SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)
(Affiliated to Bharathidasan University,Tiruchirappalli)
Accredited by NAAC-An ISO 9001:2015 Certified Institution
SUNDARAKKOTTAI, MANNARGUDI–614016.
TAMILNADU, INDIA.

B.Sc., ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
(For the candidates admitted in the academic year 2024–2025)

PROGRAMME OUTCOMES FOR B.Sc., DEGREE

PO No.	Programme Outcomes (*Upon completion of this undergraduate programme on B.Sc. Artificial Intelligence and Machine Learning, the students will be able to*)
PO-1	**Disciplinary knowledge**: Demonstrate comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate program of study in Bachelor of Science.
PO-2	**Critical thinking, Problem Solving and Reflective thinking:** think critically about the issues and identify, critically analyze and solve problems from the disciplines of concern using appropriate tools and techniques and the knowledge, skills and attitudes acquired and extrapolate the same to real life situations; show critical sensibility to life experiences, with self awareness and reflexivity of both self and society.
PO-3	**Analytical & Scientific Reasoning:** evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints; critically evaluate ideas, evidence, and experiences from an open minded and reasoned perspective.
PO-4	**Research-related Skills:** develop a sense of capability for relevant/appropriate inquiry and asking questions, synthesize, articulate and report results and to recognize and predict cause and effect relationships, define problems, formulate and establish hypothesis, analyze and interpret and draw conclusions from data, execute and report the results of an experiment or investigation.
PO-5	**Digital literacy and Effective Communication:** use ICT in a variety of learning situations and speak, read, write and listen clearly in person and through electronic media in English and in one or more Indian languages, and make meaning of the world by connecting people, ideas ,books, media and technology; efficiently communicate thoughts and ideas in a clear and concise manner.
PO-6	**Individual and Team Work:** effectively accomplish tasks individually as well as work effectively and respectfully as member or leader with diverse teams, facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interest so for a common cause and work efficiently as a member of a team.
PO-7	**Multicultural Competence and Social Interaction:** understand the values and beliefs of multiple cultures, global perspectives, engage and interact respectfully with diverse groups and elicit views of others, mediate disagreements and help reach conclusions in group settings.
PO-8	**Awareness of Ethical issues, Human values and Gender Issues:** embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work and understand the value of relationship between self and the community and aware of the various issues concerning women and society.
PO-9	**Awareness of Environment and Sustainability:** understand the impacts of technology and business practices in societal and environmental contexts, and sustainable development.
PO-10	**Self directed and Lifelong learning:** acquire knowledge and skills, including learning "how to learn", that are necessary for participating in learning activities throughout life and to engage in independent and life-long learning in the broadest context of socio-technological changes.

PROGRAMME SPECIFIC OUTCOMES FOR B.Sc., ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

PSO No.	Program Specific Outcomes (*Upon completion of the B.Sc., ARTIFICIAL INTELLIGENCE & MACHINE LEARNING Degree Programme,the Undergraduate will be able to*)
PSO-1	Understand, analyze and demonstrate the knowledge of human cognition, Artificial Intelligence and Machine Learning in terms of real world problems to meet the challenges of the future.
PSO-2	Understand, analyze and develop essential proficiency in the areas related to artificial Intelligence and Machine Learning in terms of underlying statistical and computational principles and apply the knowledge to solve practical problems.
PSO-3	Learn the basic concepts of Artificial Intelligence and Machine Learning and to apply them to various areas, like Image Processing, Speech Recognition, Product Recommendations, Medical Diagnosis etc.
PSO-4	Develop computational knowledge and project development skills using innovative tools and techniques to solve problems in the areas related to Deep Learning, Machine learning, Artificial Intelligence.
PSO-5	Develop automated solutions for current societal problems using AI & ML computing techniques.
PSO-6	Apply the concepts of Artificial Intelligence and Machine Learning, to analyze, design and develop intelligent systems for Computer Vision, Virtual Reality, Augmented Reality and Natural Language Processing
PSO-7	Solve the complex problems, using latest hardware and software tools, along with analytical skills to arrive at cost effective and appropriate solutions .

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B.Sc., ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
CHOICE BASED CREDIT SYSTEM – LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS –LOCF)
(For the candidates admitted in the academic year 2024 – 2025)

ELIGIBILITY: Those who have completed in 10th , +2 examinations with Mathematics as one the core subject

Sem.	Part	Course	Title	Ins. Hrs	Credit	Exam Hours	Marks Int.	Marks Ext.	Total
I	I	Language Course – I Tamil $ / Other Languages + #		6	3	3	25	75	100
	II	English Course – I		6	3	3	25	75	100
	III	Core Course – I (CC)	Programming in C and Data Structures	5	4	3	25	75	100
		Core Practical – I (CP)	Programming in C Lab	4	4	3	40	60	100
		First Allied Course – I (AC)		4	4	3	25	75	100
		First Allied Course – II (AC)		3	-	-	-	-	-
	IV	Value Education		2	2	3	25	75	100
		TOTAL		**30**	**20**	**-**	**-**	**-**	**600**
II	I	Language Course - II Tamil $ / Other Languages + #		6	3	3	25	75	100
	II	English Course- II		6	3	3	25	75	100
	III	Core Course – II (CC)	Programming in Python	5	4	3	25	75	100
		Core Practical – II (CP)	Programming in Python Lab	4	4	3	40	60	100
		First Allied Course – II (AC)		3	2	3	25	75	100
		First Allied Course – III (AC)		4	4	3	25	75	100
		Add on Course – I ##	Professional English – I	6*	4	3	25	75	100
	IV	Environmental Studies		2	2	3	25	75	100
	VI	Naan Mudhalvan Scheme (NMS) @@	Language Proficiency for Employability -Effective English	-	2	3	25	75	100
		TOTAL		**30**	**28**	**-**	**-**	**-**	**900**

III	I	Language Course – III Tamil $ / Other Languages + #		6	3	3	25	75	100
	II	English Course -III		6	3	3	25	75	100
	III	Core Course – III (CC)	RDBMS and NoSQL	5	4	3	25	75	100
		Core Practical – III (CP)	RDBMS and NoSQL Lab	4	4	3	40	60	100
		Second Allied Course – I (AC)		4	4	3	25	75	100
		Second Allied Practical (AP)		3	-	-	-	-	-
		Add on Course – II ##	Professional English - II	6*	4	3	25	75	100
	IV	Non-Major Elective I @ - Those who choose Tamil in Part I can choose a non-major elective course offered by other departments. Those who do not choose Tamil in Part I must choose either **a)** Basic Tamil if Tamil language was not studied in school level **or** b) Special Tamil if Tamil language was studied upto 10th & 12th std.		2	2	3	25	75	100
		TOTAL		**30**	**24**	**-**	**-**	**-**	**700**
IV	I	Language Course –IV Tamil $ / Other Languages + #		6	3	3	25	75	100
	II	English Course – IV		6	3	3	25	75	100
	III	Core Course -IV (CC)	Artificial Intelligence	5	4	3	25	75	100
		Core Practical - IV (CP)	Artificial Intelligence Lab	4	4	3	40	60	100
		Second Allied Practical (AP)		3	2	3	40	60	100
		Second Allied Course – II (AC)		4	4	3	25	75	100
	IV	Non-Major Elective II @ - Those who choose Tamil in Part I can choose a non-major elective course offered by other departments. Those who do not choose Tamil in Part I must choose either **a)** Basic Tamil if Tamil language was not studied in school level **or** b) Special Tamil if Tamil language was studied upto 10th & 12th std.		2	2	3	25	75	100
	VI	Naan Mudhalvan Scheme (NMS) @@	Digital Skills for Employability	-	2	3	25	75	100
		TOTAL		**30**	**24**	**-**	**-**	**-**	**800**

V	III	Core Course -V (CC)	Embedded Systems and IoT	5	5	3	25	75	100
		Core Course - VI(CC)	Open Source Software	5	5	3	25	75	100
		Core Course - VII(CC)	Robotics	5	5	3	25	75	100
		Core Practical -V (CP)	Robotics Lab	4	4	3	40	60	100
		Major Based Elective – I (Any one)	1. Virtual Reality and Augmented Reality 2. Fuzzy Logic and Neural Networks	5	5	3	25	75	100
	IV	Skill Based Elective I	Mobile Application Development	4	2	3	25	75	100
		Soft Skills Development		2	2	3	25	75	100
		TOTAL		**30**	**28**	**-**	**-**	**-**	**700**
VI	III	Core Course - VIII (CC)	Human Computer Interaction	6	6	3	25	75	100
		Core Course -IX (CC)	Machine Learning	6	6	3	25	75	100
		Core Practical - VI(CP)	Machine Learning Techniques Lab	4	4	3	40	60	100
		Major Based Elective - II (Any one)	1. Natural Language Processing 2. Deep Learning	5	5	3	25	75	100
		Project		4	3	-	20	80	100
	IV	Skill Based Elective – II	Cloud Computing	4	2	3	25	75	100
	V	Gender Studies		1	1	3	25	75	100
		Extension Activities **		-	1	-	-	-	-
	VI	Naan Mudhalvan Scheme (NMS) @@		-	-	-	-	-	-
		TOTAL		**30**	**28**	**-**	**-**	**-**	**700**
		GRAND TOTAL		**180**	**152**	**-**	**-**	**-**	**4400**

List of Allied Courses

First Allied Course	Second Allied Course
Mathematics	Applied Physics

$ For those who studied Tamil upto 10th +2 (Regular Stream).

+ Syllabus for other Languages should be on par with Tamil at degree level.

Those who studied Tamil upto 10th +2 but opt for other languages in degree level under Part- I should study special Tamil in Part – IV.

The Professional English – Four Streams Course is offered in the 2nd and 3rd Semester (only for 2022-2023 Batch) in all UG Courses. It will be taught apart from the Existing hours of teaching / additional hours of teaching (1 hour /day) as a 4 credit paper as an add on course on par with Major Paper and completion of the paper is must to continue his / her studies further. (As per G.O. No. 76, Higher Education (K2) Department dated: 18.07.2020).

* The Extra 6 hrs / cycle as per the G.O. 76/2020 will be utilized for the Add on Professional English Course.

@ NCC Course is one of the Choices in Non-Major Elective Course. Only the NCC cadets are eligible to choose this course. However, NCC Course is not a Compulsory Course for the NCC Cadets.

** Extension Activities shall be outside instruction hours. @@

Naan Mudhalvan Scheme.

SUMMARY OF CURRICULUM STRUCTURE OF UG PROGRAMMES

Sl. No.	Part	Types of the Courses	No. of Courses	No. of Credits	Marks
1.	I	Language Courses	4	12	400
2.	II	English Courses	4	12	400
3.		Core Courses	8	40	800
4.		Core Practical	7	29	700
5.		Allied Courses I & II	4	16	400
6.	III	Allied Practical	2	4	200
7.		Major Based Elective Courses	2	8	200
8.		Add on Courses	2	8	200
9.		Project	1	3	100
10.		Non-Major Elective Courses (Practical)	2	4	200
11.		Skill Based Elective Courses	2	4	200
12.	IV	Soft Skills Development	1	2	100
13.		Value Education	1	2	100
14.		Environmental Studies	1	2	100
15.	V	Gender Studies	1	1	100
16.		Extension Activities	1	1	--
17.	VI	Naan Mudhalvan Scheme	2	4	200
		Total	**45**	**2**	**4400**

First Year   **CORE COURSE I**   **Semester I**
PROGRAMMING IN C AND DATA
STRUCTURES

Code: **(Theory)**   **Credit: 4**

COURSE OBJECTIVES:

- To know about the basics of C Programming, Control and Looping Structures and programming with it.
- To understand Arrays, Pointers and String Processing in C language
- To know about the basic concepts in Data Structures.

UNIT - I:

Basic of C: History of C and its importance – Structure of a C program – Data Types – Constants and Variables – Operators and Expressions – Order of Precedence, Evaluating of Arithmetic Expressions – Type Conversion- Decision Statements: if, if-else, and nested if statements.

UNIT - II:

Loops Structures: For Loop, While, Do-while loop – Arrays: - One Dimensional Array, Two-dimensional Arrays, Character Arrays and Strings – Functions: Function with arrays- Function with decision and looping statements - Recursion.

UNIT - III:

Pointers: Introduction – Pointer Expressions – Chain of Pointers – Pointers and Arrays – Array of Pointers – Pointers as function arguments – Functions returning Pointers – Pointers to Functions – Function pointer – Structures - declaration, initialization, Array of Structures – Pointer to structures, Structures and functions – Typed of Enumerated data types, Unions.

UNIT - IV:

Strings Processing, Standard string library functions – Files: introduction and files functions – Writing and reading in Text mode – Simple application: Display the contents of a file. Write data to a file. Append data to an existing file – File IO – Reading and writing structures.

UNIT - V:

Stack: LIFO concept, Stack operations, Array implementation of stack – Queue: FIFO concept, Queue operations, Array implementation of queue – Singly Linked List: concepts, operations – Doubly Linked List: concepts, operations – Trees: General trees, Binary trees.

UNIT – VI   CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able to:

- Summarize the basic knowledge to develop C programs
- Manipulate Looping, arrays and functions
- Apply and write programs for solving real world problems
- Create open, read, manipulate, write and close files.
- Understand the basic concepts in data structures.

TEXT BOOKS:

1. E. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill, New Delhi, Seventh Edition, 2016.
2. E. Horowitz, S. Sahni and Susan Anderson Freed, "Fundamental Data Structures in C", 2ed, Orient Black Swan Publisher, 2009.
3. Byron S. Gottfried, "Programming with C", Schaum's Outline Series, Tata- McGraw Hill Edition, New Delhi, 1991.

REFERENCE BOOKS:

1.E. Karthikeyan, "A Textbook on C Fundamentals, Data Structures and Problem Solving", Prentice-Hall of India Private Limited, New Delhi, 2008.

2.Yashavant Kanetkar, "Let us C", BPB Publications, Tenth Edition, New Delhi, 2010.

3.Szuhay, Jeff, and Szuhay, Jeff, "Learn C Programming: A Beginner's Guide to Learning C Programming the Easy and Disciplined Way", Packt Publishing, 2020.

4.Jena, Sisir Kumar, and Jena, Sisir Kumar, "C Programming: Learn to Code", CRC Press, 2021.

E-RESOURCES:

1.https://www.tutorialspoint.com/cprogramming/index.htm
2.https://www.w3schools.in/data-structures/intro

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First Year   **CORE PRACTICAL I**   **Semester I**
                     PROGRAMMING IN C LAB

Code: **(Practical)**   **Credit: 4**

COURSE OBJECTIVES:

- To learn the programming knowledge using C language.
- To create derived and user defined data types.
- To demonstrate the functioning of pointers in C.

1. Write a Program
   a. To convert temperature from degree Centigrade to Fahrenheit.
   b. To find whether the given number is Even or Odd.
   c. To find the greatest of three numbers.
2. Write a Program to use the switch statement to display Monday to Sunday.
3. Write a Program to display first Ten Natural Numbers and their sum.
4. Write a Program to find Multiplication of Two Matrices.
5. Write a Program
   a. To find the maximum number in Array using pointer.
   b. To reverse a number using pointer.
   c. To add two numbers using pointer.
6. Write a Program to solve Quadratic Equation using functions.
7. Write a Program to find factorial of a number using Recursion.
8. Write a Program to show Call by Value and Call by Reference.
9. Write a Program to create a file containing Student Details.
10. Write a program to implement a stack using singly linked list, Implement Queue using Linked List.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- To relate the ways to solve simple programs
- To understand and trace the execution of programs using arrays
- To develop programs with functions and pointers
- To solve data handling problems using files
- To implement stack and queue operations.

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First Year   **CORE COURSE II**   **Semester II**
                              PROGRAMMING IN PYTHON

Code: **(Theory)**   **Credit: 4**

COURSE OBJECTIVES:

- To develop programs using functions and pass arguments in Python.
- To write programs using loops and decision statements in Python.
- To design and program Python applications.

UNIT - I:

Introduction to Python: Features of Python - How to Run Python - Identifiers - Reserved Keywords - Variables - Comments in Python - Indentation in Python - Multi-Line Statements - Multiple Statement Group (Suite) - Quotes in Python - Input, Output and Import Functions - Operators. Data Types and Operations: Numbers – Strings – List – Tuple – Set – Dictionary – Data type conversion.

UNIT - II:

Flow Control: Decision Making – Loops – Nested Loops – Types of Loops. Functions: Function Definition – Function Calling - Function Arguments - Recursive Functions - Function with more than one return value.

Unit - III:

Modules and Packages: Built-in Modules - Creating Modules - import Statement - Locating Modules - Namespaces and Scope - The dir() function - The reload() function - Packages in Python - Date and Time Modules. File Handling- Directories in Python.

UNIT - IV:

Object-Oriented Programming: Class Definition - Creating Objects - Built-in Attribute Methods - Built-in Class Attributes- Destructorsin Python – Encapsulation - Data Hiding – Inheritance - Method Overriding- Polymorphism.

UNIT - V:
Exception Handling: Built-in Exceptions-Handling Exceptions-Exception with Arguments - Raising Exception - User-definedException - Assertions in Python. Regular Expressions: The match() function - The search() function - Search and Replace - Regular Expression Modifiers: Option Flags-Regular Expression Patterns- Character Classes-Special Character Classes - Repetition Cases - findall() method - compile() method.

UNIT – VI   CURRENT CONTOURS (For continuous internal assessment only):

An Introduction to Interactive Programming in Python - Study on Julia – an high level language approach.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- To recall and understand the features of python programming language
- To illustrate various programming mechanism used in python
- To apply various language construct to write simple programs in python
- To examine the application of object oriented concept in python
- To distinguish the various constructs used in python.

TEXT BOOKS:

1. Jeeva Jose and P. Sojan Lal, "Introduction to Computing and Problem Solving with PYTHON", Khanna Book Publishing Co, 2016.
2. Mark Summerfield. ─ Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
3. Martin C. Brown, ─PYTHON: The Complete Reference‖, McGraw-Hill, 2001
4. Wesley J. Chun, "Core Python Programming", Prentice Hall Publication, 2006.

REFERENCE BOOKS:
1. Timothy A Budd, "Exploring Python", Tata McGraw Hill, New Delhi, 2011
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly Media, 2016.
3. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/O Reilly Publishers, 2016
4. Guido van Rossum and Fred L. Drake Jr, ─An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

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Code: **(Practical)**   **Credit: 4**

COURSE OBJECTIVES:

- To develop the Numbers, Math functions and Strings.
- To create different Decision Making statements and Functions.
- To design GUI Applications in Python.

1. Write a python program that displays the following information: Your name, Full address Mobile number, College name, Course subjects.
2. Write a python program to find the largest three integers using if-else and conditional operator.
3. Write a python program that asks the user to enter a series of positive numbers (The user should enter a negative number to signal the end of the series) and the program should display the numbers in order and their sum.
4. Write a python program to find the product of two matrices [A]mxp and [B]pxr
5. Write recursive functions for GCD of two integers.
6. Write recursive functions for the factorial of positive integer.
7. Write recursive functions for Fibonacci Sequence up to given number n.
8. Write recursive functions to display prime number from 2 to n
9. Write a python program that writes a series of random numbers to a file from 1 to n and display
10. Write a python program to sort a given sequence: String, List and Tuple.
11. Write a python program to make a simple calculator.
12. Write a python program for Linear Search and Binary Search

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- To recall and relate the features of python programming language
- To compare various programming mechanism used in python
- To construct simple programs in python using various language features
- To distinguish the various constructs used in python
- To apprise the application of object oriented concept in python

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Second Year   **CORE COURSE III**   **Semester III**
RDBMS AND NOSQL
Code: **(Theory)**   **Credit: 4**

COURSE OBJECTIVES:

- To know the basic concepts about database, its concepts, applications, data models, schemas and instances.
- To gain knowledge about database system architecture, the relational data model and about SQL.
- To Know about NoSQL and data models in NoSQL

UNIT - I:

Introduction to Databases : Databases and Database Users - Introduction - Example - Characteristics of the Database Approach - Actors on the Scene -Workers behind the Scene - Advantages of Using the DBMS Approach - A Brief History of Database Applications

UNIT - II:

Database System Concepts and Architecture : Data Models, Schemas, and Instances - Three-Schema Architecture and Data Independence - Database Languages and Interfaces - The Database System Environment - Centralized and Client/Server Architectures for DBMSs - Classification of Database Management Systems - The Relational Data Model and SQL : The Relational Data Model and Relational - Database Constraints - Relational Model Concepts - Relational Model Constraints and Relational Database Schemas - Update Operations, Transactions, and Dealing with Constraint Violations

UNIT - III:

Basic SQL : SQL Data Definition and Data Types - Specifying Constraints in SQL - Basic Retrieval Queries in SQL - INSERT, DELETE, and UPDATE Statements in SQL - Additional Features of SQL - More SQL: Complex Queries, Triggers, Views, and Schema Modification - More Complex SQL Retrieval Queries - Specifying Constraints as Assertions and Actions as Triggers - Views (Virtual Tables) in SQL - Schema Change Statements in SQL

UNIT - IV:

NoSQL : The Value of Relational Databases - Impedance Mismatch - Application and Integration Databases - Attack of the Clusters - The Emergence of NoSQL - Aggregate Data Models : Aggregates - Key-Value and Document Data Models - Column-Family Stores - Summarizing Aggregate-Oriented Databases.

UNIT - V:

Details on Data Models: Relationships - Graph Databases - Schemaless Databases - Materialized Views - Modeling for Data Access - Distribution Models:

Single Server - Sharding Master-Slave Replication - Peer-to-Peer Replication - Combining Sharding and Replication**.**

UNIT – VI   CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- To know about databases and about database users.
- To understand the concept of Database system structure and the concept of Relational model.
- To know about SQL.
- To know about the Emergence of NoSQL.
- To understand about data models in NoSQL.

TEXT BOOKS:

1. Fundamentals of Database System By Elmasari & Navathe- Pearson Education, 7th Edition, 2017
2. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Sadalage, P. & Fowler, Wiley Publications, 1st Edition ,2019.
3. Bipin Desai, An Introduction to Database System Galgotia Publications, 1981
REFERENCE BOOKS:
  1. S.K.   Singh   Database System: concept, Design & Application, Pearson Education, 2011
  2. leon & leon, Database management system, Vikas publishing House, 2009
  3.Toby J. Teorey, Sam S. Lightstone, Tom Nadeau,   Database Modeling and Design: Logical Design, Elsevier India Publications, 2005
  4. Gillenson, Fundamentals of Database Management System, Wiley, 2008

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COURSE OBJECTIVES:

• To practise the relational database functions using various operations
• To write queries in SQL to retrieve any type of information from a data base.
• To be able to understand unstructured table creation and processing using NoSQL.

Demonstrate the following SQL commands and can take any back end RDBMS system for implementation purpose.

1. Write a SQL query for creating Table, and SQL queries for inserting, deleting, updating the records in Table.
2. Write SQL Queries for AND/OR/NOT operation, Union- Intersection and Minus
3. Write SQL queries for various Join Operations.
4. Write SQL query for Sorting and Grouping the records.
5. Write Nested queries, Sub queries using SQL.
6. Write a SQL program using Built-in functions.
7. Create a view and access the view using query.
8. Creation of unstructured table contents using Nosql commands

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able:

• To work on database queries.
• To relate the entity relationship and join dependencies with software programs
• Write queries on aggregate functions, subqueires.
• Create structured and unstructured database using SQL and NoSQL
• Able to implement various functions of NoSQL.

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COURSE OBJECTIVES:

* To gain a basic idea of AI and AI related problem solving, inference, perception, knowledge representation, and learning.
* To know about the Heuristics search techniques and about knowledge representation in AI
* To know about Predicate Logic and about Reasoning in AI

UNIT - I:

Artificial Intelligence: AI Problems – Underlying Assumption – AI Technique – Level of the Model – Criteria of Success – Some General References. Problems, Problem Spaces, and Search: Defining the Problem as a State Space Search –Production Systems – Problem Characteristics – Production SystemCharacteristics – Issues in the Design of Search Programs.

UNIT – II:

Heuristic Search Techniques: Generate and Test – Hill Climbing – Best-FirstSearch – Problem Reduction – Constraint Satisfaction – Means-ends Analysis. Knowledge Representation Issues: Representations and Mappings – Approaches to Knowledge Representation – Issues in Knowledge Representation – The Frame Problem.

UNIT - III:

Using Predicate Logic: Representing Simple Facts in Logic – Representing Instance and ISA Relationships – Computable Functions and Predicates – Resolution – Natural Deduction - Representing Knowledge Using Rules:Procedural Versus Declarative Knowledge – Logic Programming – Forward Versus Backward Reasoning – Matching – Control Knowledge.

UNIT - IV:

Symbolic Reasoning Under Uncertainty: Introduction to Non-monotonic Reasoning – Logics for Non-monotonic Reasoning – Implementation Issues – Augmenting a Problem-solver – Implementation Depth First Search –Implementation Breadth First Search. Statistical Reasoning: Probability and Baye's Theorem – Certainty Factors and Rule- based Systems – Bayesian Networks – Dempster-Shafer Theory – Fuzzy Logic

UNIT - V:

Semantic Nets- Frames.- Conceptual Dependency – Scripts – CYC. - Syntactic- Semantic Spectrum of Representation – Logic and Slot-and-Filler Structures – Other Representational Techniques.

UNIT – VI   CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- To understand the basic idea of artificial intelligence and its application areas.
- To apply basic principles of AI in solutions that requires problem solving, inference, perception, knowledge representation, and learning.
- To demonstrate awareness and a fundamental understanding of various applications of AI techniques.
- To understand about Logic programming and about Reasoning related to AI.
- To know about the different representational techniques in AI.

TEXT BOOKS:

1. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2017
2. M. Tim Jones, - Artificial Intelligence: A Systems Approach (Computer Science), Jones and Bartlett Publishers Inc.; First Edition, 2008.

REFERENCE BOOKS:
1. Nils J. Nilsson, - The Quest for Artificial Intelligence, Cambridge University Press, 2009.
2. Gerhard Welss, - Multi Agents Systems, Second Edition, 2013
3. David L. Poole and Alan K. Mackworth, - Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
4. Dan W. Patterson, "Introduction to AI and ES", PearsonEducation,2007

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ARTIFICIAL INTELLIGENCE LAB
Code: **(Practical)**   **Credit: 4**

COURSE OBJECTIVES:

- To impart knowledge about the practical aspects in Artificial Intelligence related problems
- To program different AI methods using a programming language
- To know how the logical operations and reason based AI problems are used using programming

1. Write a program to implement the Hill Climbing problem
2. Write a program to implement the Towers of Hanoi problem
3. Write a program to implement the Missionaries and Cannibals problem
4. Write a program to implement the 8 queens problem
5. Write a program to implement the A* Algorithm
6. Write a program to Implement the Breadth first algorithm
7. Write a program to implement the Depth first algorithm
8. Write a program to implement the predicate logic

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- Solve various kinds of problems using AI techniques.
- Solve basic AI based problems using any programming language.
- Understand to implement the various kinds of AI based algorithms.
- Apply AI techniques to real-world problems to develop intelligent systems.
- To understand problems related to AI.

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Third Year   **CORE COURSE V**   **Semester V**
                          EMBEDDED SYSTEM AND IOT
Code: **(Theory)**   **Credit: 5**

COURSE OBJECTIVES:

- To expose the students about the fundamentals of Embedded System.
- To discuss on aspects required in embedded system design techniques.
- To understand the fundamentals of Internet of Things.

UNIT - I:

Embedded System vs General Computing System - Classification of Embedded System, Purpose of Embedded system, Quality Attributes of Embedded System - Typical Embedded System- Core of Embedded System, Memory, Sensors and Actuators, Communication Interface- Onboard communication interface, External communication interface.

UNIT - II:

Embedded Firmware Design Approaches- Embedded Firmware Development Languages - Embedded System Development Environment - IDE, Compiler, Linker - Types of File Generated on Cross Compilation-Simulator, Emulator and Debugging- Fundamental issues in Hardware Software Co-design- Integration and Testing of Embedded Hardware andFirmware.

UNIT - III:

Introduction-Characteristics - Physical design - protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoT vs. M2M. IoT systems management – IoT Design Methodology – Specifications Integration and Application Development.

UNIT - IV:

Physical device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web services. Intel Galileo Gen2 with Arduino- Interfaces - Arduino IDE – Programming - APIs and Hacks. Various Real time applications of IoT- Connecting IoT to cloud – Cloud Storage for IoT

UNIT - V:

IoE – Overview – Architecture-Smart objects and LLNs-Secure mobility. Home automation – Cities: Smart parking – Environment: Weather monitoring – Agriculture: Smart irrigation – Data analytics for IoT – Software & management tools for IoT cloud storage models & Communication APIs – Cloud for IoT – Amazon Web Services for IoT.

UNIT – VI   CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- To understand the embedded system design process and embedded firmware concepts.
- To understand the fundamental issues I hardware and software co-design.
- To learn physical and logical design, IoT levels, and IoT design methodologies.
- To understand tools for IoT cloud storage models & Communication APIs
- To understand the Communication APIs, Cloud for IoT, Amazon Web Services for IoT.

TEXT BOOKS:

1. Shibu K.V, "Introduction to Embedded System", Tata McGraw-Hill, 2014.
2. Unit -1: Chapters 1 & 2.1 to 2.4, Unit-2: Chapters 2.5, 7, 9, 12, 13.
3. Internet of things – A Hands on approach, Arshdeep Bahga, Vijay Madisetti
4. Unit-3: Chapters 1,2,3,4,5, Unit-4: Chapters 7,8,9,10, Unit-5: Chapters 9,10, 11,13
5. David E. Simon, "An Embedded Software Primer", Pearson Education Asia, Addison Wesley, 2001. Dr. M. Kalaiselvi Geetha, Professor in CSE, FEAT, Annamalai University Page 217

REFERENCE BOOKS:

1. Marilyn Wolf, Computers as Components, Principles of Embedded Computing System Design", Morgan Kaufmann Publishers, Third edition, 2012.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.
3. Manoel Carlos Ramon, "Intel Galileo and Intel Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.
4. Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014.

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Third Year   **CORE COURSE VI**   **Semester V**
OPEN SOURCE SOFTWARE
Code: **(Theory)**   **Credit: 5**

COURSE OBJECTIVES:

- To explain the need and importance of open source software
- To introduce the various open source software's like Linux, MySQL, PHP and Python
- To provide a built-in community that continuously modifies and improves the source code.

UNIT - I:

Introduction to open sources–Need of open sources–advantages of open sources – application of opensources. Open source operating systems: LINUX: Introduction – general overview –Kernel mode and user mode–process–advanced concepts – scheduling–personalities–cloning–signals–developmentwith Linux..

UNIT - II:

MySQL: Introduction –setting up account –starting,terminating and writing your own SQL programs -record selectionTechnology – working with strings – Date and Time – sorting Query results – generating summary – working with meta data–using sequences– MySQL and Web.

UNIT - III:

PHP: Introduction–programming in web environment–variables- constants–data types –operators –statements – functions – arrays – OOP – string manipulations and regular expression – file handling and data storage–PHP and SQL database–PHP and LDAP – PHP connectivity – sending and receiving E-mails –debugging and error handling– security–templates

UNIT - IV:

Syntax and style– python objects – numbers – sequences–strings–lists and tuples–dictionaries–conditional loops–files–input and output–errors and exceptions–functions–modules–classes and OOP – execution environment

UNIT - V:

Pearl back grounder – pearl overview–pearl parsing rules–variables and data–statements and control structures– subroutines-,packages and modules– working with files– data manipulation.

UNIT – VI   CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- To explain common open source licenses and the impact of choosing a license.
- To explain open source project structure and how to successfully setup a project.
- To be competent with distributed software engineering tools and processes such as test-driven development, issues tracking, unit testing, code review, distributed version control, and continuous integration.
- To work on an open source project and will be expected to make a significant contribution.
- To study common open source software licenses, open source project structure, distributed team software development, and current events in the open source world.

TEXT BOOKS:

1. Remy Card, Eric and Frank Mevel ,The Linux Kernel Book, ,Wiley Publications, 2003 Unit-1: Chapters 1,2,3,4, 5
2. Steve Suchring, John, MySQL Bible, Wiley, 2002. Unit-2: Chapters 1,6,7,9,11 & 12
3. Rasmus Lerdorf and Levin Tatroe, Programming PHP, O Reilly, 2002

Unit-3: Chapters 1,2,3,4,5,8, & 12

REFERENCE BOOKS:

1. Wesley J. Chun, Core Python Programming, Prentice Hall, 2001
2. Unit-4: Chapters 1,2,3,4, 5 & 7
3. Martin C. Brown, Perl: The Complete Reference,2ndEdn, TMH, 2009
4. Unit-5: Chapters 1,2,5,6,7 & 8
5. Vikram Vaswani, MySQL: The Complete Reference, 2ndEdn,TMH,2009

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Third Year	CORE COURSE VII	Semester V
	ROBOTICS	
Code:	(Theory)	Credit: 5

COURSE OBJECTIVES:

- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming.

UNIT - I:

Robot - Definition - Robot Anatomy - Coordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-DifferentApplications.

UNIT-II:

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT - III:

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques,Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

UNIT - IV:

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT - V:

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

UNIT – VI   CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able to:

- Understand the fundamentals of robots.
- Know the concepts of sensors and machine vision.
- Understand navigation controls for operating robotics.
- Understand the planning and navigation of obstacle avoidance.
- Understand the implementation of robot economics.

TEXT BOOKS:

1. Klafter R.D., Chmielewski T.A and Negin M., "Robotic Engineering - An Integrated Approach", Prentice Hall, 2003. (Unit 1 : Chapter 1 & 2, Unit II: Chapter 4, Unit III: Chapter 5, Unit IV: Chapter 3 & 8, Unit V: Chapter 9)
2. Groover M.P., "Industrial Robotics -Technology Programming and Applications", McGraw Hill, 2001.
3. Craig J.J., "Introduction to Robotics Mechanics and Control", Pearson Education, 2008.

REFERENCE BOOKS:

1.Deb S.R., "Robotics Technology and Flexible Automation" Tata McGraw Hill Book Co., 1994.

2.Fu.K.S.,Gonzalz R.C. and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill Book Co., 1987.

  3.Janakiraman P.A., "Robotics and Image Processing", Tata McGraw Hill, 1995.

4.Rajput R.K., "Robotics and Industrial Automation", S.Chand and Company, 2008.

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Third Year   **CORE PRACTICAL V**   **Semester V**

ROBOTICS LAB

Code: **(Practical)**   **Credit: 4**

COURSE OBJECTIVES:

- To Impart Practical Training related to Artificial Intelligence and Robotics and various movements of robots through hands on training.
- Open source platforms used to experiment the kinematics
- It helps to perform robotics tasks execution using computer vision.

List of Experiments:

1. Determination of maximum and minimum position of links.
2. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
3. Estimation of accuracy, repeatability and resolution.
4. Robot programming and simulation for pick and place
5. Robot programming and simulation for Colour identification
6. Robot programming and simulation for Shape identification
7. Robot programming and simulation for machining (cutting, welding)
8. Robot programming and simulation for writing practice
9. Robot programming and simulation for any industrial process (Packaging, Assembly)
10. Robot programming and simulation for multi process.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able to:

- Understand various graphical function for bot functioning.
- Gain more knowledge and hands on training on robot movement programming.
- Understand the implementation of open source platforms.
- Implement the robotics tasks execution.
- Implement kinematics based experiment and know any robotic simulation software to model the different types of robots and calculate work volume for different robots.

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Third Year   **MAJOR BASED ELECTIVE I**   **Semester V**

1. VIRTUAL REALITY AND AUGMENTED REALITY

Code: **(Theory)**   **Credit: 5**

COURSE OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues.
- To understand virtual reality, augmented reality and using them to build Biomedical engineering applications.
- To know the intricacies of these platform to develop PDA applications with better optimality

UNIT - I:

INTRODUCTION: The three I's of virtual reality-commercial VR technology and the five classic components of a VR system - Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces-Output Devices: Graphics displays-sound displays & haptic feedback.

UNIT - II:

VR DEVELOPMENT PROCESS: Geometric modeling - kinematics modeling-physical modeling - behavior modeling - model Management.

UNIT - III:

CONTENT CREATION CONSIDERATIONS FOR VR: Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -side effects of exposures to virtual realityenvironment

UNIT - IV:

VR ON THE WEB & VR ON THE MOBILE: JS-pros and cons-building blocks (WebVR, WebGL, Three.js, device orientation events)- frameworks (A-frame, React VR)-Google VR for Android-Scripts, mobile device configuration, building to android-cameras and interaction-teleporting-spatial audio-Assessing human parameters-device development and drivers-Design Haptics

UNIT - V:

APPLICATIONS: Medical applications-military applications-robotics applications-Advanced Real time Tracking- other applications- games, movies, simulations, therapy

UNIT – VI   CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned.

TEXT BOOKS:

1. C. Burdea & Philippe Coiffet, "Virtual Reality Technology", Second Edition, Gregory, John Wiley & Sons, Inc., 2008.
   Unit-1: Chapters 1,2,3, Unit-2: Chapter 5, Unit-3: Chapter 7, Unit-4: Chapter 7, Unit-5: Chapter 8
2. Jason Jerald. 2015. The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool, New York, NY, USA.
3. Augmented Reality: Principles and Practice (Usability) by Dieter Schmalstieg & Tobias Hollerer, Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016. ISBN: 9780321883575

REFERENCE BOOKS:

1. Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability),Steve Aukstakalnis, Addison-Wesley Professional; 1 edition, 2016.
2. The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything, Robert Scoble & Shel Israel, Patrick Brewster Press;1 edition, 2016.
3. Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile, Tony Parisi, O'Reilly Media; 1 edition, 2015.
4. Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages, Tony Parisi, O'Reilly Media; 1 edition, 2014.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able to:

- Understand the basics of VR and AR
- Analyse & Design a system or process to meet given specifications with realistic engineering constraints.
- Identify problem statements and function as a member of an engineering design team.
- Utilize technical resources
- Propose technical documents and give technical oral presentations related to design mini project results.

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Third Year   **MAJOR BASED ELECTIVE I**   **Semester V**
2. FUZZY LOGIC AND NEURAL NETWORKS

Code: **(Theory)**   **Credit: 5**

COURSE OBJECTIVES:

- To introduce the concepts of neural networks and fuzzy systems
- To explain the basic mathematical elements of the theory of fuzzy sets.
- Understand the context of neural networks and deep learning. Know how to use a neural network

UNIT - I:

Introduction: What is a Neural Networks:-Artificial Neural Networks- Biological Neural Networks- Where are neural nets being used? - Signal Processing-Control-Pattern Recognition- Medicine- Speech Production-Speech Recognition-Business-How Are Neural Networks Used- Typical Architectures -Setting the Weights-Supervised training – unsupervised training – Fixed-weight nets-Common Activation Functions.

UNIT - II:

Developing Neural Networks: The 1940s: The Beginning of Neural Nets-The 1950s and1960s: The First Golden Age of Neural Networks-The 1970s The Quiet years-The 1980s Enthusiasm. When Neural Nets Began?-The McCulloch-Pitts Neuron: Architecture-Algorithm-Applications.

UNIT - III:

Simple Neural Nets for Pattern classification-General Discussion: Architecture-Biases and Thresholds-Linear separability - Data Representation. Hebb Net:-Algorithm - Application. Perceptron – Architecture – Algorithm - Application Adaline: Architecture – Algorithm – Applications - Madaline.- Architecture - Algorithm-Applications-

UNIT-IV:

Fuzzy Set Theory: Fuzzy versus Crisp. Crisp Sets: Operations on Crisp Sets-Properties of Crisp sets- Partition and covering – Rule of Addition – Rule of Inclusion-Fuzzy Sets: Membership.

UNIT - V:

Basic Fuzzy Set Operations-Properties of Fuzzy sets. Crisp Fuzzy Relations: Fuzzy Cartesian product-Operations on Fuzzy Relations. Fuzzy logic-Fuzzy Proposition-Fuzzy Rule based System-Fuzzy logic-Defuzzification

UNIT – VI   CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able to:

- Understand the basic concept of fuzzy sets, fuzzy logic defuzzification
- Learn basics of Artificial Neural of theory and programming of Microprocessors
- Analyze various techniques in feedback and feed forward Neural networks.
- Understand the principle of competitive neural networks Adaptive resonance theory
- Learn the architecture and algorithm of Cognitron, Neo cognitron The concepts of fuzzy associative memory and fuzzy systems.

TEXT BOOKS:

1. Fausett, L. V. (1993). Fundamentals of neural networks: Architectures, algorithms and applications: United States edition. Pearson. Unit I : Chapter1 Unit II : Chapters 1.5, 1.6, 1.7, Chapter 2, Unit III : Chapter 2
2. Rajasekaran, S., & Pai, G. A. V. (2007). Neural networks, fuzzy logic, and genetic algorithms: Synthesis and applications. New Delhi: Prentice Hall.Unit IV Chapter 6, Unit V: Chapters 7

REFERENCE BOOKS:

1.Haykin, S. S. (1994). *Neural networks: A comprehensive foundation*. Macmillan.Valluru, S. K., & Rao, T. N. (2010).

2. *Introduction to neural networks, fuzzy logic & genetic algorithms*. Jaico Publishing House.

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Third Year   **SKILL BASED ELECTIVE I**   **Semester V**
                  MOBILE APPLICATION DEVELOPMENT
Code: **(Theory)**   **Credit: 2**

COURSE OBJECTIVES:

* Understand system requirements for mobile applications
* Generate suitable design using specific mobile development frameworks
* Implement the design using specific mobile development frameworks

UNIT-I:

INTRODUCTION: Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications

UNIT - II:

BASIC DESIGN: Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – user interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT - III:

ADVANCED DESIGN: Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications

UNIT - IV:

TECHNOLOGY I – ANDROID: Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction withserver side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

UNIT - V:

TECHNOLOGY II – IOS: Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi
- iPhone marketplace.

UNIT – VI   CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able to:

- Describe the requirements for mobile applications
- Explain the challenges in mobile application design and development
- Develop design for mobile applications for specific requirements
- Implement the design using Android SDK
- Implement the design using Objective C and iOS and deploy mobile applications in Android and iPhone marketplace for distribution

TEXT BOOKS:

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012
2. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", Dream Tech, 2012
3. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012

REFERENCE BOOKS:

1.David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS

2.Development: Exploring the iOS SDK", Apress, 2013.

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Third Year   **CORE COURSE VIII**   **Semester VI**

HUMAN COMPUTER INTERACTION

Code: **(Theory)**   **Credit: 6**

COURSE OBJECTIVES:

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities and be aware of mobile HCI.
- To learn the guidelines for user interface.

UNIT - I:

FOUNDATIONS OF HCI: The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies

UNIT - II:

DESIGN & SOFTWARE PROCESS: Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design

UNIT - III:

MODELS AND THEORIESHCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration models- Hypertext, Multimedia and WWW.

UNIT - IV:

MOBILE HCI: Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies

UNIT - V:

WEB INTERFACE DESIGN: Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies

UNIT – VI   CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- To design effective dialog for HCI
- To design effective HCI for individuals and persons with disabilities.
- To assess the importance of user feedback.
- To explain the HCI implications for designing multimedia / ecommerce /e-learning Web sites.
- To develop meaningful user interface.

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, ―Human Computer Interaction‖, 3rd Edition, Pearson Education, 2004 (UNIT I, II & III)
2. Brian Fling, ―Mobile Design and Development‖, First Edition, O'Reilly Media Inc., 2009 (UNIT – IV)
3. Bill Scott and Theresa Neil, ―Designing Web Interfaces‖, First Edition, O'Reilly, 2009. (UNIT-V)
4. Human-Computer Interaction: Fundamentals and Practice, Gerard Jounghyun Kim, CRC Press, 2015

REFERENCE BOOKS:

1. M.G. Helander, Handbook of Human-Computer Interaction, Elsevier Science, 2014.
2. Kim, Gerard Jounghyun. Human-Computer Interaction: Fundamentals and Practice, CRC Press, 2015.
3. Biele, Cezary. Human Movements in Human-Computer Interaction (HCI), Springer International Publishing,2021
4. Cognitive Behavior and Human Computer Interaction Based on Machine Learning Algorithms, Wiley, 2021.

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Third Year   **CORE COURSE IX**   **Semester VI**
                            MACHINE LEARNING
Code: **(Theory)**   **Credit: 6**

COURSE OBJECTIVES:

- To facilitate the basics of machine learning concepts.
- To learn building a machine learning model from the scratch
- To understand the evaluation of models.

UNIT - I:

Introduction: Introduction, easy for human hard for machines, a simple predicting machine, classifying is not very different from predicting, training a simple classifier, one classifier is not enough, Types of machine learning, Applications of Machine Learning, Perspectives and issues in machine learning.

UNIT - II:

Probabilistic and Stochastic Models: Bayesian Learning – Bayes theorem, Concept learning, Maximum likelihood, Bayes optimal classifier, Gibbs algorithm, Naive Bayes classifier, Expectation maximization and Gaussian Mixture Models, Hidden Markov models

UNIT - III:

Supervised learning: Introduction, Regression, Linear regression, Classification: Decision trees, k-Nereast Neighbours, Support Vector Machine, Logistic regression, Random Forest. Artificial Neural Network: Introduction, Perceptrons, multi-layer networks and back propagation.

UNIT - IV:

Unsupervised learning: Introduction, Supervised vs Unsupervised Cluster Analysis, K-means clustering, Hierarchical clustering. Dimension reduction: Principal Component Analysis, Linear Discriminant Analysis

UNIT - V:

Modelling and evaluation: Building the model, Training a model, evaluating a model, improving a model. Performance metrics - accuracy, precision, recall, sensitivity, specificity, AUC, RoC, Bias Variance decomposition.

Unit – VI   Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able to:

- Explain machine learning
- Apply machine learning concepts in various domains
- Implement supervised, unsupervised learning techniques
- Differentiate supervised and unsupervised learning techniques
- Create and evaluate models

TEXT BOOKS:

1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, —Machine Learning, Pearson Education.(Unit1: Chapter1:.4,1.5,1.7,1.9; Unit 2: Chapter 6; Unit 3: Chapter 7, 8, 10; Unit 4 Chapter 9 (9.1,9.4), Unit 5: Chapter 3;)
2. Ethem Alpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014. (Unit2: Chapter 7, Chapter 15)
3. Tariq Rashid, "Make your own neural network", Create Space Independent Publishing Platform, US 2016, ISBN:978-1-5308-2660-5 (Unit1, Part1)

REFERENCE BOOKS:

1.Shai Shalev-Shwartz, Shai Ben-David, — Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press.

2.T. Hastie, R. Tibshirani and J. Friedman, "Elements of Statistical Learning", Springer.

3.Charu C. Aggarwal, "DATA CLUSTERING Algorithms and Applications", CRC Press, 2014.

4.C. Bishop, "Pattern Recognition and Machine Learning", Springer.

5.Sebastian Raschka and Vahid Mirjalili, "Python Machine Learning", PacktPublishing, Third Edition, 2019

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Third Year   **CORE PRACTICAL VI**   **Semester VI**
                    MACHINE LEARNING TECHNIQUES LAB
Code: **(Practical)**   **Credit: 4**

COURSE OBJECTIVES:

- Make use of Data sets in implementing the machine learning algorithms
- To Impart Practical Training in Machine Learning.
- It focuses on providing hands on training to implement various kinds applications using the tools.

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a.CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and pply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data sets to redasa .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes / APIcan be used to write the program. Calculate the accuracy, precision, andrecall for your dataset.

Course Outcomes:

Upon successful completion of this course the students would be able:

- To understand the implementation procedures for the machine learning algorithms
- To design Java/Python programs for various Learning algorithms.
- To apply appropriate data sets to the Machine Learning algorithms.
- To identify and apply Machine Learning algorithms to solve real world problems.
- To understand to Implement character recognition using Multilayer Perceptron.

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1. NATURAL LANGUAGE PROCESSING

Code: **(Theory)**   **Credit: 5**

COURSE OBJECTIVES:

- To learn the fundamentals of natural language processing
- To understand the use of CFG and PCFG in NLP
- To understand the role of semantics of sentences and pragmatics and to apply the NLP techniques to IR applications

UNIT - I:

INTRODUCTION: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

UNIT - II:

WORD LEVEL ANALYSIS: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging,Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging
– Hidden Markov and Maximum Entropy models.

UNIT - III:

SYNTACTIC ANALYSIS: Context-Free Grammars, Grammar rules for English, Tree banks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

UNIT - IV:

SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, sectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT - V:

DISCOURSE ANALYSIS AND LEXICAL RESOURCES: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Co-reference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, Word Net, Prop Bank, Frame Net, Brown Corpus, British National Corpus (BNC).

Unit – VI   Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.
Course Outcomes:

Upon successful completion of this course the students would be able:

- To tag a given text with basic Language features
- To design an innovative application using NLP components
- To implement a rule based system to tackle morphology/syntax of a language
- To design a tag set to be used for statistical processing for real-time applications
- To compare and contrast the use of different statistical approaches for different types of NLP applications.

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.1. Breck Baldwin, ―Language Processing with Java and Ling Pipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, ―Natural Language Processing with Java‖, O_Reilly Media, 2015.

REFERENCE BOOKS:
    1. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language
    2. Processing, Second Edition, Chapman and Hall/CRC Press, 2010. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information
    3. Retrieval‖, Oxford University Press, 2008.
    4. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python‖, First Edition, O_Reilly Media, 2009.

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Third Year   **MAJOR BASED ELECTIVE II**   **Semester VI**
                                      2. DEEP LEARNING
Code: **(Theory)**   **Credit: 5**

COURSE OBJECTIVES:

- To provide the fundamental concepts in deep learning.
- It provides the massive datasets and affordable computing, enabling new applications in computer vision and natural language processing.
- Students can able to design, implement, and train these models to solve real-world problems.

UNIT - I:

The Neural Network – Limits of Traditional Computing – Machine Learning – Neuron–FF Neural Networks–Types of Neurons –Soft max output layers

UNIT - II:

Tensor flow–Variables–Operations–Placeholders–Sessions–Sharing Variables – Graphs–Visualization

UNIT - III:

Convolution Neural Network – Feature Selection–Max Pooling–Filters and FeatureMaps–Convolution Layer–Applications

UNIT - IV:

Recurrent Neural Network –Memory cells–sequence analysis–STM—Memory augmented Neural Networks–NTM—Application

Unit – VI   Current Contours (for Continuous Internal Assessment Only):

Reinforcement Learning –MDP–Q Learning– Applications

Unit-VI:

Contemporary Developments Related to the Course during the Semester Concerned
COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- Understand the convolution, recurrent and other neural network architectures for deep learning.
- Implement deep learning models in Python using the PyForch library and train them with real world datasets.
- Gain knowledge on various tools used for deep learning and its applications
- Understand the recurrent neural networks with attention mechanisms for natural language classification, generation, and translation.

- Understand how to evaluate the performance of different deep learning models.

TEXT BOOKS:

1. Nikhil Buduma, Nicholas Locascio, ―Fundamentals of Deep Learning: Designing Next Generation Machine Intelligence Algorithms‖ O'Reilly Media, 2017. Unit-1: Chapter 1, Unit-2: Chapter 3, Unit-3: Chapters 5, Unit-4: Chapters 7, 8Unit-5: Chapter 9.
2. Lan Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning (Adaptive computation and Machine Learnings eries ‖,MITPress,2017.

REFERENCE BOOKS:
1. Goodfellow, Ian, Deep Learning, MIT Press, 2016.
2. Gibson, Adam, and Patterson, Josh,Deep   Learning: A   Practitioner's
   i. Approach, O'Reilly Media, 2017.
3. Charniak, Eugene, Introduction to Deep Learning, MIT Press, 2019.
4. Locascio, Nicholas, and Buduma, Nikhil, Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms, O'Reilly Media, 2017.

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Third Year   **PROJECT**   **Semester-VI**

Code: **Credit: 3**

The candidate shall be required to take up a Project Work by group or individual and submit it at the end of the final year. The Head of the Departmentshall assign the Guide who, in turn, will suggest the Project Work to the studentsin the beginning of the final year. A copy of the Project Report will be submitted to the University through the Head of the Department on or before the date fixed bythe University.

The Project will be evaluated by an internal and an external examiner nominated by the University. The candidate concerned will have to defend his/her Project through a Viva-voce.

ASSESSMENT/EVALUATION/VIVA VOCE:

1. PROJECT REPORT EVALUATION (Both Internal & External)

    I. Plan of the Project   - 20 marks

    II. Execution of the Plan/collection of   - 45 marks
            Data / Organisation of Materials /
            Hypothesis, Testing etc. and
            presentation of the report.

    III. Individual initiative   - 15 marks

2.   Viva-Voce / Internal & External   - 20 marks

            TOTAL   **- 100 marks**

PASSING MINIMUM:

	Vivo-Voce 20 Marks	**Dissertation 80 Marks**
Project	40% out of 20 Marks (i.e. 8 Marks)	40% out of 80 marks (i.e. 32 marks)

A candidate who gets less than 40% in the Project must resubmit the Project Report. Such candidates need to defend the resubmitted Project at the Viva-voce within a month. A maximum of 2 chances will be given to the candidate.

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Third Year   **SKILL BASED ELECTIVE II**   **Semester VI**
                              CLOUD COMPUTING
Code: **(Theory)**   **Credit: 2**

COURSE OBJECTIVES:

- To learn the basics of cloud computing, to implement the key concept of virtualization.
- To inculcate the knowledge of different cloud computing services and security and to apply Map-Reduce concept of applications and amazon web services
- To understand how to migrate the applications in cloud

UNIT - I:

Introduction-History of Cloud Computing – Characteristics of Cloud – Cloud Computing Model – Issues and Challenges for Cloud Computing – Advantages and disadvantages of Cloud Computing – Security Privacy and Trust – Virtualization – Threats to Cloud Computing – Next Generation of Cloud computing - Cloud Computing Architecture: Cloud Architecture – Cloud Computing Models – Comparisons of Models – Deployment Models – Identity as a Service.

UNIT - II:

Virtualization – Implementation of virtualization – Virtualization Support at The OS Level – Middleware Support For Virtualization – Advantages of Virtualization – Virtualization Implementation Techniques – Hardware Virtualization - Types of Virtualization – Load Balancing in Cloud Computing – Logical Cloud Computing Model – Virtualization for Data-Centre .

UNIT - III:

Security Reference Architecture – Security Issues in Cloud Computing – Classification of Security issues - Types of Attacks – Security Risks in Cloud Computing – Security Threats against Cloud Computing - Emerging trends in Security and Privacy.

UNIT - IV:

Amazon Web Services – Microsoft Azure - Google App Engine – Data Security - Privacy – Service Oriented Architecture Components – Design Principle of SOA – SOA Requirements – Benefits of SOA – Web Services .

UNIT - V:

Motivations for Migration – Issues in Migrating the Applications to the Cloud – Types of Migration - Planning for Migrating the application to Cloud – Migration Road Map.

Unit – VI   Current Contours (for Continuous Internal Assessment Only):

Trends on cloud computing such edge computing, serverless computing, Kubemetes – study of cloud examples (Microsoft Azure, Icloud, salesforce, IBMcloud, VMware

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- To define cloud computing and memorize the different cloud service and deployment models.
- To apply and design suitable Virtualization concept, Cloud Resource Management and design scheduling algorithms.
- To use and examine different cloud computing services.
- To design different workflows according to requirements and apply Map-Reduce programming model.
- To analyze the components of open stack& Google cloud platform Understand mobile cloud computing and migrating strategies for cloud applications

TEXT BOOKS:

1. "Cloud Computing" – V.K. Pachghare PHI Delhi Learning Private Limited, 2016. ISBN: 978-81-203-5213-1 [Unit– I: Chapter 1,2; Unit– II: Chapter 3;Unit – III: Chapter 5; Unit – IV: Chapter 7,9; Unit – V: Chapter 10;]
2. Sharma, Rishabh," Cloud Computing Fundamentals, Industry Approach and Trends", New Delhi: John Wiley, 2017, ISBN: 978-81-265-5306-8
3. Chitra, D,"Grid and Cloud Computing ", D. Chitra and A. Kaliappan, Jodhpur: Scientific Publishers (India), 2016, ISBN: 978-93-85983-05-4

REFERENCE BOOKS:
1. Rittinghouse and Ransome, Cloud Computing: Implementation, Management, and Security, CRC Press, 2016.
2. Michael Miller "Cloud Computing Web based application that change the way you work and collaborate online". Pearsonedition, 2008.
3. Kris Jamsa, Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More, Jones & Bartlett Learning,2012.

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