3. Realign high dimensional data using reductiontechniques for the given problem
4. Analyze optimization and generalization techniques of deeplearning for the given problem.
5. Evaluate the given deep learningapplication and enhance by applying latest techniques.

DATA SCIENCE AND ITS APPLICATIONS			
Subject Code	21AI63	**CIE Marks**	50
Number of Contact Hours/Week	3:2:0	**SEE Marks**	50
Total Number of Contact Hours	42	**Exam Hours**	03
CREDITS –3			

Course Objectives: This course will enable students to:

- Determinetheappropriatenaturallanguageprocessing,machinelearninganddeeplearningmodels to solve thebusiness-relatedchallenges.
- Indicateproficiencywithstatisticalanalysisofdatatoderiveinsightfromresultsandinterpretthedata findingsvisually.
- Demonstrateskillsindatamanagementbyobtaining,cleaningandtransformingthedata.
- Discusshowsocialnetworksappraisethewaysinwhichthesocialclusteringshapeindividualsandgroupsincontemporarysociety.

Module-1	**Contact Hours.**

Introduction:WhatisDataScience? **Visualizing Data,** matplotlib, Bar Charts, Line Charts, Scatterplots, **Linear Algebra,**Vectors, Matrices, **Statistics,** Describing a Single Set of Data, Correlation, Simpson'sParadox, Some Other Correlational Caveats, Correlation and Causation, **Probability,**Dependence and Independence, Conditional Probability, Bayes's Theorem, RandomVariables,ContinuousDistributions,TheNormalDistribution,TheCentralLimitTheorem. **Chapters 1, 3, 4, 5 and** **6RBT:L2,L3**	9
Module-2	
Hypothesis and Inference,Statistical Hypothesis Testing, Example: Flipping a Coin,p-Values, Confidence Intervals, p-Hacking, Example: Running an A/B Test, BayesianInference,**GradientDescent,**TheIdeaBehindGradientDescentEstimatingtheGradient,UsingtheGradient,ChoosingtheRightStepSize,UsingGradientDescentto Fit Models, Minibatch and Stochastic Gradient Descent, **Getting Data,** stdin andstdout,Reading Files,Scraping theWeb,UsingAPIs,Example:UsingtheTwitterAPIs, **Working with Data,** Exploring Your Data, Using NamedTuples, Dataclasses,CleaningandMunging,ManipulatingData,Rescaling,AnAside:tqdm,DimensionalityReduction. **Chapters7,8,9and10**	9

RBT:L2,L3	
Module-3	
MachineLearning,Modeling,WhatIsMachineLearning?,OverfittingandUnderfitting,Correctness,TheBias-VarianceTradeoff,FeatureExtractionandSelection, **k-Nearest Neighbors,** The Model, Example: The Iris Dataset, The Curse ofDimensionality,**NaiveBayes,**AReallyDumbSpamFilter,AMoreSophisticatedSpam Filter, Implementation, Testing Our Model, Using Our Model, **Simple LinearRegression,** The Model, Using Gradient Descent, Maximum Likelihood Estimation,**Multiple Regression,** The Model, Further Assumptions of the Least Squares Model,FittingtheModel,InterpretingtheModel,GoodnessofFit,Digression:TheBootstrap,StandardErrorsofRegressionCoefficients,Regularization,**LogisticRegression,** The Problem, The Logistic Function, Applying the Model, Goodness ofFit,SupportVectorMachines. **Chapters 11, 12, 13, 14, 15 and** **16RBT:L2,L3**	8
Module-4	

DecisionTrees,WhatIsaDecisionTree?,Entropy,TheEntropy ofaPartition,CreatingaDecisionTree,PuttingItAllTogether,RandomForests,**NeuralNetworks,**Perceptrons, Feed-Forward Neural Networks, Backpropagation, Example:Fizz Buzz,**Deep Learning,** The Tensor, The Layer Abstraction, The Linear Layer,Neural Networks as a Sequence of Layers, Loss and Optimization, Example: XORRevisited, Other Activation Functions, Example: FizzBuzz Revisited, Softmaxes andCross-Entropy, Dropout, Example: MNIST, Saving and Loading Models, **Clustering,**The Idea, The Model, Example: Meetups, Choosing k, Example: Clustering Colors,Bottom-Up Hierarchical Clustering. **Chapters17, 18, 19 and** **20RBT:L2,L3**	8
Module-5	
Natural Language Processing, Word Clouds, n-Gram Language Models, Grammars,AnAside:GibbsSampling,TopicModeling,WordVectors,RecurrentNeuralNetworks, Example: Using a Character-Level RNN, **Network Analysis,** BetweennessCentrality, Eigenvector Centrality, Directed Graphs and PageRank, **RecommenderSystems,**ManualCuration,RecommendingWhat'sPopular,User-BasedCollaborativeFiltering,Item-BasedCollaborativeFiltering,MatrixFactorization. **Chapters 21, 22 and** **23RBT:L2,L3**	8
CourseOutcomes: Afterstudyingthiscourse,studentswillbeableto:	

- Interpret the concepts and methods of mathematical disciplines relevant to data analyticsandstatisticalmodeling.
- Examine, visualize,curate,and preparedata and recognizehow thequalityofthe dataandthemeansof datacollection mayaffect interpretation.
- Determinethemachinelearning,deeplearningandnaturallanguageprocessingskillstodesignandimplementefficient,data-drivensolutionsforrealworldproblems.
- Illustratehownetworkanalysisandrecommendersystemscancontributetoincreasingknowledgeaboutdiverseaspects ofsocietalclustering.

QuestionPaperPattern:
The question paper will have TEN questions. There will be TWO questions in each module, covering all the topics. The student need to answer FIVE full questions, selecting ONE full question from each module.
Textbooks:
1.Joel Grus, **"Data Science from Scratch",** 2nd Edition, O'Reilly Publications/Shroff PublishersandDistributorsPvt.Ltd.,2019.ISBN-13:978-9352138326.
ReferenceBooks:

1. Emily Robinsonand JacquelineNolis,**"Build aCareerin DataScience",**1st Edition,ManningPublications,2020. ISBN: 978-1617296246.
2. AurélienGéron,**"Hands-OnMachineLearningwithScikit-Learn,Keras,andTensorFlow:Concepts,Tools,andTechniquestoBuildIntelligentSystems",** 2nd Edition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., 2019. ISBN-13:978-1492032649.
3. François Chollet, **"Deep Learning with Python**", 1st Edition, Manning Publications, 2017.ISBN-13:978-1617294433
4. JeremyHowardandSylvainGugger,**"DeepLearningforCoderswithfastaiandPyTorch",** 1st Edition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd.,2020.ISBN-13:978-1492045526.
5. SebastianRaschkaandVahidMirjalili,**"PythonMachineLearning:MachineLearningandDeepLearning withPython,scikit-learn,andTensorFlow2"**,3rd Edition,PacktPublishing Limited,2019.ISBN-13:978-1789955750

CG AND FUNDAMENTALS OF IMAGE PROCESSING		
Subject Code	**21AI641**	Credits:3
CIE:50	SEE:50	SEE:03 hrs
Hours/Week:3hrs(Theory)		Total Hours:42Hrs
Prerequisite: None		

Course Objectives:

CO 1. Overview of Computer Graphics along with its applications.
CO 2. Exploring 2D and 3D graphics mathematics along with OpenGL API's.
CO 3. Use of Computer graphics principles for animation and design of GUI's .
CO 4. Introduction to Image processing and Open CV.
CO 5. Image segmentation using Open CV.

Modules	**Teaching Hours**

Module I Overview: Computer Graphics hardware and software and OpenGL: Computer Graphics: Video Display Devices, Raster-Scan Systems Basics of computer graphics, Application of Computer Graphics. OpenGL: Introduction to OpenGL, coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham's).	**9 Hours**
Module II 2D and 3D graphics with OpenGL: 2D Geometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates, 2D Composite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 3D Geometric Transformations: Translation, rotation, scaling, composite 3D transformations, other 3D transformations, OpenGL geometric transformations functions	**9 Hours**
Module III Interactive Input Methods and Graphical User Interfaces: Graphical Input Data ,Logical Classification of Input Devices, Input Functions for Graphical Data , Interactive Picture-Construction Techniques, Virtual-Reality Environments, OpenGL Interactive Input-Device Functions, OpenGL Menu Functions , Designing a Graphical User Interface. Computer Animation :Design of Animation Sequences, Traditional Animation Techniques, General Computer-Animation Functions, Computer-Animation Languages, Character Animation, Periodic Motions, OpenGL Animation Procedures.	**8 Hours**
Module IV Introduction to Image processing: overview, Nature of IP, IP and its related fields, Digital Image representation, types of images. Digital Image Processing Operations: Basic relationships and distance metrics, Classification of Image processing Operations. Computer vision and OpenCV: What is computer vision, Evolution of computer vision, Application of Computer vision, Feature of OpenCV, OpenCV library modules, OpenCV environment, Reading, writing and storing images using OpenCV. OpenCV drawing Functions. OpenCV Geometric Transformations	**8 Hours**
Module V Image Segmentation: Introduction, classification, detection of discontinuities, Edge detection (up to canny edge detection(included)). Image processing with Open CV: Resizing , Rotation/ Flipping, Blending, Creating region of Interest (ROI), Image Thresholding, Image Blurring and smoothing, Edge Detection, Image contours and Face Detection on images using OpenCV	**8 Hours**
Course Outcomes: After studying this course, students will be able to:	

CO 1. Construct geometric objects using Computer Graphics principles and OpenGL APIs.
CO 2. Use OpenGL APIs and related mathematics for 2D and 3D geometric Operations on the objects.
CO 3. Design GUI with necessary techniques required to animate the created objects
CO 4. Apply OpenCV for developing Image processing applications.
CO 5. Apply Image segmentation techniques along with programming, using OpenCV, for developing simple applications.

Question Paper Pattern:

The question paper will have TEN questions.
There will be TWO questions in each module, covering all the topics.
The student need to answer FIVE full questions, selecting ONE full question from each module.

Textbooks:

1. Donald D Hearn, M Pauline Baker and WarrenCarithers: Computer Graphics with OpenGL 4th Edition, Pearson, 2014

2. S. Sridhar, Digital Image Processing, second edition, Oxford University press 2016.

Reference Books:

1. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008

2. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: Pearson education

BUSINESS INTELLIGENCE		
SubjectCode	**21AI642**	Credits:3
CIE:50	SEE:50	SEE:03 hrs
Hours/Week:3hrs(Theory)		Total Hours:42Hrs

Prerequisite:None

CourseObjectives:

To enable the students to obtain the knowledge of Software Testing Tools and Techniques

Modules	**Teaching Hours**

Module I Development Steps, BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved In These Activities, Risks Of Not Performing Step, Hardware, Middleware, DBMS Platform, Non Technical Infrastructure Evaluation	**9 Hours**
Module II Managing The BI Project, Defining And Planning The BI Project, Project Planning Activities, Roles And Risks Involved In These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process	**9 Hours**
Module III Differences in Database Design Philosophies, Logical Database Design, Physical Database Design, Activities, Roles And Risks Involved In These Activities, Incremental Rollout, Security Management, Database Backup And Recovery	**8 Hours**
Module IV Growth Management, Application Release Concept, Post Implementation Reviews, Release Evaluation Activities, The Information Asset and Data Valuation, Actionable Knowledge – ROI, BI Applications, The Intelligence Dashboard	**8 Hours**
Module V Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics f enterprise reporting, BI road ahead.	**8 Hours**
Question Paper Pattern:	
The question paper will have TEN questions. There will be TWO questions in each module, covering all the topics. The student need to answer FIVE full questions, selecting ONE full question from each module.	
Textbooks:	
1 Business Intelligence Roadmap : The Complete Project Lifecycle for Decision Support Applications Larissa T Moss and ShakuAtre Addison Wesley Information Technology Series 2003. 2 Fundamentals of Business Analytics R N Prasad, SeemaAcharya Wiley India 2011.	
Reference Books:	
1 Business Intelligence: The Savvy Manager's Guide David Loshin Morgan Kaufmann 2 Delivering Business Intelligence with Microsoft SQL Server 2005 Brian Larson McGraw Hill 2006 3 Foundations of SQL Server 2008 Business Intelligence Lynn Langit Apress 2011	

SOFTWARE TESTING & TOOLS		
SubjectCode	**21AI65OE1**	Credits:3
CIE:50	SEE:50	SEE:03 hrs

Hours/Week:3hrs(Theory)	Total Hours:42Hrs

Prerequisite: The students should have the knowledge of Software Engineering FundamentalsandObject Oriented programming languages

CourseObjectives:

ToenablethestudentstoobtaintheknowledgeofSoftwareTestingToolsandTechniques

Differentiate the various testing techniques

Analyze the problem and derive suitable test cases

.• Apply suitable technique for designing of flow graph

• Explain the need for planning and monitoring a process•

Modules	TeachingHours
Module I Basics of Software Testing: Basic definitions, Software Quality , Requirements, Behaviour and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies , Levels of testing, Testing and Verification, Static Testing. Problem Statements: Generalized pseudocode, the triangle problem, the NextDate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper T1:Chapter1, T3:Chapter1, T1:Chapter2. RBT: L1, L2, L3	**9Hours**

Module II Functional Testing: Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, Nextdate problem and commission problem, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations, Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. Fault Based Testing: Overview, Assumptions in fault based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis. T1: Chapter 5, 6 & 7, T2: Chapter 16 RBT: L1, L2, L3	9Hours

Module III Structural Testing: Overview, Statement testing, Programme testing, Condition testing , Path testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations, Data –Flow testing: Definition-Use testing, Slice-based testing, Guidelines and observations. Test Execution: Overview of test execution, from test case specification to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay T3:Section 6.2.1, T3:Section 6.2.4, T1:Chapter 9 & 10, T2:Chapter 17 RBT: L1, L2, L3	**8Hours**
Module IV Process Framework :Basic principles: Sensitivity, redundancy, restriction, partition, visibility, Feedback, the quality process, Planning and monitoring, Quality goals, Dependability properties ,Analysis Testing, Improving the process, Organizational factors. Planning and Monitoring the Process: Quality and process, Test and analysis strategies and plans, Risk planning, monitoring the process, Improving the process, the quality team Documenting Analysis and Test: Organizing documents, Test strategy document, Analysis and test plan, Test design specifications documents, Test and analysis reports. 10 T2: Chapter 3 & 4, T2: Chapter 20, T2: Chapter 24. RBT: L1, L2, L3	**8Hours**
Module V Integration and Component-Based Software Testing: Overview, Integration testing strategies, Testing components and assemblies. System, Acceptance and Regression Testing: Overview, System testing, Acceptance testing, Usability, Regression testing, Regression test selection techniques, Test case prioritization and selective execution. Levels of Testing, Integration Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing, A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations. T2: Chapter 21 & 22, T1 : Chapter 12 & 13 RBT: L1, L2, L3	**8Hours**

Questionpaperpattern:

Thequestionpaper will haveTENquestions.
TherewillbeTWOquestionsin eachmodule,covering allthetopics.
ThestudentneedtoanswerFIVEfullquestions,selectingONEfullquestionfromeachmodule.

Textbooks:

1. Paul C. Jorgensen: Software Testing, A Craftsman‟s Approach, 3rd Edition, Auerbach Publications, 2008. (Listed topics only from Chapters 1, 2, 5, 6, 7, 9, 10, 12, 13)
2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009. (Listed topics only from Chapters 3, 4, 16, 17, 20,21, 22,24)
3. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.(Listed topics only from

Section 1.2 , 1.3, 1.4 ,1.5, 1.8,1.12,6. 2.1,6. 2.4)

ReferenceBooks:

1. Software testing Principles and Practices – Gopalaswamy Ramesh, SrinivasanDesikan, 2 nd Edition, Pearson, 2007.
2. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004.
3. The Craft of Software Testing – Brian Marrick, Pearson Education, 1995.
4. AnirbanBasu, Software Quality Assurance, Testing and Metrics, PHI, 2015.
5. NareshChauhan, Software Testing, Oxford University press.

Courseoutcomes:
On completion ofthecourse, thestudentwillhavetheabilityto:

Course Code	CO#	CourseOutcome(CO)
	CO1	Derive test cases for any given problem
	CO2	Compare the different testing techniques
	CO3	Classify the problem into suitable testing model
	CO4	Apply the appropriate technique for the design of flow graph
	CO5	Create appropriate document for the software artefact.

MANAGEMENT INFORMATION SYSTEM		
SubjectCode	**21AI65OE2**	Credits:3
CIE:50	SEE:50	SEE:03 hrs
Hours/Week:3hrs(Theory)		Total Hours:42Hrs
Prerequisite: The students should have the knowledge of Software Engineering FundamentalsandObject Oriented programming languages		

Course Objectives: ToenablethestudentstoobtaintheknowledgeofSoftwareTestingToolsandTechniques	
Modules	**TeachingHours**
Module I **Fundamentals of Information Systems:** Information systems in business, fundamentals of information systems solving business problems with information systems.	**9Hours**
Module II **Information Systems for Business Operations:** Business information systems, Transaction processing systems, management, information systems and decision support systems. Artificial intelligence technologies in business, information system for strategic applications and issues in information technology.	**9Hours**
Module III **Issues in Managing Information Technology:** Managing information resources and technologies global information technology, management, planning and implementing change, integrating business change with IT, security and ethical challenges in managing IT, social challenges of information technology	**8 Hours**
Module IV **E-Business Model:** E-commerce frame work, Architectural frame work for e-commerce, Application services and transaction, Models – B2C Transactions, B2B Transactions, Intra-Organizational Transactions, WWW Architecture: Client server structure of the web, e-Commerce architecture, Technology behind the web.	**8 Hours**
Module V **Consumer Oriented E-Commerce:** Consumer oriented Application: Finance and Home Banking, Home shopping, Home Entertainment, Mercantile Process Models, Consumers perspective, Merchants perspective. Electronics Data Interchange (EDI): EDI Concepts, Applications in business – components of international trade, Customs Financial EDI, Electronic fund transfer, Manufacturing using EDI, Digital Signatures and EDI.	**8 Hours**
Question paper pattern:	

The question paper will have TEN questions. There will be TWO questions in each module,covering all the topics. The student need to answer FIVE full questions, selecting ONE full question from each module.
Textbooks:
Management Information systems – managing information technology in the internet worked enterprise – jams. A O'Brien – Tata McGraw Hill publishing company limited – 2002. 2. Management Information Systems – Laaudon & Laudon – PHI – ISBN 81-203-1282-1.1998
ReferenceBooks:
Management Information systems – S. Sadogopan. – PHI – 1998Edn. ISBN 81-203-1180-9. 2. Information systems for modern management – G.R. Murdick – PHI – 2nd Edition.

CYBER SECURITY		
SubjectCode	**21AI65OE3**	Credits:3
CIE:50	SEE:50	SEE:03 hrs
Hours/Week:3hrs(Theory)		Total Hours:42Hrs
Prerequisite: None		
Course Objectives: ToenablethestudentstoobtaintheknowledgeofSoftwareTestingToolsandTechniques CO 1. To familiarize cybercrime terminologies and ACTs CO 2. Understanding cybercrime in mobiles and wireless devices along with the tools for Cybercrime and prevention CO 3. Understand the motive and causes for cybercrime, cybercriminals, and investigators CO 4. Understanding criminal case and evidence, detection standing criminal case and		
Modules		**Teaching Hours**
Module I **Introduction to Cybercrime:** Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes, **Cybercrime:** The Legal Perspectives, **Cybercrimes**: An Indian Perspective, Cybercrime and the Indian ITA 2000. Textbook1:Ch1 (1.1 to 1.8).		**9Hours**

Module II	9Hours
Cyber offenses: **How Criminals Plan Them**: Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cybercafe and Cybercrimes. **Botnets:** The Fuel for Cybercrime, Attack Vector Textbook1: Ch2 (2.1 to 2.7).	
Module III	**8 Hours**
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, Attacks on Wireless Networks. Textbook1: Ch4 (4.1 to 4.9, 4.12).	
Module IV	**8 Hours**
Understanding the people on the scene: Introduction, understanding cyber criminals, understanding cyber victims, understanding cyber investigators. **The Computer Investigation process:** investigating computer crime. **Understanding Cybercrime Prevention:** Understanding Network Security Concepts, Understanding Basic Cryptography Concepts, Making the Most of Hardware and Software Security. Textbook 2:Ch3,Ch 4, Ch 7	
Module V	**8 Hours**
Cybercrime Detection Techniques: Security Auditing and Log Firewall Logs, Reports, Alarms, and Alerts, Commercial Intrusion Detection Systems, Understanding E-Mail Headers Tracing a Domain Name or IP Address. **Collecting and preserving digital Evidence:** Introduction, understanding the role of evidence in a criminal case, collecting digital evidence, preserving digital evidence, recovering digital evidence, documenting evidence. TextBook 2:Ch 9, Ch 10	

Question paper pattern:

The question paper will have TEN questions.
There will be TWO questions in each module, covering all the topics.
The student need to answer FIVE full questions, selecting ONE full question from each module.

Textbooks:

1. SunitBelapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2013

2. Debra Little John Shinder and Michael Cross, "Scene of the cybercrime", 2nd edition, Syngress publishing Inc, Elsevier Inc, 2008

Reference Books:

1. Robert M Slade, "Software Forensics", Tata McGraw Hill, New Delhi, 2005.
2. Bernadette H Schell, Clemens Martin, "Cybercrime", ABC – CLIO Inc, California, 2004.
3. Nelson Phillips and EnfingerSteuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.

4. Kevin Mandia, Chris Prosise, Matt Pepe, “Incident Response and Computer Forensics”, Tata McGraw - Hill, New Delhi, 2006.

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

Course Code	CO#	Course Outcome(CO)
	CO1	Derive test cases for any given problem
	CO2	Compare the different testing techniques
	CO3	Classify the problem into suitable testing model
	CO4	Apply the appropriate technique for the design of flow graph
	CO5	Create appropriate document for the software artefact.

Data Science and Application Lab		
Subject Code	**21AIL66**	Credits:1
CIE:50	SEE:50	SEE:03 hrs
Hours/Week:2hrs(Practical)		Total Hours:28 Hrs

Course Objectives :

1. Recognize and implement various ways of selecting suitable model parameters for different Data Science techniques.
2. Integrate machine learning, deep learning libraries and mathematical and statistical tools that are suitable for the Data Science applications under consideration

1. A study was conducted to understand the effect of number of hours the students spent studying on their performance in the final exams. Write a code to plot line chart with number of hours spent studying on x-axis and score in final exam on y-axis. Use a red '*' as the point character, label the axes and give the plot a title.

Number of hrs spent studying (x)	Score in the final exam (0 – 100) (Y)
10	95
9	80
2	10
15	50
10	45
16	98
11	38
16	93

2. For the given dataset mtcars.csv (www.kaggle.com/ruiromanini/mtcars), plot a histogram to check the frequency distribution of the variable 'mpg' (Miles per gallon)

3. Consider the books dataset BL-Flickr-Images-Book.csv from Kaggle (https://www.kaggle.com/adeyoyintemidayo/publication-of-books) which contains information about books. Write a program to demonstrate the following.

1. Import the data into a DataFrame
2. Find and drop the columns which are irrelevant for the book information.
3. Change the Index of the DataFrame
4. Tidy up fields in the data such as date of publication with the help of simple regular expression. Combine str methods with NumPy to clean columns .

4. Train a regularized logistic regression classifier on the iris dataset (https://archive.ics.uci.edu/ml/machine-learning-databases/iris/ or the inbuilt iris dataset) using sklearn.Train the model with the following hyperparameter C = 1e4 and report the best classification accuracy.

5. Train an SVM classifier on the iris dataset using sklearn. Try different kernels and the associated hyperparameters. Train model with the following set of hyperparameters RBFkernel, gamma=0.5, one-vs-rest classifier, no-feature-normalization. Also try C=0.01,1,10 C=0.01,1,10. For the above set of hyperparameters, find the best classification accuracy along with total number of support vectors on the test data.

6. Consider the following dataset. Write a program to demonstrate the working of the decision tree based ID3 algorithm.

Price	Maintenance	Capacity	Airbag	Profitable
Low	Low	2	No	Yes
Low	Med	4	Yes	Yes

Low	Low	4	No	Yes
Low	Med	4	No	No
Low	High	4	No	No
Med	Med	4	No	No
Med	Med	4	Yes	Yes
Med	High	2	Yes	No
Med	High	5	No	Yes
High	Med	4	Yes	Yes
high	Med	2	Yes	Yes
High	High	2	Yes	No
high	High	5	Yes	Yes

7. Consider the dataset spiral.txt (https://bit.ly/2Lm75Ly). The first two columns in the dataset corresponds to the co-ordinates of each data point. The third column corresponds to the actual cluster label. Compute the rand index for the following methods:
1. K – means Clustering
2. Single – link Hierarchical Clustering
3. Complete link hierarchical clustering. Also visualize the dataset and which algorithm will be able to recover the true clusters.

8. Implement a k-Nearest Neighbor algorithm to classify the iris dataset. Print out both correct and wrong predictions.

Course Outcome

At the end of the course the student will be able to:

	CO1	Demonstrate proficiency with statistical analysis of data.
	CO2	Illustrate the ability to build and assess data-based models.
	CO3	Optimize the data using SVM Classifiers
	CO4	Apply clustering algorithms and logistic regressions on data sets.

MINI-PROJECT		
Subject Code	**19ISMP63**	Credits:02
CIE:50	SEE:50	SEE: 03hours
Hours/Week : --2 hrs		Total hrs: 28

Prerequisite: The students should have Thorough knowledge of Software Engineering and Mastering any one programming language.

Course Objectives:

- To understand the current requirement of the Industries.
- To understand the different software development and testing methodologies.

- To understand and apply architectural model, data flow and control flow diagrams.
- To acquire good documentation, demonstration skills and impact of application on society.

	Teaching Hours
Project comprises of: 1. Literature Survey 2. Requirement Analysis - S/w Requirement - H/w Requirements 3. Design Module presentation 4. Application 5. System Requirement Specification document SRS document contains synopsis, problem formulation and requirement analysis based on above factors. Document should be submitted by the end of Semester	

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

	CO1	Demonstrate the skills of performing surveys on current industrial requirements.
	CO2	Analyze the requirements and apply appropriate software development methodology.
	CO3	Implement and Validate the architectural model, data flow and control flow structures.
	CO4	Demonstrate the documentation and presentation skills
	CO5	Implement the Societal and Ethical systems.