VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Artificial Intelligence and Machine Learning (AI)
Scheme of Teaching and Examinations
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

V SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	HSMC	18CS51	Management and Entrepreneurship for IT Industry	HSMC	2	2	--	03	40	60	100	3
2	PCC	18AI52	Python Programming	CS / IS / AI	3	2	--	03	40	60	100	4
3	PCC	18CS53	Database Management System	CS / IS / AI	3	2	--	03	40	60	100	4
4	PCC	18CS54	Automata Theory and Computability	CS / IS / AI	3	--	--	03	40	60	100	3
5	PCC	18AI55	Principles of Artificial Intelligence	CS / IS / AI	3	--	--	03	40	60	100	3
6	PCC	18AI56	Mathematics for Machine Learning	CS / IS / AI	3	--	--	03	40	60	100	3
7	PCC	18AIL57	Artificial Intelligence Laboratory	CS / IS / AI	--	2	2	03	40	60	100	2
8	PCC	18CSL58	DBMS Laboratory with mini project	CS / IS / AI	--	2	2	03	40	60	100	2
9	HSMC	18CIV59	Environmental Studies	Civil/ Environmental [Paper setting: Civil Engineering Board]	1	--	--	02	40	60	100	1
				TOTAL	18	10	4	26	360	540	900	25

Note: PCC: Professional Core, HSMC: Humanity and Social Science.

AICTE activity Points: In case students fail to earn the prescribed activity Points, eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

Head of the Department
Dept. of Artificial Intelligence & Machine Learning
Alva's Institute of Engineering and Technology
Shobhavana Campus, Mijar
Moodubidire 574 225, D.K. Karnataka, India

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Artificial Intelligence and Machine Learning (AI)

Scheme of Teaching and Examinations

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018 – 19)

VI SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	PCC	18AI61	Machine Learning	CS / IS / AI	3	2	--	03	40	60	100	4
2	PCC	18AI62	Digital Image Processing	CS / IS / AI	3	2	--	03	40	60	100	4
3	PCC	18AI63	Java for Mobile Applications	CS / IS / AI	3	2	--	03	40	60	100	4
4	PEC	18AI64X	Professional Elective -1	CS / IS / AI	3	--	--	03	40	60	100	3
5	OEC	18AI65X	Open Elective –A	CS / IS / AI	3	--	--	03	40	60	100	3
6	PCC	18AIL66	Machine Learning Laboratory	CS / IS / AI	--	2	2	03	40	60	100	2
7	PCC	18AIL67	Digital Image Processing Laboratory with mini project	CS / IS / Ai	--	2	2	03	40	60	100	2
8	MP	18AIL68	Mobile Application Development Laboratory	CS / IS / AI	--	2	2	03	40	60	100	2
9	INT	--	Internship	(To be carried out during the intervening vacations of VI and VII semesters)				--	--	--	--	--
				TOTAL	15	12	6	24	320	480	800	24

Note: PCC: Professional core, PEC: Professional Elective, OE: Open Elective, MP: Mini-project, INT: Internship.

Professional Elective -1

Course code under 18XX64X	Course Title
18AI641	Natural Language Processing
18AI642	Software Project and Management
18AI643	Web Programming
18AI644	Foundation for Data Science

Open Elective –A (18CS65x are not to be opted by CSE / ISE /AIML Programs)

18CS651	Mobile Application Development
18CS652	Introduction to Data Structures and Algorithms
18CS654	Introduction to Operating System

Students can select any one of the open electives offered by any Department (Please refer to the list of open electives under 18CS65X).
Selection of an open elective is not allowed provided,
- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Adviser/Mentor.

Mini-project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be

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 senior faculty members of the Department, one of whom shall be 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 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 college. 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.
SEE for Mini project:
(i) Single discipline: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.
(ii) Interdisciplinary: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.

Internship: All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not takeup/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

(Effective from the academic year 2018 -2019)

SEMESTER – V

Subject Code	18CS51	CIE Marks	40
Number of Contact Hours/Week	2:2:0	SEE Marks	60
Total Number of Contact Hours	40	Exam Hours	3 Hrs

CREDITS – 03

Course Learning Objectives: This course will enable students to:

- Explain the principles of management, organization and entrepreneur.
- Discuss on planning, staffing, ERP and their importance
- Infer the importance of intellectual property rights and relate the institutional support

Module – 1	CH
Introduction - Meaning, nature and characteristics of management, scope and Functional areas of management, goals of management, levels of management, brief overview of evolution of management theories.. Planning Nature, importance, types of plans, steps in planning, Organizing nature and purpose, types of Organization, Staffing- meaning, process of recruitment and selection	08

RBT: L1, L2

Module – 2	
Directing and controlling- meaning and nature of directing, leadership styles, motivationTheories, Communication- Meaning and importance, Coordination- meaning andimportance, Controlling- meaning, steps in controlling. methods of establishing control.	08

RBT: L1, L2

Module – 3	
Entrepreneur – meaning of entrepreneur, characteristics of entrepreneurs, classification and types of entrepreneurs, various stages in entrepreneurial process, role of entrepreneurs in economic development, entrepreneurship in India and barriers to entrepreneurship. Identification of business opportunities, market feasibility study, technical feasibility study, financial feasibility study and social feasibility study.	08

RBT: L1, L2

Module – 4	
Preparation of project and ERP - meaning of project, project identification, project selection, project report, need and significance of project report, contents, formulation, guidelines by planning commission for project report, **Enterprise Resource Planning: Meaning and Importance-** ERP and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources – Types of reports and methods of report generation	08

RBT: L1, L2

Module 5	
Micro and Small Enterprises: Definition of micro and small enterprises, characteristics and advantages of micro and small enterprises, steps in establishing micro and small enterprises, Government of India indusial policy 2007 on micro and small enterprises, case study (Microsoft), Case study(Captain G R Gopinath),case study (N R Narayana Murthy &Infosys), **Institutional support:** MSME-DI, NSIC, SIDBI, KIADB, KSSIDC, TECSOK, KSFC, DIC and District level single window agency, **Introduction to IPR.**	

RBT: L1, L2

Course outcomes: The students should be able to:

- Define management, organization, entrepreneur, planning, staffing, ERP and outline their importance in entrepreneurship
- Utilize the resources available effectively through ERP
- Make use of IPRs and institutional support in entrepreneurship

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Principles of Management -P. C. Tripathi, P. N. Reddy, Tata McGraw Hill, 4th Edition, 2010.
2. Dynamics of Entrepreneurial Development & Management -Vasant Desai Himalaya Publishing House.
3. Entrepreneurship Development -Small Business Enterprises -Poornima M Charantimath Pearson Education – 2006.
4. Management and Entrepreneurship - KanishkaBedi- Oxford University Press-2017

Reference Books:

1. Management Fundamentals -Concepts, Application, Skill Development Robert Lusier – Thomson.
2. Entrepreneurship Development -S S Khanka -S Chand & Co.
3. Management -Stephen Robbins -Pearson Education /PHI -17th Edition, 2003

Head of the Department
Dept. of Artificial Intelligence & Machine Learning
Alva's Institute of Engineering and Technology
Shobhavana Campus, Mijar
574 225, D.K. Karnataka, India

PYTHON PROGRAMMING

[(Effective from the academic year 2018 -2019)
SEMESTER – V

Subject Code	18AI52	IA Marks	40
Number of Lecture Hours/Week	3:2:0	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
	CREDITS – 04		

Course Learning Objectives: This course will enable students to:

- Learn the syntax and semantics of Python programming language.
- Illustrate the process of structuring the data using lists, tuples and dictionaries.
- Demonstrate the use of built-in functions to navigate the file system.
- Implement the Object Oriented Programming concepts in Python.
- Appraise the need for working with various documents like Excel, PDF, Word and Others.

Module – 1	Contact Hours
Python Basics, Entering Expressions into the interactive Shell, The integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program,**Flow control,** Boolean Values, Comparison Operators, Boolean Operators,Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules,Ending a Program Early with sys.exit(), **Functions,**def Statements with Parameters, Return Values and return Statements,The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number	10

Textbook 1: Chapters 1 – 3

RBT: L1, L2

Module – 2	
Lists, The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples,References, Dictionaries and Structuring Data, The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, **Manipulating Strings,** Working with Strings, Useful String Methods, Project: Password Locker, Project: Adding Bullets to Wiki Markup	10

Textbook 1: Chapters 4 – 6

RBT: L1, L2, L3

Module – 3	
Pattern Matching with Regular Expressions, Finding Patterns of Text Without Regular Expressions, Finding Patterns of Text with Regular Expressions,More Pattern Matching with Regular Expressions, Greedy and Nongreedy Matching, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching, Substituting Strings with the sub() Method, Managing Complex Regexes, Combining re .IGNORECASE, re .DOTALL, and re .VERBOSE, Project: Phone Number and Email Address Extractor, Reading and Writing Files, Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module,Saving Variables with the pprint.pformat() Function, Project: Generating Random Quiz Files, Project: Multiclipboard.	10

Textbook 1: Chapters 7 – 10

RBT: L1, L2, L3

Module – 4	
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,Inheritance, Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation	10
Textbook 2: Chapters 15 – 18	
RBT: L1, L2, L3	
Module – 5	
Web Scraping, Project: MAPIT.PY with the webbrowser Module, Downloading Files from the Web with the requests Module, Saving Downloaded Files to the Hard Drive, HTML, Parsing HTML with the BeautifulSoup Module, Project: "I'm Feeling Lucky" Google Search,Project: Downloading All XKCD Comics, Controlling the Browser with the selenium Module, **Working with Excel Spreadsheets,** Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts, **Working with PDF and Word Documents,** PDF Documents, Project: Combining Select Pages from Many PDFs, Word Documents, **Working with CSV files and JSON data,** The csv Module, Project: Removing the Header from CSV Files, JSON and APIs, The json Module, Project: Fetching Current Weather Data	10
Textbook 1: Chapters 11 – 14	
RBT: L1, L2, L3	

Course Outcomes: After studying this course, students will be able to
- Demonstrate proficiency in handling of loops and creation of functions.
- Identify the methods to create and manipulate lists, tuples and dictionaries.
- Discover the commonly used operations involving regular expressions and file system.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Determine the need for scraping websites and working with CSV, JSON and other file formats.

Question paper pattern:
- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

TEXT BOOKS:
1. Al Sweigart,"**Automate the Boring Stuff with Python**",1 Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/) (Chapters 1 to 18)
2. Allen B. Downey, "**Think Python: How to Think Like a Computer Scientist**", 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Chapters 13, 15, 16, 17, 18) (Download pdf/html files from the above links)

Reference Books:

DATABASE MANAGEMENT SYSTEM
(Effective from the academic year 2018 -2019)
SEMESTER – V

Subject Code	18CS53	CIE Marks	40
Number of Contact Hours/Week	3:2:0	SEE Marks	60
Total Number of Contact Hours	50	Exam Hours	3 Hrs

CREDITS –4

Course Learning Objectives: This course will enable students to:

- Provide a strong foundation in database concepts, technology, and practice.
- Practice SQL programming through a variety of database problems.
- Demonstrate the use of concurrency and transactions in database
- Design and build database applications for real world problems.

Module 1	Contact Hours
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. **Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization. **Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10** **RBT: L1, L2, L3**	10
Module 2	
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. **Relational Algebra:** Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. **Mapping Conceptual Design into a Logical Design:** Relational Database Design using ER-to-Relational mapping. **SQL:** SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL. Additional features of SQL. **Textbook 1: Ch4.1 to 4.5, 5.1 to 5.3, 6.1 to 6.5, 8.1; Textbook 2: 3.5** **RBT: L1, L2, L3**	10
Module 3	
SQL : Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. **Database Application Development:** Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The Internet Bookshop. **Internet Applications:** The three-Tier application architecture, The presentation layer, The Middle Tier **Textbook 1: Ch7.1 to 7.4; Textbook 2: 6.1 to 6.6, 7.5 to 7.7.** **RBT: L1, L2, L3**	10
Module 4	
Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. **Normalization Algorithms:** Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms **Textbook 1: Ch14.1 to 14.7, 15.1 to 15.6**	10

1. Jake VanderPlas, **"Python Data Science Handbook: Essential Tools for Working with Data"**, 1ˢᵗ Edition, O'Reilly Media, 2016. ISBN-13: 978-1491912058
2. Charles Dierbach, **"Introduction to Computer Science Using Python"**, 1ˢᵗ Edition, Wiley India Pvt Ltd, 2015. ISBN-13: 978-8126556014
3. Wesley J Chun, **"Core Python Applications Programming"**, 3ʳᵈ Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365

AUTOMATA THEORY AND COMPUTABILITY
(Effective from the academic year 2018 -2019)
SEMESTER – V

Subject Code	18CS54	CIE Marks	40
Number of Contact Hours/Week	3:0:0	SEE Marks	60
Total Number of Contact Hours	40	Exam Hours	3 Hrs

CREDITS –3

Course Learning Objectives: This course will enable students to:

- .... core concepts in Automata and Theory of Computation
- Identify different Formal language Classes and their Relationships
- Design Grammars and Recognizers for different formal languages
- Prove or disprove theorems in automata theory using their properties
- Determine the decidability and intractability of Computational problems

	Contact Hours
Module 1	
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**	08
Module 2	
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**	08
Module 3	
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, Non-determinism 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**	08
Module 4	
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**	08
Module 5	
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, Church-Turing 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**	08

Textbook 1: Appendix: G.1(only), J.1 & J.2

Module 5

Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. **Concurrency Control in Databases:** 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, Introduction to Database Recovery	10

Protocols: Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures

Textbook 1: 20.1 to 20.6, 21.1 to 21.7, 22.1 to 22.4, 22.7.

RBT: L1, L2, L3

Course Outcomes: The student will be able to :

- Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS.
- Use Structured Query Language (SQL) for database manipulation.
- Design and build simple database systems
- Develop application to interact with databases.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Fundamentals of Database Systems, RamezElmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

Reference Books:

1. SilberschatzKorth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013.
2. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.

Head of the Department
Dept. of Artificial Intelligence & Machine Learning
Alva's Institute of Engineering and Technology
Shobhavana Campus, Mijar
Moodubidire 574 225, D.K. Karnataka, India

SEMESTER – V

Subject Code	18AI55	CIE Marks	40
Number of Contact Hours/Week	3:0:0	SEE Marks	60
Total Number of Contact Hours	40	Exam Hours	3 Hrs

CREDITS – 03

Course Learning Objectives: This course will enable students to

1. Gain a historical perspective of AI and its foundations.
2. Become familiar with basic principles of AI toward problem solving
3. Get to know approaches of inference, perception, knowledge representation, and learning.

	CH
Module – 1	
Introduction to AI: history, Intelligent systems, foundation and sub area of AI , applications, current trend and development of AI. **Problem solving**: state space search and control strategies. Chapter 1 and 2 RBT: L1, L2	08
Module – 2	
Problem reduction and Game playing : Problem reduction, game playing, Bounded look-ahead strategy, alpha-beta pruning, Two player perfect information games Chapter 3 RBT: L1, L2	08
Module – 3	
Logic concepts and logic Programming: propositional calculus, Propositional logic, natural deduction system, semantic tableau system, resolution refutation, predicate logic, Logic programming. Chapter 4 RBT: L1, L2	08
Module – 4	
Advanced problem solving paradigm: Planning: types of planning sytem, block world problem, logic based planning, Linear planning using a goal stack, Means-ends analysis, Non linear planning strategies, learning plans Chapter 6. RBT: L1, L2	08
Module – 5	
Knowledge Representation , Expert system Approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, Knowledge representation using Frames. Expert system: introduction phases, architecture ES verses Traditional system Chapter 7 and 8 (8.1 to 8.4) RBT: L1, L2	08

Course outcomes: The students should be able to:

- Apply the knowledge of Artificial Intelligence to write simple algorithm for agents.
- Apply the AI knowledge to solve problem on search algorithm.
- Develop knowledge base sentences using propositional logic and first order logic.
- Apply first order logic to solve knowledge engineering process.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

DPT. I I I I I

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.

Question Paper Pattern:
- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:
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, NarosaPublishers, 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.

Head of the Department
Dept. of Artificial Intelligence & Machine Learning
Alva's Institute of Engineering and Technology
Shobhavana Campus, Mijar
Moodubidire 574 225, D.K. Karnataka, India

MATHEMATICS FOR MACHINE LEARNING
(Effective from the academic year 2018 -2019)
SEMESTER – V

Subject Code	18AI56	CIE Marks	40
Number of Contact Hours/Week	3:0:0	SEE Marks	60
Total Number of Contact Hours	40	Exam Hours	3 Hrs

CREDITS – 03

Course Learning Objectives: This course will enable students to:

- Improve the skills and knowledge in linear algebra to get more out of machine learning.
- Understand the vector calculus required to build many common machine learning techniques.
- Learn the probability and distribution in statistics to build machine learning applications.
- Learn the basic theoretical properties of optimization problems, for applications in machine learning

Module – 1	CH
Linear Algebra-Part1: Introduction, Matrices , System of Linear Equations, Vector Spaces, Linear Dependence and independence, Gaussian Elimination, Basis and basis set, Rank, Norms , Inner Products, Lengths and Distances, Angles (Ch: 2-2.6, Ch:3-3.3) RBT: L1, L2	08
Module – 2	
Linear Algebra-Part2: Orthogonality, Orthonormal Basis, Orthogonal Complement, Rotations, Determinant and Trace, Eigenvalues and Eigenvectors – its interpretations, Projections, Regression, Diagonalization, Singular Value Decomposition(Ch:3.4-3.6, 3.9, Ch:4-4.5) RBT: L1, L2	08
Module – 3	
Vector Calculus: Introduction, Differentiation of Univariate Functions, Partial Differentiation and Gradients, Gradients of Vector-Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients, Backpropagation (Ch-5) RBT: L1, L2	08
Module – 4	
Probability and Distribution: Probability , Conditional probability, Baye's Theorem, Discrete and Continuous Random Variables and Distributions, Expectation and its Interpretations, Standard discrete and continuous distribution functions, Central Limit theorem (Ch-6) RBT: L1, L2	08
Module – 5	
Optimization: Introduction, Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers, Convex Optimization (Ch-7) RBT: L1, L2	08

Course outcomes: The students should be able to:

- Improve the skills and knowledge in linear algebra to get more out of machine learning.
- Understand the vector calculus required to build many common machine learning techniques.
- Learn the probability and distribution in statistics to build machine learning applications.
- Learn the basic theoretical properties of optimization problems, for applications in machine learning

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong. "Mathematics for Machine Learning" , Published by Cambridge University Press, Copyright 2020

Reference Books:

Textbooks:

1. Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014

Reference Books:

1. Elaine Rich, Kevin Knight, Artificial Intelligence, Tata McGraw Hill
2. Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier, 1980
3. StaurtRussel, Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education, 3rd Edition, 2009
4. George F Luger, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011

Head of the Department
Dept. of Artificial Intelligence & Machine Learning
Alva's Institute of Engineering and Technology
Shobhavana Campus, Mijar
Moodubidire 574 225, D.K. Karnataka, India

ARTIFICIAL INTELLIGENCE LABORATORY

(Effective from the academic year 2018 -2019)

SEMESTER – V

Subject Code	18AIL57	CIE Marks	40
Number of Contact Hours/Week	0:2:2	SEE Marks	60
Total Number of Lab Contact Hours		Exam Hours	3 Hrs

Credits – 2

Course Learning Objectives: This course will enable students to:

Implement and evaluate AI algorithms in Python programming language.

Descriptions (if any):

Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.

Programs List:

Practicing Problems in Python(Students can be encouraged to practice good number of practice problems , some practice problems are listed here)

1.	(a) Write a python program to print the multiplication table for the given number
	(b) Write a python program to check whether the given number is prime or not?
	(c) Write a python program to find factorial of the given number?
2.	(a) Write a python program to implement List operations (Nested List, Length,Concatenation, Membership, Iteration, Indexing and Slicing)
	(b) Write a python program to implement List methods (Add, Append, Extend & Delete).
3.	Write a python program to implement simple Chatbot with minimum 10 conversations
4.	Write a python program to Illustrate Different Set Operations
5.	(a)Write a python program to implement a function that counts the number of times a string(s1) occurs in another string(s2)
	(b)Write a program to illustrate Dictionary operations([],in,traversal)and methods: keys(),values(),items()

AI Problems to be implemented in Python	
1	Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem
2	Implement and Demonstrate Best First Search Algorithm on any AI problem
3	Implement AO* Search algorithm.
4	Solve 8-Queens Problem with suitable assumptions
5	Implementation of TSP using heuristic approach
6	Implementation of the problem solving strategies: either using Forward Chaining or Backward Chaining
7	Implement resolution principle on FOPL related problems
8	Implement any Game and demonstrate the Game playing strategies

Laboratory Outcomes: The student should be able to:

- Implement and demonstrate AI algorithms.
- Evaluate different algorithms.

Conduct of Practical Examination:

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Subjected to change in accoradance with university regulations)*
  - i) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  - j) For laboratories having PART A and PART B
    - i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    - ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

1. Sheldon Axler, "Linear Algebra Done Right" third edition, 2015, Springer

2. David C. Lay, "Linear Algebra and its Applications," 3rd edition, Pearson Education (Asia) Pte. Ltd,2005.

3. Gilbert Strang, "Linear Algebra and its Applications", 3rd edition, Thomson Learning Asia, 2003.

4. D. Chatterjee, "Analytical Geometry: Two and Three Dimensions", Alpha Science International Limited, 2009

5. Charles M. Grinstead, J. Laurie Snell, "Introduction to Probability".

6. DasGupta, Anirban, "Probability for Statistics and Machine Learning: Fundamentals and Advanced Topics", Springer, 2011

7. David Morin, "Probability: For the Enthusiastic Beginner", 2016

8. V. Jeyakumar, Alexander M. Rubinov, " Continuous Optimization: Current Trends and Modern Applications(Applied Optimization) 2005th Edition

9. Kulkarni, Anand J., Satapathy, Suresh Chandra, "Optimization in Machine Learning and Applications", Springer, 2020

Head of the Department
Dept. of Artificial Intelligence & Machine Learning
Alva's Institute of Engineering and Technology
Shobhavana Campus, Mijar
Moodubidire 574 225, D.K. Karnataka, India

DBMS LABORATORY WITH MINI PROJECT

(Effective from the academic year 2018 -2019)
SEMESTER – V

Subject Code	18CSL58	CIE Marks	40
Number of Contact Hours/Week	0:2:2	SEE Marks	60
Total Number of Lab Contact Hours		Exam Hours	3 Hrs

Credits – 2

Course Learning Objectives: This course will enable students to:

- Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
- Strong practice in SQL programming through a variety of database problems.
- Develop database applications using front-end tools and back-end DBMS.

Descriptions (if any):

PART-A: SQL Programming ()
- Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
- Create schema and insert at least 5 records for each table. Add appropriate database constraints.

PART-B: Mini Project ()
- Use Java, C#, PHP, Python, or any other similar front-end tool. All applications must be demonstrated on desktop/laptop as a stand-alone or web based application (Mobile apps on Android/IOS are not permitted.)

Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.

Programs List:	

PART A

1.	Consider the following schema for a Library Database:
	BOOK(Book_id, Title, Publisher_Name, Pub_Year)
	BOOK_AUTHORS(Book_id, Author_Name)
	PUBLISHER(Name, Address, Phone)
	BOOK_COPIES(Book_id, Branch_id, No-of_Copies)
	BOOK_LENDING(Book_id, Branch_id, Card_No, Date_Out, Due_Date)
	LIBRARY_BRANCH(Branch_id, Branch_Name, Address)
	Write SQL queries to
	  1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc.
	  2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017.
	  3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
	  4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.
	  5. Create a view of all books and its number of copies that are currently available in the Library.

2.	Consider the following schema for Order Database:
	SALESMAN(Salesman_id, Name, City, Commission)
	CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id)
	ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)
	Write SQL queries to
	  1. Count the customers with grades above Bangalore's average.
	  2. Find the name and numbers of all salesman who had more than one customer.
	  3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.)
	  4. Create a view that finds the salesman who has the customer with the highest order

		5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.

3.		Consider the schema for Movie Database:
		ACTOR(Act_id, Act_Name, Act_Gender)
		DIRECTOR(Dir_id, Dir_Name, Dir_Phone)
		MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)
		MOVIE_CAST(Act_id, Mov_id, Role)
		RATING(Mov_id, Rev_Stars)
		Write SQL queries to
		    1. List the titles of all movies directed by 'Hitchcock'.
		    2. Find the movie names where one or more actors acted in two or more movies.
		    3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation).
		    4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.
		    5. Update rating of all movies directed by 'Steven Spielberg' to 5.

4.		Consider the schema for College Database:
		STUDENT(USN, SName, Address, Phone, Gender)
		SEMSEC(SSID, Sem, Sec)
		CLASS(USN, SSID)
		SUBJECT(Subcode, Title, Sem, Credits)
		IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)
		Write SQL queries to
		    1. List all the student details studying in fourth semester 'C' section.
		    2. Compute the total number of male and female students in each semester and in each section.
		    3. Create a view of Test1 marks of student USN '1BI15CS101' in all subjects.
		    4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.
		    5. Categorize students based on the following criterion:
		       If FinalIA = 17 to 20 then CAT = 'Outstanding'
		       If FinalIA = 12 to 16 then CAT = 'Average'
		       If FinalIA< 12 then CAT = 'Weak'
		       Give these details only for 8th semester A, B, and C section students.

5.		Consider the schema for Company Database:
		EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo)
		DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate)
		DLOCATION(DNo,DLoc)
		PROJECT(PNo, PName, PLocation, DNo)
		WORKS_ON(SSN, PNo, Hours)
		Write SQL queries to
		    1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.
		    2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise.
		    3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department
		    4. Retrieve the name of each employee who works on all the projects controlledby department number 5 (use NOT EXISTS operator).
		    5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.

PART B: Mini Project

MACHINE LEARNING
(Effective from the academic year 2018 -2019)
SEMESTER – VI

		CIE Marks	40
Subject Code	18AI61	SEE Marks	60
Number of Contact Hours/Week	3:2:0	Exam Hours	3 Hrs
Total Number of Contact Hours	50		

CREDITS – 04

Course Learning Objectives: This course will enable students to:
- Define machine learning and understand the basic theory underlying machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Understand the basic concepts of learning and decision trees.
- Understand Bayesian techniques for problems appear in machine learning
- Perform statistical analysis of machine learning techniques.

	CH
Module – 1	10
Introduction: Machine learning Landscape: what is ML?, Why, Types of ML, main challenges of ML (T2:Chapter1) **Concept learning and Learning Problems** – Designing Learning systems, Perspectives and Issues – Concept Learning – Find S-Version Spaces and Candidate Elimination Algorithm –Remarks on VS-Inductive bias – **T2: Chapter 1** T1: Chapter 1 and 2)	
Module – 2	10
End to end Machine learning Project : Working with real data, Look at the big picture, Get the data, Discover and visualize the data, Prepare the data, select and train the model, Fine tune your model **Classification** : MNIST, training a Binary classifier, performance measure, multiclass classification, error analysis, multi label classification, multi output classification (T2: Chapter 2 and 3)	
Module – 3	10
Training Models: Linear regression, gradient descent, polynomial regression, learning curves, regularized linear models, logistic regression Support Vector Machine: linear, Nonlinear , SVM regression and under the hood **(T2: Chapter 4 and 5)** RBT: L1, L2	
Module – 4	10

Decision Trees
  Training and Visualizing DT, making prediction, estimating class, the CART training, computational complexity, GINI impurity, Entropy, regularization Hyper parameters, Regression, instability
Ensemble learning and Random Forest:
  Voting classifiers, Bagging and pasting, Random patches, Random forests, Boosting, stacking
(T2: Chapter 6 and 7)
RBT: L1, L2	

Module – 5	10
Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– example- Bayesian Belief Network – EM Algorithm **Text book (T1: Chapter 6)** RBT: L1, L2	

Course outcomes: The students should be able to:

For any problem selected make sure that the application should have five or more tables indicative areas include; health care , salary management, office automation, etc.

Laboratory Outcomes: The student should be able to:

- Create, Update and query on the database.
- Demonstrate the working of different concepts of DBMS
- Implement. analyze and evaluate the project developed for an application.

Conduct of Practical Examination:

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.

Marks Distribution (subjected to change in accordance with university regulations)

  k) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  l) For laboratories having PART A and PART B
     i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
     ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

DIGITAL IMAGE PROCESSING
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Subject Code	18AI62	CIE Marks	40
Number of Contact Hours/Week	3:2:0	SEE Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS –4

- **Course Learning Objectives:** This course will enable students to:
- Understand the fundamentals of digital image processing
- Understand the image transform used in digital image processing
- Understand the image enhancement techniques used in digital image processing
- Understand the image restoration techniques and methods used in digital imageprocessing
- Understand the Morphological Operations and Segmentation used in digital image processing

Module-1	Contact Hours.
Digital Image Fundamentals: What is Digital Image Processing?,Originsof Digital Image Processing, Examples of fields that use DIP, FundamentalSteps in Digital Image Processing, Components of an Image ProcessingSystem, Elements of Visual Perception, Image Sensing and Acquisition,Image Sampling and Quantization, Some Basic Relationships betweenPixels, Linear and Nonlinear Operations. [Text1: Chapter 1 and Chapter 2: Sections 2.1 to 2.5, 2.6.2]	10
RBT: L1,L2	
Module-2	
Spatial Domain: Some Basic Intensity Transformation Functions,Histogram Processing, Fundamentals of Spatial Filtering ,SmoothingSpatial Filters, Sharpening SpatialFilters**Frequency Domain**: Preliminary Concepts, The Discrete FourierTransform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering inthe Frequency Domain, Image Smoothing and Image Sharpening UsingFrequency Domain Filters, and Selective Filtering. [Text1: Chapter 3: Sections 3.2 to 3.6 and Chapter 4: Sections 4.2, 4.5 to4.10]	10
RBT: L1,L2, L3	
Module-3	
Restoration: Noise models, Restoration in the Presence of Noise Onlyusing Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, InverseFiltering, Minimum Mean Square Error (Wiener) Filtering, and ConstrainedLeast Squares Filtering. [Text1: Chapter 5: Sections 5.2, to 5.9]	10
RBT: L1,L2, L3	
Module-4	
Color Image Processing: Color Fundamentals, Color Models, and Pseudo-colorImage Processing. **Wavelets:** Background, Multiresolution Expansions.	10
Morphological Image Processing: Preliminaries, Erosion and Dilation,Opening and Closing,	

- Apply effectively ML algorithms for appropriate applications.
- Apply bayesian techniques and derive effectively learning rules.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education, 2013
2. AurelienGeron, Hands-on Machine Learning with Scikit-Learn &TensorFlow , O'Reilly, Shroff Publishers and Distributors pvt.Ltd 2019

Reference Books:

1. EthemAlpaydin, Introduction to Machine Learning, PHI Learning Pvt. Ltd. 2nd Ed., 2013
2. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer, 1st edition, 2001
3. Machine Learning using Python ,Manaranjan Pradhan, U Dinesh kumar, Wiley, 2019
4. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson,2020

Head of the Department
Dept. of Artificial Intelligence & Machine Learning
Alva's Institute of Engineering and Technology
Shobhavana Campus, Mijar
Moodubidire 574 225, D.K. Karnataka, India

INTRODUCTION TO DATA SRUCTURES AND ALGORITHM
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Subject Code	18CS652	CIE Marks	40
Number of Contact Hours/Week	3:0:0	SEE Marks	60
Total Number of Contact Hours	40	Exam Hours	3 Hrs

CREDITS –3

Course Learning Objectives: This course will enable students to:
- Identify different data structures in C programming language
- Appraise the use of data structures in problem solving
- Implement data structures using C programming language.

Module 1	Contact Hours
Introduction to C, constants, variables, data types, input output operations, operators and expressions, control statements, arrays, strings, built-in functions, user defined functions, structures, unions and pointers **Text Book 1: Chapter 1 and 2** **RBT: L1, L2**	08
Module 2	
Algorithms, Asymptotic notations, introduction to data structures, Types of data structures, Arrays. **Text Book 1: Chapter 3 and 4** **RBT: L1, L2**	08
Module 3	
Linked lists, Stacks **Text Book 1: Chapter 5 and 6** **RBT: L1, L2**	08
Module 4	
Queues, Trees **Text Book 1: Chapter 7 and 8** **RBT: L1, L2**	08
Module 5	
Graphs, Sorting ,(selection, insertion, bubble, quick)and searching(Linear, Binary, Hash) **Text Book 1: Chapter 9 and 10** **RBT: L1, L2**	08

Course Outcomes: The student will be able to :
- Identify different data structures in C programming language
- Appraise the use of data structures in problem solving
- Implement data structures using C programming language.

Question Paper Pattern:
- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:
1. Data structures using C , E Balagurusamy, McGraw Hill education (India) Pvt. Ltd, 2013.
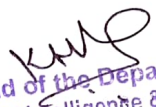
Reference Books:
1. Ellis Horowitz and SartajSahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

training/android developer fundamentals course concepts/details (Download pdf file from the above link)

Reference Books:

1. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014.
2. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015.
3. J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt Ltd. 2016. ISBN-13: 978-8126565580
4. Anubhav Pradhan, Anil V Deshpande, "Composing Mobile Apps" using Android, Wiley 2014, ISBN. 978-81-265-4660-2

Head of the Department
Dept. of Artificial Intelligence & Machine Learning
Alva's Institute of Engineering and Technology
Shobhavana Campus, Mijar
Moodubidire 574 225, D.K. Karnataka, India

MOBILE APPLICATION DEVELOPMENT
(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Subject Code	18CS651	CIE Marks	40
Number of Contact Hours/Week	3:0:0	SEE Marks	60
Total Number of Contact Hours	40	Exam Hours	3 Hrs

CREDITS –3

Course Learning Objectives: This course will enable students to:
- Learn to setup Android application development environment
- Illustrate user interfaces for interacting with apps and triggering actions
- Interpret tasks used in handling multiple activities
- Identify options to save persistent application data
- Appraise the role of security and performance in Android applications

Module – 1	CH
Get started, Build your first app, Activities, Testing, debugging and using support libraries **Textbook 1: Lesson 1,2,3** **RBT: L1, L2**	08

Module – 2	
User Interaction, Delightful user experience, Testing your UI **Textbook 1: Lesson 4,5,6** RBT: L1, L2	08

Module – 3	
Background Tasks, Triggering, scheduling and optimizing background tasks **Textbook 1: Lesson 7,8** **RBT: L1, L2**	08

Module – 4	
All about data, Preferences and Settings, Storing data using SQLite, Sharing data with content providers, Loading data using Loaders **Textbook 1: Lesson 9,10,11,12** **RBT: L1, L2**	08

Module – 5	
Permissions, Performance and Security, Firebase and AdMob, Publish// **Textbook 1: Lesson 13,14,15** **RBT: L1, L2**	08

Course outcomes: The students should be able to:
- Create, test and debug Android application by setting up Android development environment
- Implement adaptive, responsive user interfaces that work across a wide range of devices.
- Infer long running tasks and background work in Android applications
- Demonstrate methods in storing, sharing and retrieving data in Android applications
- Analyze performance of android applications and understand the role of permissions and security
- Describe the steps involved in publishing Android application to share with the world

Question Paper Pattern:
- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:
1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-

Items That Go Together, Measuring Surprise: Lift and Leverage, Example: Beer and Lottery Tickets, Associations Among Facebook Likes, Profiling: Finding Typical Behavior, Link Prediction and Social Recommendation.

Text Book 1: Chapter 7, Chapter 10, Chapter 12
RBT: L1, L2, L3

Course outcomes: The students should be able to:

- Apply the knowledge of mathematics to explain the concept of data science, the available techniques in data science and its scope in business
- **Develop** a Decision tree based on supervised segmentation and predict the class for a given data set by selecting (through solving) the attribute for segmentation using the available techniques.
- **Analyze** the given data set, and solve a problem by performing Classification using the basics of mathematics and data science
- **Develop** solutions to group entities in data set and **apply** it for the given real-world data using the basic knowledge of similarity, neighbors and clustering
- **Analyze** the importance of mining text (social data) and formulate the association rules based on market basket analysis

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Foster Provost and Tom Fawcett, Data Science for Business, O'Reilly, 2013

Reference Books:

1. Cathy O'Neil and Rachel Schutt, **Doing Data Science**, O'Reilly, 2014.
2. Hector Cuesta, **Practical Data Analysis**, PACKT Publishing, 2013
3. Michael R. Berthold, Christian Borgelt, Frank Höppner Frank Klawonn, **Guide to Intelligent Data Analysis**, Springer-Verlag London Limited, 2010
4. Data Analytics using Python, Bharti Motwani, Wiley, 2020

Head of the Department
Dept. of Artificial Intelligence & Machine Learning
Alva's Institute of Engineering and Technology
Shobhavana Campus, Mijar
Moodubidire 574 225, D.K. Karnataka, India

- Construct and visually format tables and forms using HTML and CSS
- Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.
- Appraise the principles of object oriented development using PHP
- Inspect JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features.

Question Paper Pattern:
- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:
1. Randy Connolly, Ricardo Hoar, **"Fundamentals of Web Development"**, 1st Edition, Pearson Education India. (**ISBN:978-9332575271**)

Reference Books:
1. Robin Nixon, **"Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5"**, 4th Edition, O'Reilly Publications, 2015. (**ISBN:978-9352130153**)
2. Luke Welling, Laura Thomson, **"PHP and MySQL Web Development"**, 5th Edition, Pearson Education, 2016. (**ISBN:978-9332582736**)
3. Nicholas C Zakas, **"Professional JavaScript for Web Developers"**, 3rd Edition, Wrox/Wiley India 2012 (**ISBN:978-8126535088**)
4. David Sawyer Mcfarland, **"JavaScript & jQuery: The Missing Manual"**, 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014

Mandatory Note:
Distribution of CIE Marks is a follows (Total 40 Marks):
- 20 Marks through IA Tests
- 20 Marks through practical assessment

Maintain a copy of the report for verification during LIC visit

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FOUNDATION FOR DATA SCIENCE
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Subject Code	18AI644	CIE Marks	40
Number of Contact Hours/Week	3:0:0	SEE Marks	60
Total Number of Contact Hours	40	Exam Hours	3 Hrs

CREDITS – 03

Course Learning Objectives: This course will enable students to:
- Understand the knowledge of mathematics to explain the concept of data science
- Design Decision tree to predict the class for a given data
- Analyze the given data set, and solve a problem by performing Classification using the basics of mathematics and data science
- Develop solutions to group entities in data set and apply it for the given real-world data using the basic knowledge of similarity, neighbors and clustering

Introduction: Data-Analytic Thinking: The Ubiquity of Data Opportunities, Example: Hurricane Frances, Example: Predicting Customer Churn. Data Science, Engineering, and Data-Driven Decision Making, Data Processing and —Big Data‖, Data and Data Science Capability as a Strategic Asset, Data-Analytic Thinking. **Business Problems and Data Science Solutions:** From Business Problems to Data Mining Tasks, Supervised Versus Unsupervised Methods, Data Mining and Its Results, The Data Mining Process, Business Understanding, Data Understanding, Data Preparation, Modeling, Evaluation, Deployment, Other Analytics Techniques and Technologies: Statistics, Database Querying, Data Warehousing, Regression Analysis, Machine Learning and Data Mining **Text Book 1: Chapter 1, Chapter 2** **RBT: L1, L2**	08

Module – 2

Introduction to Predictive Modeling: From Correlation to Supervised Segmentation Models, Induction, and Prediction, Supervised Segmentation, Selecting Informative Attributes Example: Attribute Selection with Information Gain, Supervised Segmentation with Tree- Structured Models, Visualizing Segmentations, Trees as Sets of Rules, Probability Estimation, Example: Addressing the Churn Problem with Tree Induction. **Text Book 1: Chapter 3** **RBT: L1, L2**	08

Module – 3

Fitting a Model to Data: Classification via Mathematical Functions: LinearDiscriminant Functions, Optimizing an Objective Function, An Example of Mining a Linear Discriminant from Data, Linear Discriminant Functions for Scoring and Ranking Instances, Support Vector Machines briefly, Regression via Mathematical Functions, Class Probability Estimation and Logistic —Regression‖. Logistic Regression: Some Technical Details. Example: Logistic Regression versus Tree Induction, Non-Linear Functions, Support vector machines and Neural Networks. Overfitting and its Avoidance. Fundamental Concepts,ExemplaryTechniques,Regularization,Genaralization, Overfitting,Overfitting Examined **Text Book 1: Chapter 4, Chapter 5** **RBT: L1, L2, L3**	08

Module – 4

Similarity, Neighbors, and Clusters: Similarity and Distance, Nearest-Neighbor Reasoning, Example: Whiskey Analytics, Nearest Neighbors for Predictive Modeling, How Many Neighbors and How Much Influence? Geometric Interpretation, Overfitting, and Complexity Control. Issues with Nearest-Neighbor Methods. Some important Technical Details Relating to Similarities and neighbors. Clustering, Example: Whiskey Analytics Revisited, Hierarchical Clustering, Nearest Neighbors Revisited: Clustering Around Centroids. Understanding the Results of Clustering **Text Book 1: Chapter 6** **RBT: L1, L2,L3**	08

Module – 5

Decision Analytic Thinking I: What is a Good Model? Evaluating Classifiers Plain Accuracyand its Problems, The confusion matrix, Problems with unbalanced Classes, Problems with Unequal Costs and Benefits. **Representing and Mining Text**: Why Text Is Important? Why Text Is Difficult? Representation, Bag of Words, Term Frequency, Measuring Sparseness: Inverse Document Frequency, Combining Them: TFIDF, Example: Jazz Musicians	08

WEB PROGRAMMING

(Effective from the academic year 2018 -2019)
SEMESTER – VI

Subject Code	18AI643	CIE Marks	40
Number of Contact Hours/Week	3:0:0	SEE Marks	60
Total Number of Contact Hours	40	Exam Hours	3 Hrs

CREDITS –4

Course Learning Objectives: This course will enable students to:

- Illustrate the Semantic Structure of HTML and CSS
- Compose forms and tables using HTML and CSS
- Design Client-Side programs using JavaScript and Server-Side programs using PHP
- Infer Object Oriented Programming capabilities of PHP
- Examine JavaScript frameworks such as jQuery and Backbone

Module 1	Contact Hours
Introduction to HTML, What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling. **Textbook 1: Ch. 2, 3** **RBT: L1, L2, L3**	8

Module 2	
HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks. **Textbook 1: Ch. 4,5** **RBT: L1, L2, L3**	8

Module 3	
JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions **Textbook 1: Ch. 6, 8** **RBT: L1, L2, L3**	8

Module 4	
PHP Arrays and Superglobals, Arrays, $ GET and $ POST Superglobal Arrays, $ SERVER Array, $ Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling **Textbook 1: Ch. 9, 10** **RBT: L1, L2, L3**	8

Module 5	
Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation, Backbone MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services. **Textbook 1: Ch. 13, 15,17** **RBT: L1, L2, L3**	8

Course Outcomes: The student will be able to :

Project Scheduling: Basic concepts, Project Scheduling – Basic Principles, The Relationship BetweenPeople and Effort – Effort Distribution, defining a Task Set for The Software Project – a Task Set Example –Refinement of Major Tasks, defining a Task Network, Scheduling – Timeline Charts – Tracking the Schedule– Tracking Progress for an OO Project. **T1: Chapter 34** **RBT: L1, L2**	08
Software Quality: What is Quality? Software Quality – Garvin's Quality Dimensions, McColl''sQualityFactors, ISO 9126 Quality Factors, Targeted Quality Factors, The Transition to a Quantitative View, TheSoftware Quality Dilemma - "Good Enough" Software, The Cost Of Quality, Risks, Negligence and Liability,Quality and Security, The Impact Of Management Actions, Achieving Software Quality – SoftwareEngineering Methods, Project Management Techniques, Quality Control, Quality Assurance. T1: Chapter 19 **RBT: L1, L2**	08

Course outcomes: The students should be able to:

- Describe the basics of software project management concepts, principles and practices.
- Apply the different metrics and techniques to measure a software project.
- Apply software cost estimation models.
- Apply scheduling techniques to software project.
- Discuss the software quality concepts and good practices.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:
1. Software Engineering: APractitioner'sApproachRoger S. Pressman, BruceMaximMcGraw Hill 8th Edition,2015

Reference Books:
1. Software Project ManagementBobHughesMikeCotterellRajibMallMcGraw Hill 6th Edition 2018
2. Managing the Software ProcessWattsHumphreyPearson Education 2000
3. Software Project Management inpracticePankajJalote Pearson Education 2002

Head of the Department
Dept. of Artificial Intelligence & Machine Learning
Alva's Institute of Engineering and Technology
Shobhavana Campus, Mijar
Moodubidire 574 225, D.K. Karnataka, India

SOFTWARE PROJECT MANAGEMENT			
(Effective from the academic year 2018 -2019)			
SEMESTER – VI			
Subject Code	18AI642	CIE Marks	40
Number of Contact Hours/Week	3:0:0	SEE Marks	60
Total Number of Contact Hours	40	Exam Hours	3 Hrs

CREDITS – 03	

Course Learning Objectives: This course will enable students to:

- Understand the basics of software project management concepts, principles and practices.
- Understand the different methods of estimation for software project.
- Understand the basic concepts, principles and practices of software project scheduling and riskmanagement.
- Analyse a software project based on various review metrics with review guidelines
- Understand software project maintenance, reengineering and configuration management.

Module – 1	Contact Hours
Project Management Concepts: The Management Spectrum – The People, The Products, The Process, TheProject, People -The Stakeholders, Team Leaders, The Software Team, Agile Teams, Coordination AndCommunication Issues, The Product – Software Scope, Problem Decomposition, The Process – Melding TheProductsAnd The Process, Process Decomposition, The Project, The W5HH Principle, Critical Practices. **T1: Chapter 31** **RBT: L1, L2**	08
Module – 2	
Metrics in the Process and Project Domains -Process Metrics And Software Process Improvement, ProjectMetrics, Software Measurement – Size-Oriented Metrics, Function-Oriented Metrics, Reconciling LOC AndFP Metrics, Object-Oriented Metrics, Use Cases- Oriented Metrics, Webapp Project Metrics, Metrics ForSoftware Quality – Measuring Quality ,Defect Removal Efficiency, Integrating Metrics With The SoftwareProcess - Arguments For Software Metrics, Establishing A Baseline, Metrics Collection Computation AndEvaluation, Metrics For Small Organisation, Establishing A Software Metrics Program. **T1: Chapter 32** **RBT: L1, L2**	08
Module – 3	
Estimation for Software Project: Observations On Estimation, The Project Planning Process, SoftwareScope And Feasibility, Resources – Human Resources, Reusable Software Resources, EnvironmentalResources, Software Project Estimation, Decomposition Techniques – Software Sizing, Problem BasedEstimation, An Example Of LOC Based Estimation, An Example Of FP – Based Estimation, Process Based Estimation, An Example Of Process Based Estimation, Estimation With Usecases, An Example Of EstimationUsing Use Case Points, Reconciling Estimates, Empirical Estimation Models – The Structure Of EstimationModels, The COCOMO II Model, The Software Equation. **T1: Chapter 33** **RBT: L1, L2**	08
Module – 4	

Retrieval   valuation Lexical Resources: World Net Frame Net Stemmers DOS Tagger

Research Corpora.
Textbook 1: Ch. 9,12
RBT: L1, L2, L3

Course outcomes: The students should be able to:

- Analyze the natural language text.
- Define the importance of natural language.
- Understand the concepts Text mining.
- Illustrate information retrieval techniques.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), "Natural LanguageProcessing and Text Mining", Springer-Verlag London Limited 2007.

Reference Books:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: Anintroduction to Natural Language Processing, Computational Linguistics and Speechrecognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummingspublishing company, 1995.
3. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.

NATURAL LANGUAGE PROCESSING
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Subject Code	18AI641	CIE Marks	40
Number of Contact Hours/Week	3:0:0	SEE Marks	60
Total Number of Contact Hours	40	Exam Hours	3 Hrs

CREDITS – 03

Course Learning Objectives: This course will enable students to:
- Analyze the natural language text.
- Define the importance of natural language.
- Understand the concepts Text mining.
- Illustrate information retrieval techniques.

	Contact Hours
Module – 1	
Overview and language modeling: Overview: Origins and challenges of NLP-Language and Grammar Processing Indian Languages NLP Applications Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model. **Textbook 1: Ch. 1,2** **RBT: L1, L2, L3**	08
Module – 2	
Word level and syntactic analysis: Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency-Parsing-Probabilistic Parsing. **Textbook 1: Ch. 3,4** **RBT: L1, L2, L3**	08
Module – 3	
Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. **Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles:** Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. **A Case Study in Natural Language Based Web Search:** InFact System Overview, The GlobalSecurity.org Experience. **Textbook 2: Ch. 3,4,5** **RBT: L1, L2, L3**	08
Module – 4	
Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, **Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures:** Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. **Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling:** Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. **Evolving Explanatory Novel Patterns for Semantically-Based Text Mining:** Related Work, A Semantically Guided Model for Effective Text Mining. **Textbook 2: Ch. 6,7,8,9** **RBT: L1, L2, L3**	08
Module – 5	
Information Retrieval And Lexical Resources: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information	08

RBT: L1, L2, L3	
Module 5	
Getting to know the Android User Interface: Views and ViewGroups, FrameLayout, LinearLayout, TableLayout, RelativeLayout, ScrollView **Designing User Interface with Views:** TextView view – Button, ImageButton, EditText, Checkbox, ToggleButton, RadioButton and RadioGroupViews. **Creating and using Databases:** Creating the DBAdapter Helper class, using the database programmatically. **Text Book 3: Ch 4.1, 5.1, 7.3** **RBT: L1, L2, L3**	10

Course Outcomes: The student will be able to:

- Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs
- Design efficient user interface using different layouts.
- Develop application with persistent data storage using SQLite

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007.
2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007
3. J. F. DiMarzio, Beginning Android Programming with Android Studio, 4th Edition, 2017

Reference Books:

1. John Horton,Android Programming for Beginners, 1st Edition, 2015
2. Dawn Griffiths & David Griffiths, Head First Android Development, O'Reilly, 1st Edition, 2015

Head of the Department
Dept. of Artificial Intelligence & Machine Learning
Alva's Institute of Engineering and Technology
Shobhavana Campus, Mijar
Moodubidire 574 225, D.K. Karnataka, India

JAVA FOR MOBILE APPLICATIONS
(Effective from the academic year 2018 -2019)
SEMESTER – VI

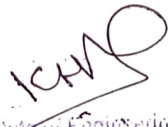| Subject Code	18AI63	CIE Marks	40
Number of Contact Hours/Week	3:2:0	SEE Marks	60
Total Number of Contact Hours	50	Exam Hours	3 Hrs

CREDITS – 4

Course Learning Objectives: This course will enable students to:

- To have an insight into enumerations and collection frameworks for storing and processing data.
- To understand the architecture and components of android application.
- To design interactive user interface.
- To work with SQLite database

Module 1	Contact Hours
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. **RBT: L2, L3**	10
Module 2	
The Collections and Framework, Collection Overview, Recent Changes to 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 **RBT: L1, L2**	10
Module 3	
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 **Text Book 1: Ch 15**	10
Module 4	
Getting Started with Android Programming: What is Android? Features of Android, Android Architecture, obtaining the required tools, launching your first android application **Activities, Fragments and Intents:** Understanding activities, linking activities using intents, fragments. **Text Book 2: Ch 1, 3**	10

The Hit or Miss Transforms, and Some Basic Morphological Algorithms

[Text1: Chapter 6: Sections 6.1 to 6.3, Chapter 7: Sections 7.1 and 7.2, Chapter 9: Sections 9.1 to 9.5]

RBT: L1, L2, L3

Module-5	
Segmentation: Introduction, classification of image segmentation algorithms, Detection of Discontinuities, Edge Detection, Hough Transforms and Shape Detection, Corner Detection, and Principles of Thresholding. **Representation and Description:** Representation, and Boundary descriptors. [Text2: Chapter 9: Sections 9.1, to 9.7 and Text 1: Chapter 11: Sections 11.1 and 11.2]	10

RBT: L1, L2, L3

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

- Understand, Ascertain and describe the basics of image processing concepts through mathematical interpretation.
- Apply image processing techniques in both the spatial and frequency (Fourier) domains.
- Demonstrate image restoration process and its respective filters required.
- Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Ed., Prentice Hall, 2008.

2. S. Sridhar, Digital Image Processing, Oxford University Press, 2nd Edition, 2016.

Reference Books:

2. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004.

(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Subject Code	18CS654	CIE Marks	40
Number of Contact Hours/Week	3:0:0	SEE Marks	60
Total Number of Contact Hours	40	Exam Hours	3 Hrs
	CREDITS – 3		

Course Learning Objectives: This course will enable students to:

- Explain the fundamentals of operating system
- Comprehend multithreaded programming, process management, memory management and storage management.
- Familier with various types of operating systems

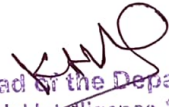| Module – 1	CH
Introduction: What OS do, Computer system organization, architecture, structure, Operations, Process, memory and storage management, Protection and security, Distributed systems, Special purpose systems, computing environments. System Structure: OS Services, User OSI, System calls, Types of system calls, System programs, OS design and implementation, OS structure, Virtual machines, OS generation, system boot Textbook1: Chapter i, 2	08
RBT: L1, L2	
Module – 2	
Process Concept: Overview, Process scheduling, Operations on process, IPC, Examples in IPC, Communication in client-server systems. Multithreaded Programming: Overview, Models, Libraries, Issues, OS Examples Textbook1: Chapter 3,4 RBT: L1, L2	08
Module – 3	
Process Scheduling: Basic concept, Scheduling criteria, Algorithm, multiple processor scheduling, thread scheduling, OS Examples, Algorithm Evaluation. Synchronization: Background, the critical section problem, Petersons solution, Synchronization hardware, Semaphores, Classic problems of synchronization, Monitors, Synchronization examples, Atomic transactions Textbook1: Chapter 5, 6 RBT: L1, L2	08
Module – 4	
Deadlocks: System model, Deadlock characterization, Method of handling deadlock, Deadlock prevention, Avoidance, Detection, Recovery from deadlock Memory management strategies: Background, swapping, contiguous memory allocation, paging, structure of page table, segmentation, Textbook1: Chapter 7, 8 RBT: L1, L2	08
Module – 5	
Virtual Memory management: Background, Demand paging, Copy-on-write, Page replacement,	08

allocation of frames, Trashing, Memory mapped files, Allocating Kernel memory, Operating system examples

File system: File concept, Access methods, Directory structure, File system mounting, File sharing, protection

Textbook1: Chapter 9, 10
RBT: L1, L2

Course outcomes: The students should be able to:

- Explain the fundamentals of operating system
- Comprehend process management, memory management and storage management.
- Familiar with various types of operating systems

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. A. Silberschatz, P B Galvin, G Gagne, Operating systems, 7th edition, John Wiley and sons,.

Reference Books:

1. William Stalling,"Operating Systems: Internals and Design Principles", Pearson Education, 1st Edition, 2018.
2. Andrew S Tanenbaum, Herbert Bos, "Modern Operating Systems", Pearson Education, 4th Edition, 2016

Head of the Department
Dept. of Artificial Intelligence & Machine Learning
Alva's Institute of Engineering and Technology
Shobhavana Campus, Mijar
Moodubidire 574 225, D.K. Karnataka, India

(Effective from the academic year 2018 -2019) SEMESTER – VI			
Subject Code	18AIL66	CIE Marks	40
Number of Contact Hours/Week	0:2:2	SEE Marks	60
Total Number of Lab Contact Hours		Exam Hours	3 Hrs

Credits – 2

Course Learning Objectives: This course will enable students to:

- Implement and evaluate ML algorithms in Python/Java programming language.

Descriptions (if any):

1. The programs can be implemented in either JAVA or Python.
2. Data sets can be taken from standard repository such as UCI

installation procedure of the required software must be demonstrated, carried out in **groups** and documented in the journal.

Programs List:

1.	Implement and demonstratethe**FIND-Salgorithm** for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file and show the output for test cases. Develop an interactive program by Compareing the result by implementing **LIST THEN ELIMINATE** algorithm.
2	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.
3	Demonstrate Pre processing (Data Cleaning, Integration and Transformation) activity on suitable data: For example: Identify and Delete **Rows that Contain Duplicate Data** by considering an appropriate dataset. Identify and Delete Columns That Contain a Single Value by considering an appropriate dataset.
4	Demonstrate the working of the decision tree based **ID3 algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge toclassify a new sample.
5	Demonstrate the working of the Random forest **algorithm**. Use an appropriate data set for building and apply this knowledge toclassify a new sample.
6	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.
7	Assuming a set of documents that need to be classified, use the **naive Bayesian Classifier** model to perform this task. Calculate the accuracy, precision, and recall for your data set.
8	Construct a**Bayesian network** considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
9	Demonstrate the working of EM algorithm to cluster a set of data stored in a .CSV file.
10	Demonstrate the working of SVM classifier for a suitable data set

Laboratory Outcomes: The student should be able to:

- Implement and demonstration of ML algorithms.
- Evaluation of different algorithms.

Conduct of Practical Examination:

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Subjected to change in accordance with university regulations)*
  - m) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks

  - n) For laboratories having PART A and PART B
    - i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    - ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

(Effective from the academic year 2018 -2019)
SEMESTER – VI

Course Code	18AIMP68	IA Marks	40
Number of Contact Hours/Week	0:2:2	Exam Marks	60
Total Number of Contact Hours	3 Hours/Week	Exam Hours	03

CREDITS – 02

Course Learning Objectives: This course will enable students to:

- Learn and acquire the art of Android Programming.
- Configure Android studio to run the applications.
- Understand and implement Android's User interface functions.
- Create, modify and query on SQlite database.
- Inspect different methods of sharing data using services.

Descriptions (if any):

1. Installation procedure of the Android Studio/Java software must be demonstrated and carried out in groups.

2. Students should use the latest version of Android Studio/Java/Kotlin to execute these programs. Diagrams given are for representational purpose only, students are expected to improvise on it.

3. Part B programs should be developed as an application and be demonstrated as a mini project in a group by adding extra features or the students can also develop their own application and demonstrate it as a mini project. (Projects/programs are not limited to the list given in Part B)

Programs List:

	PART – A
1	Create an application to design a Visiting Card. The Visiting card should have a company logo at the top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and the website address is to be displayed. Insert a horizontal line between the job title and the phone number.

2	Develop an Android application using controls like Button, TextView, EditText for designing a calculator having basic functionality like Addition, Subtraction, Multiplication, and Division.

SIMPLE CALCULATOR

Result

`Input <Edit Text>`

7	8	9	/
4	5	6	*
1	2	3	-
.	0	=	+

C

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3 Create a SIGN Up activity with Username and Password. Validation of password should happen based on the following rules:

- Password should contain uppercase and lowercaseletters.
- Password should contain letters andnumbers.
- Password should contain specialcharacters.
- Minimum length of the password (the default value is8).

On successful **SIGN UP** proceed to the next Login activity. Here the user should **SIGN IN** using the Username and Password created during signup activity. If the Username and Password are matched then navigate to the next activity whichdisplays a message saying "Successful Login" or else display a toast message saying "Login Failed".The user is given only two attempts and after thatdisplay a toast message saying "Failed Login Attempts" and disable the SIGN IN button. Use Bundle to transfer information from one activity to another.

SIGNUP ACTIVITY

Username [   ]

Password [   ]

SIGN UP

LOGIN ACTIVITY

Username [   ]

Password [   ]

SIGN IN

4	Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds.
	CHANGING WALLPAPER APPLICATION
	CLICK HERE TO CHANGE WALLPAPER
5	Write a program to create an activity with two buttons START and STOP. On pressing of the START button, the activity must start the counter by displaying the numbers from One and the counter must keep on counting until the STOP button is pressed. Display the counter value in a TextViewcontrol.
	COUNTER APPLICATION
	Counter Value
	START
	STOP
6	Create two files of XML and JSON type with values for City_Name, Latitude, Longitude, Temperature, and Humidity. Develop an application to create an activity with two buttons to parse the XML and JSON files which when clicked should display the data in their respective layouts side by side.
	PARSING XML AND JSON DATA
	PARSING XML AND JSON DATA
	XML DATA JSON Data
	Parse XML Data City_Name Mysore City_Name: Mysore
	Latitude 12.295 Latitude 12.295
	Longitude 76.639 Longitude 76.639
	Parse JSON Data Temperature. 22 Temperature 22
	Humidity 90% Humidity 90%

7	Develop a simple application with one Edit Text so that the user can write some text in it. Create a button called "Convert Text to Speech" that converts the user input text into voice.
	TEXT TO SPEECH APPLICATION
	Convert Text to Speech
8	Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phonecontacts.
	CALL AND SAVE APPLICATION
	1234567890 DEL
	1 2 3
	4 5 6
	7 8 9
	* 0 #
	CALL SAVE

PART - B

1	Write a program to enter Medicine Name, Date and Time of the Day as input from the user and store it in the SQLite database. Input for Time of the Day should be either Morning or Afternoon or Evening or Night. Trigger an alarm based on the Date and Time of the Day and display the Medicine Name.
	MEDICINE DATABASE
	Medicine Name [ ]
	Date [ ]
	Time of the Day [ ]
	Insert

2	Develop a content provider application with an activity called "Meeting Schedule" which takes Date, Time and Meeting Agenda as input from the user and store this information into the SQLite database. Create another application with an activity called "Meeting Info" having DatePicker control, which on the selection of a date should display the Meeting Agenda information for that particular date, else it should display a toast message saying "No Meeting on this Date".

MEETING INFO

Pick a date to get meeting info   [/ /]   📅

MEETING SCHEDULE

Date   [   ]

Time   [   ]

Meeting Agenda   [   ]

[Add Meeting Agenda]   [Search]

CANCEL   OK

3	Create an application to receive an incoming SMS which is notified to the user. On clicking this SMS notification, the message content and the number should be displayed on the screen. Use appropriate emulator control to send the SMS message to your application.

SMS APPLICATION

Display SMS Number

Display SMS Message

4	Write a program to create an activity having a Text box, and also Save, Open and Create buttons. The user has to write some text in the Text box. On pressing the Create button the text should be saved as a text file in MkSDcard. On subsequent changes to the text, the Save button should be pressed to store the latest content to the same file. On pressing the Open button, it should display the contents from the previously stored files in the Text box. If the user tries to save the contents in the Textbox to a file without creating it, then a toast message has to be displayed saying "First Create aFile".

FILE APPLICATION

[Create]   [Open]

┌─────────────────────┐
│   │
│   │
│   │
└─────────────────────┘

[Save]

5	Create an application to demonstrate a basic media player that allows the user to Forward, Backward, Play and Pause an audio. Also, make use of the indicator in the seek bar to move the audio forward or backward as required.

MEDIA PLAYER APPLICATION

Audio Name

◄──────────────────────────

◄ ▶ ❚❚ ▶

6	Develop an application to demonstrate the use of Asynchronous tasks in android. The asynchronous task should implement the functionality of a simple moving banner. On pressing the **Start Task** button, the banner message should scroll from right to left. On pressing the **Stop Task** button, the banner message should stop. Let the banner message be "Demonstration of Asynchronous Task".

ASYNCHRONOUS TASK

[Start Task]

[End Task]

7	Develop an application that makes use of the clipboard framework for copying and pasting of the text. The activity consists of two Edit Text controls and two Buttons to trigger the copy and paste functionality.

CLIPBOARD ACTIVITY

```
[                    ]

[                    ]

[ Copy Text ]   [ Paste Text ]
```

8	Create an AIDL service that calculates Car Loan EMI. The formula to calculate EMI is

$$E = P * (r(1+r)^n)/((1+r)^n-1)$$

where

   E = The EMI payable on the car loan amount

   P = The Car loan Principal Amount

   r = The interest rate value computed on a monthly basis

   n = The loan tenure in the form of months

The down payment amount has to be deducted from the principal amount paid towards buying the Car. Develop an application that makes use of this AIDL service to calculate the EMI. This application should have four Edit Text to read the Principal Amount, Down Payment, Interest Rate, Loan Term (in months) and a button named as "Calculate Monthly EMI". On click of this button, the result should be shown in a Text View. Also, calculate the EMI by varying the Loan Term and Interest Rate values.

CAR EMI CALCULATOR

```
Principal Amount     [              ]              EMI:   Result

Down Payment         [              ]

Interest Rate        [              ]

Loan Term (in months) [             ]


              [ Calculate Monthly EMI ]
```

Laboratory Outcomes: After studying these laboratory programs, students will be able to

- Create, test and debug Android application by setting up Android development environment.
- Implement adaptive, responsive user interfaces that work across a wide range of devices.
- Infer long running tasks and background work in Android applications.
- Demonstrate methods in storing, sharing and retrieving data in Android applications.

- Infer the role of permissions and security for Androidapplications

Procedure to Conduct Practical Examination

- **Experiment distribution**
    - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
    - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A with equal opportunity and in Part B demonstrate the Mini project.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Subjected to change in accoradance with university regulations)*
    - q) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
    - r) For laboratories having PART A and PART B
        - i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
        - ii. **Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks**

Text Books:

1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developer-fundamentals-course-concents/details
(Download pdf file from the above link)

Reference Books:

1. Erik Hellman, **"Android Programming – Pushing the Limits"**, 1st Edition, Wiley India Pvt Ltd, 2014. ISBN-13: 978-8126547197
2. Dawn Griffiths and David Griffiths, **"Head First Android Development"**, 1st Edition, O'Reilly SPD Publishers, 2015. ISBN-13:978-9352131341
3. Bill Phillips, Chris Stewart and Kristin Marsicano, **"Android Programming: The Big Nerd Ranch Guide"**, 3 Edition, Big Nerd Ranch Guides, 2017. ISBN-13:978-0134706054

Head of the Department
Dept. of Artificial Intelligence & Machine Learning
Alva's Institute of Engineering and Technology
Shobhavana Campus, Mijar
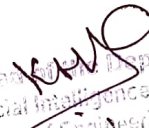Moodubidire - 574 225, D.K. Karnataka, India

(OPEN ELECTIVE)
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Subject Code	18CS653	CIE Marks	40
Number of Contact Hours/Week	3:0:0	SEE Marks	60
Total Number of Contact Hours	40	Exam Hours	3 Hrs
	CREDITS – 3		

Course Learning Objectives: This course will enable students to:

- Learn fundamental features of object oriented language and JAVA
- Set up Java JDK environment to create, debug and run simple Java programs.
- Learn object oriented concepts using programming examples.
- Study the concepts of importing of packages and exception handling mechanism.
- Discuss the String Handling examples with Object Oriented concepts

Module – 1	C H
An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings **Text book 1: Ch 2, Ch 3** RBT: L1, L2	08

Module – 2	
Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java's Selection Statements, Iteration Statements, Jump Statements. **Text book 1: Ch 4, Ch 5** **RBT: L1, L2**	08

Module – 3	
Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class. Text book 1: Ch 6, Ch 7.1-7.9, Ch 8. RBT: L1, L2	08

Module – 4	
Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions. **Text book 1: Ch 9, Ch 10** RBT: L1, L2	08

Module – 5	
Enumerations, Type Wrappers, I/O, Applets, and Other Topics: I/O Basics, Reading Console Input, Writing Console Output, The PrintWriter Class, Reading and Writing Files, Applet Fundamentals, The transient and volatile Modifiers, Using instanceof, strictfp, Native Methods, Using assert, Static Import, Invoking Overloaded Constructors Through this( ), String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String , Additional String Methods, StringBuffer, StringBuilder.	08

Text book 1: Ch 12.1,12.2, Ch 13, Ch 15
RBT: L1, L2

Course outcomes: The students should be able to:

- Explain the object oriented concepts and JAVA
- Develop computer programs to solve real world problems in Java.

Develop simple GUI interfaces for a computer program to interact with users

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under 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 Edition, Tata McGraw Hill, 2007. (Chapters 2, 3, 4, 5, 6,7, 8, 9,10, 12,13,15)

Reference Books:

1. Cay S Horstmann, "Core Java - Vol. 1 Fundamentals", Pearson Education, 10th Edition, 2016.
2. Raoul-Gabriel Urma, Mario Fusco, Alan Mycroft, "Java 8 in Action", Dreamtech Press/Manning Press, 1st Edition, 2014.

(Effective from the academic year 2018 -2019)
SEMESTER – VI

Subject Code	18AIL67	CIE Marks	40
Number of Contact Hours/Week	0:2:2	SEE Marks	60
Total Number of Lab Contact Hours		Exam Hours	03

CREDITS – 2

Course Learning Objectives: This course will enable students to:

- Demonstrate the basic skills of image process
- Demonstrate the application development skills
- Design and develop the applications of images

Descriptions (if any): --

Programming tools preferred: MATLAB, Python, Java or any other relevant platform.

- For Part A: Students must exhibit the results and its print copy to be attached to Lab record.
- For Part B: Real Time Images can be used to demonstrate the work.
  During the practical exam: the students should demonstrate and answer Viva-Voce

Programs List:PART A

1	Write a Program to read a digital image. Split and display image into 4 quadrants, up, down, right and left
2	Write a program to showrotation, scaling, and translation of an image.
3	Read an image, first apply erosion to the image and then subtract the result from the original. Demonstrate the differencein the edge image if you use dilation instead of erosion.
4	Read an image and extract and display low-level features such as edges, textures usingfiltering techniques
5	Demonstrate enhancing and segmenting low contrast 2D images.

PART B :MINI PROJECT

Student should develop a mini project and it should be demonstratedin the laboratory examination, Some of the projects are listed and it is not limited to:

- Recognition of License Plate through Image Processing
- Recognition of Face Emotion in Real-Time
- Detection of Drowsy Driver in Real-Time
- Recognition of Handwriting by Image Processing
- Detection of Kidney Stone
- Verification of Signature
- Compression of Color Image
- Classification of Image Category
- Detection of Skin Cancer
- Marking System of Attendance using Image Processing
- Detection of Liver Tumor
- IRIS Segmentation
- Detection of Skin Disease and / or Plant Disease
- Biometric Sensing System
- Mobile Phone Camera-based Light Communications
- Modeling of Perspective Distortion within Face Images &Library for Object Tracking
- Controlling of Intelligent Traffic Light & Image Processing

➤ Controlling of Pests in Agriculture Field with Image Processing

(During the practical exam: the students should demonstrate and answer Viva-Voce)

Laboratory Outcomes: The student should be able to illustrate the following operations:

- Image Segmentation algorithm development
- Image filtering in spatial and frequency domain.
- Morphological operations in analyzing image structures

Conduct of Practical Examination:

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A: Students are allowed to pick one experiment from PART A, with equal opportunity. The mini project from PART B to be run &exhibit the results also a report on the work is produced.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Subjected to change in accordance with university regulations)*
  - o) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  - p) For laboratories having PART A and PART B
    - i.   Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    - ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

Head of the Department
Dept. of Artificial Intelligence & Machine Learning
Alva's Institute of Engineering and Technology
Shobhavana Campus, Mijar
Moodubidire 574 225, D.K. Karnataka, India