

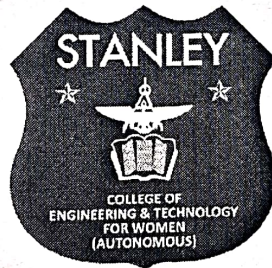
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**FACULTY OF ENGINEERING**  
**Scheme of Instructions & Examinations**

**For**  
**Four Year Degree Programme of**  
**Bachelor of Engineering (B.E)**

**In**  
**Artificial Intelligence & Data Science**  
(With effect from the academic year 2023–24)



Estd. 2008

**STANLEY COLLEGE OF ENGINEERING  
AND TECHNOLOGY FOR WOMEN  
(AUTONOMOUS)**

**(Affiliated to Osmania University)**  
**(Accredited by NAAC with "A" Grade)**  
**ABIDS, HYDERABAD-500001, Telangana.**

*S. Vaidelin*  
*BOS - Chairperson*  
*Dept. of A&DS*  
*SCETW(A)*



Abbreviation	Meaning
HS	Humanities, Social Sciences and Management
BS	Basic Sciences including Mathematics, Physics and Chemistry
ES	Engineering Sciences including Workshop, Drawing, Basic Electrical / Electronics
PC	Professional Core Subjects
PE	Professional Elective Subjects
OE	Open Elective Subjects
PW	Project Work, Seminars, Internship
MC	Mandatory Courses
PY	Philosophy
EC	Electronics and Communication Engineering.
CE	Civil Engineering,
MP	Mechanical / Production Engineering
IT	Information Technology
CS	Computer Science Engineering
EE	Electrical and Electronics Engineering
CM	Computer Engineering
AD	Artificial Intelligence and Data Science
L	Lecture
T	Tutorial
P	Practical
G	Grade
D	Drawing
CIE	Continuous Internal Evaluation
SEE	Semester End Evaluation
	Each contact hour is a clock hour
	The duration of the Practical class is two hours; however, it can be extended wherever necessary, to enable the student to complete the experiment.

**Stanley College of Engineering and Technology for Women (Autonomous)**  
**Department of Artificial Intelligence & Data Science**  
**Proposed revised scheme for the academic batch 2023-2027**

SMC901AD Induction Program (Mandatory)	3 weeks' duration
Induction program for students to be offered right at the start of the first year	<ul style="list-style-type: none"> <li>• Physical Activity</li> <li>• Creative Arts</li> <li>• Universal Human Values</li> <li>• Literary</li> <li>• Proficiency Modules</li> <li>• Lectures by Eminent People</li> <li>• Visits to local Areas</li> <li>• Familiarization to Dept./Branch &amp; Innovations</li> </ul>

## AI&amp;DS SEMESTER-I

S.No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs./W	CIE	SEE	SEE Duration in Hrs.	
	SMC901AD	Induction Program	-	-	-	-	-	-	-	0
<b>Theory Courses</b>										
1	SBS101MT	Mathematics-I	3	1	-	4	40	60	3	4
2	SBS904CH	Applied Chemistry	3	1	-	4	40	60	3	4
3	SES101AD	Programming for Problem Solving	3	-	-	3	40	60	3	3
4	SHS901EG	English	2	-	-	2	40	60	3	2
5	SHS902EG	Universal Human Values	2	-	-	2	40	60	3	2
<b>Practical and Laboratory Courses</b>										
6	SBS914CH	Chemistry Lab	-	-	2	2	40	60	3	1
7	SES111AD	Programming for Problem Solving Lab	-	-	4	4	40	60	3	2
8	SES915ME	Engineering Graphics Lab	-	-	4	4	40	60	3	2
9	SHS916AD	Design Thinking	-	-	2	2	40	60	3	1
<b>Total</b>			<b>13</b>	<b>02</b>	<b>12</b>	<b>27</b>	<b>360</b>	<b>540</b>	<b>-</b>	<b>21</b>

Stanley College of Engineering and Technology for Women (Autonomous)  
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[Prof. K. Shyamala]

[Prof. L. K. Sureshkumar]

[Dr. K. VADDEPATI]

## AI&amp;DS: SEMESTER-II

S.No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs./W	CIE	SEE	SEE Duration in Hrs.	
<b>Theory Courses</b>										
1	SBS202MT	Mathematics-II	3	1	-	4	40	60	3	4
2	SBS902PH	Applied Physics	3	1	-	4	40	60	3	4
3	SES201AD	Data Structures	3	-	-	3	40	60	3	3
4	SESX03EE	Fundamentals of Electrical & Electronics Engineering	3	1	-	4	40	60	3	4
<b>Practical and Laboratory Courses</b>										
5	SBS912PH	Applied Physics Lab	-	-	2	2	40	60	3	1
6	SHS911EG	English Lab	-	-	2	2	40	60	3	1
7	SES211AD	Data Structures Lab	-	-	4	4	40	60	3	2
8	SESX13EE	Fundamentals of Electrical & Electronics Engineering Lab	-	-	2	2	40	60	3	1
9	SES914ME	Engineering Workshop	-	-	4	4	40	60	3	2
10	SPW211AD	Idea Lab	-	-	2	2	40	60	3	1
<b>Total</b>			<b>12</b>	<b>03</b>	<b>16</b>	<b>31</b>	<b>400</b>	<b>600</b>	<b>-</b>	<b>23</b>

Note: Idea Lab to be evaluated in the subsequent semester.

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*[Signature]*  
Prof. K. Shyamada

*[Signature]*  
Prof. L.K. Suresh Kumar

*[Signature]*

## AI&amp;DS: SEMESTER - III

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hours	CIE	SEE	Duration in Hrs	
<b>Theory Courses</b>										
1	SBSX01MT	Mathematics-III	3	1	-	4	40	60	3	4
2	SESX01EC	Digital Electronics	3	-	-	3	40	60	3	3
3	SPC301AD	Discrete Mathematics	3	-	-	3	40	60	3	3
4	SPC302AD	OOPs Using Java	3	1	-	4	40	60	3	4
5	SPC303AD	Concepts in Computer Organization & Microprocessor	3	-	-	3	40	60	3	3
6	SMC901HS	Indian Constitution	2	-	-	2	-	-	-	0
<b>Practical/ Laboratory Courses</b>										
7	SHS912EG	Advanced Communication Skills Lab	-	-	2	2	40	60	3	1
8	SPC312AD	OOPs using Java Lab	-	-	2	2	40	60	3	1
9	SPC313AD	Concepts in Computer Organization & Microprocessor Lab	-	-	2	2	40	60	3	1
10	SPC314AD	Python Programming Lab	-	-	2	2	40	60	3	1
<b>Total</b>			<b>17</b>	<b>02</b>	<b>08</b>	<b>27</b>	<b>360</b>	<b>540</b>		<b>21</b>

*[Prof. K. Shyamala]*

*[Prof. L. K. Sureshkumar]*

*[Prof. Vaidhi]*

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## AI&amp;DS: SEMESTER – IV

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	SEE Duration in Hrs	
<b>Theory Courses</b>										
1	SHS901BM	Managerial Economics & Financial Accountancy	2		-	3	40	60	3	2
2	SPC401AD	Database Management System	3	1	-	4	40	60	3	4
3	SPC402AD	Design & Analysis of Algorithms	3	-	-	3	40	60	3	3
4	SPC403AD	Operating System	3	-	-	3	40	60	3	3
5	SPC404AD	Foundations of Data Science	3	1	-	4	40	60	3	4
6	SAC903CH	Environmental Science	2	-	-	2	50	-	-	0
<b>Practical/ Laboratory Courses</b>										
7	SPC411AD	Database Management System Lab	-	-	2	2	40	60	3	1
8	SPC413AD	Operating System Lab	-	-	2	2	40	60	3	1
9	SPC414AD	Foundations of Data Science Lab	-	-	2	2	40	60	3	1
10	SPC415AD	Lab on Software Tools & Techniques	-	-	2	2	40	60	3	1
Internship-I (SPW411AD)			Students must undergo internship for 4 weeks during summer vacation which will be assessed in the forthcoming V semester.							
<b>Total</b>			<b>16</b>	<b>02</b>	<b>08</b>	<b>26</b>	<b>410</b>	<b>540</b>		<b>20</b>

*SP*  
[Prof. K. Shyanda]


*KB*  
[Prof. L. K. Sureshkumar]


*Si. Varadhi*

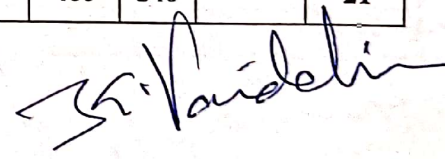
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## AI&amp;DS: SEMESTER – V

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	SEE Duration in Hrs	
<b>Theory Courses</b>										
1	SPC501AD	Artificial Intelligence & Robotics	3	-	-	3	40	60	3	3
2	SPC502AD	Automata Theory & Compiler Design	3	-	-	3	40	60	3	3
3	SPC503AD	Computer Networks	3	-	-	3	40	60	3	3
4	PE-I	Professional Elective-I	3	-	-	3	40	60	3	3
5	OE-I	Open Elective-I	3	-	-	3	40	60	3	3
<b>Practical/ Laboratory Courses</b>										
6	SPC511AD	Artificial Intelligence & Robotics Lab	-	-	2	2	40	60	3	1
7	SPC512AD	Automata Theory & Compiler Design Lab	-	-	2	2	40	60	3	1
8	SPC513AD	Computer Networks Lab	-	-	2	2	40	60	3	1
9	SPC514AD	Web Technology Applications Lab	-	-	2	2	40	60	3	1
10	SPW511AD	Technical Seminar –I	-	-	2	2	50	-	-	1
11	SPW411AD	Internship-I	-				50			1
<b>Total</b>			<b>15</b>	<b>00</b>	<b>10</b>	<b>25</b>	<b>460</b>	<b>540</b>		<b>21</b>

  
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 [Prof. K. Suresh Kumar]

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## AI&amp;DS: SEMESTER – VI

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	SEE Duration in Hrs	
<b>Theory Courses</b>										
1	SHS902BM	Entrepreneurship and Start-ups	3	-	-	3	40	60	3	3
2	SPC601AD	Big Data Analytics	3	-	-	3	40	60	3	3
3	SPC602AD	Machine Learning	3	-	-	4	40	60	3	3
4	SPC603AD	Cloud Computing	3	-	-	3	40	60	3	3
5	PE-II	Professional Elective-II	3	-	-	3	40	60	3	3
6	PE-III	Professional Elective-III	3	-	-	3	40	60	3	3
<b>Practical/Laboratory Courses</b>										
7	SPC611AD	Big Data Analytics Lab	-	-	2	2	40	60	3	1
8	SPC612AD	Machine Learning Lab	-	-	2	2	40	60	3	1
9	SPC613AD	Cloud Computing Lab	-	-	2	2	40	60	3	1
10	SPW611AD	Mini Project	-	-	2	2	50	-	-	1
Internship-II(SPW612AD)			Students must undergo internship for 4 weeks during summer vacation which will be assessed in the forthcoming VII semester.							
<b>Total</b>			<b>18</b>	<b>00</b>	<b>08</b>	<b>27</b>	<b>410</b>	<b>540</b>		<b>22</b>

*[Prof. K. Shyamala]*

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Department of Artificial Intelligence & Data Science  
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## AI&amp;DS: SEMESTER – VII

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/ D	Contact Hrs/Wk	CIE	SEE	SEE Duration in Hrs	
<b>Theory Courses</b>										
1	SPC701AD	Deep Learning	3	-	-	3	40	60	3	3
2	PE-IV	Professional Elective-IV	3	-	-	3	40	60	3	3
3	PE-V	Professional Elective-V	3	-	-	3	40	60	3	3
4	PE-VI	Professional Elective-VI	3	-	-	3	40	60	3	3
5	OE-II	Open Elective-II	3	-	-	3	40	60	3	3
<b>Practical/Laboratory Courses</b>										
6	SPC711AD	Deep Learning Lab	-	-	2	2	40	60	3	1
7	SPE	PE LAB	-	-	2	2	40	60	3	1
8	SPW711AD	Project Work-I	-	-	6	6	50	-	3	3
9	SPW612AD	Internship-II	-				50	-	-	1
<b>Total</b>			<b>15</b>	<b>00</b>	<b>10</b>	<b>25</b>	<b>380</b>	<b>440</b>	<b>24</b>	<b>21</b>

*[Prof. K. Shyamala]*

*[Prof. L. K. Sureshkumar]*

*[Prof. S. Vaidyanathan]*

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## AI&amp;DS: SEMESTER - VIII

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	SEE Duration in Hrs	
<b>Theory Courses</b>										
1	OE-III	Open Elective-III	3	-	-	3	40	60	3	3
<b>Practical/Laboratory Courses</b>										
2	SPW811AD	Project Work-II	-	-	16	16	40	120	-	8
<b>Total</b>			<b>03</b>	<b>-</b>	<b>16</b>	<b>19</b>	<b>80</b>	<b>180</b>	<b>03</b>	<b>11</b>

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[Prof. K. Shyamala]

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Department of Artificial Intelligence & Data Science  
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### List of Professional Electives:

The curriculum has specified several slots wherein the students can take electives to broaden their grasp on the subjects related to Artificial Intelligence as well as to Data Science. Some suggest elective are listed here.

Domain/Specialization	PE-I	PE-II	PE-III	PE-IV	PE-V
AI	Expert systems	Applications of AI	Augmented reality & virtual reality	Cognitive Science & Analytics	Robotics & Intelligent systems
ML & DL	Image Processing & Computer Vision	Natural language processing	Speech Processing	Soft Computing	Deep learning
Data Science	Exploratory Data Analysis	Forecasting Techniques & Data visualization	Architecture for Management of Large Datasets	Information Retrieval Systems	Web & Social media Analytics
Databases	Advanced database	NOSQL Database	Programming with SPARK		Database Security
Cloud computing	Distributed Systems	GPU Computing	Security and privacy in cloud computing	Ethics in Cyber security	Cloud application development
Cyber security, Blockchain & IOT	Cyber security	Embedded Systems	Block chain technology	Digital forensics	Open source programming for IOT

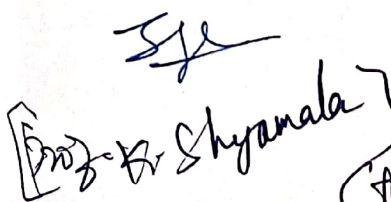
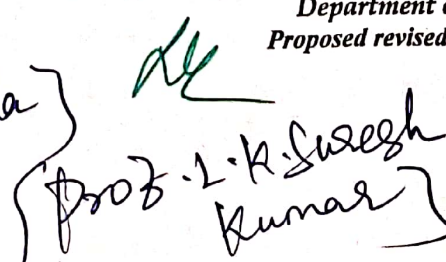
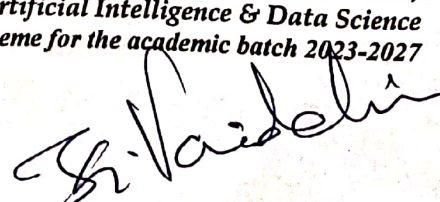
### Open Electives:

Note: Students may opt the courses as "OPEN ELECTIVE" as provided by the respective Universities/ College Level.

### Open Electives offered by AI&DS department to other Departments:



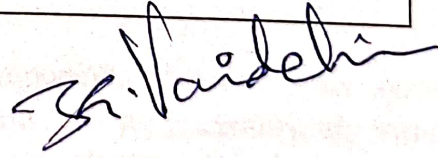
Course Code	Course Title
OEXXXAD	Artificial Intelligence
OEXXXAD	Foundations of Data Science

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### COMPARISON BETWEEN GATE AND AI&DS SYLLABUS

GATE Subject	AI&DS Subject Names and Semester
Discrete Mathematics	Discrete Mathematics (Sem-III)
Digital Logic	Digital Electronics (Sem-III)
Computer Organization and Architecture	Concepts in Computer Organization & Microprocessor (Sem-III)
Programming and Data Structures	Data Structures (Sem-II)
Algorithms	Design & Analysis of Algorithms (Sem-IV)
Theory of Computation and Compiler Design	Automata Theory and Compiler Design (Sem-V)
Operating Systems	Operating System (Sem-IV)
Databases	Database Management System (Sem-IV)
Computer Network	Computer Networks (Sem-V)



  
 [Prof. K. Shymala]      [Prof. L. K. Suresh Kumar]

Stanley College of Engineering and Technology for Women (Autonomous)  
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Course Code	Course Title				Core / Elective		
SES101AD	PROGRAMMING FOR PROBLEM SOLVING				Core		
	Contact Hours per Week				CIE	SEE	Credits
Pre Requisite	L	T	D	P			
-	3	-	-		40	60	3

#### Course Objectives:

1. Understand programming skills using the fundamentals and basics of C Language.
2. Improve problem solving skills using arrays, strings, and functions.
3. Understand the dynamics of memory by pointers and study files creation process with access permissions.

#### Course Outcomes: At the end of the course, Students should be able to:

1. Describe the concept of computer system, analyze a given problem, develop an algorithm, fundamental programming constructs, identify data representation formats And describe operators and their precedence, associativity.
2. Understand branching and loop statements
3. Describe the concept of homogeneous derives data types, strings and functions.
4. Understand pointers, heterogeneous data types.
5. Describe the concept of file system.

#### UNIT - I INTRODUCTION

**Introduction to Programming :** Computer system, components of a computer system, computing environments, computer languages, creating and running programs, algorithms, flowcharts; **Introduction to C language:** Computer languages, History of C, basic structure of C programs, process of compiling and running a C program, C tokens, keywords, identifiers, constants, strings, special symbols, variables, data types; **Operators and expressions.** **Conditional Control structures:** Decision statements; Simple if, if-else, else if ladder, Nested if and Case Statement-switch statement;

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*Dr. Vaidhi*

[Prof. K. Shyamala]

[Prof. L.K. Suresh Kumar]

## UNIT - II ITERATIVE CONTROL STRUCTURES AND ARRAYS

**Iterative Control structures:** Loop control statements: while, for and do while loops. Jump statements, break, and continue, goto statements.

**Arrays :** Concepts, one dimensional arrays, declaration and initialization of one dimensional arrays, two dimensional arrays, initialization and accessing, multi-dimensional arrays; Strings(character arrays): Arrays of characters, variable length character strings, inputting character strings, character library functions, string handling functions.

## UNIT - III FUNCTIONS, STRUCTURES AND UNIONS

**Functions:** Need for user defined functions, function declaration, function prototype, category of functions, inter function communication, function calls, parameter passing mechanisms, recursion, passing arrays to functions, passing strings to functions, storage classes, preprocessor directive.

**Structures:** Structure definition, initialization, accessing structures, nested structures, arrays of structures, structures and functions, unions, bit fields, typedef, enumerations.

## UNIT - IV POINTERS AND DYNAMIC MEMORY ALLOCATION

**Pointers:** Pointer basics, pointer arithmetic, pointers to pointers, generic pointers, array of pointers, pointers and arrays, pointers as functions arguments, functions returning pointers, passing structures through pointers, self-referential structures.

**Dynamic memory allocation:** Basic concepts, library functions.

**UNIT - V FILE HANDLING, SEARCHING AND SORTING** **Files:** Streams, basic file operations, file types, file opening modes, input and output operations with files, special functions for working with files, file positioning functions, command line arguments.

**Searching and Sorting:** linear search, binary search, bubble sort.

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*S. Vaidelin*

*Prof. K. Shyamala*

*Prof. K. K. Suresh  
Kumar*

**Text Books:**

1. Somasekhara, "Problem Solving with C", PHI.
2. Byron Gottfried, "Programming with C", Schaum's Outlines Series, Mc Graw Hill Education, 3<sup>rd</sup> Edition, 2017.
3. E. Balagurusamy, "Programming in ANSI C", McGraw Hill Education, 6<sup>th</sup> Edition, 2012.

**Reference Books :**

1. W. Kernighan Brian, Dennis M. Ritchie, "The C Programming Language", PHI Learning, 2<sup>nd</sup> Edition, 1988.
2. Yashavant Kanetkar, "Exploring C", BPB Publishers, 2<sup>nd</sup> Edition, 2003. 3. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4<sup>th</sup> Edition, 2014.
3. R. S. Bichkar, "Programming with C", Universities Press, 2<sup>nd</sup> Edition, 2012.
4. Dey Pradeep, Manas Ghosh, "Computer Fundamentals and Programming in C", Oxford University Press, 2<sup>nd</sup> Edition, 2006.
5. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4<sup>th</sup> Edition, 2014.

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 [Prof. B. Shyamala]

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 [Prof. L. K. Suresh Kumar]

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 [Prof. Vaidhyanathan]

Course Code	Course Title				Core / Elective		
SES111AD	PROGRAMMING FOR PROBLEM SOLVING LABORATORY				Core		
	Contact Hours per Week			CIE	SEE	Credits	
Pre Requisite	L	T	D	P			
-	-	-	-	4	40	60	2


#### Course Objectives :

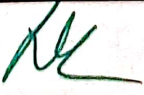
The course should enable the students to :

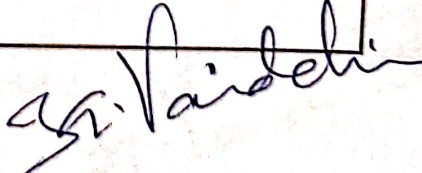
1. Formulate problems and implement algorithms using C programming language.
2. Develop programs using decision structures, loops and functions.
3. Learn memory allocation techniques using pointers and use structured programming approaches for solving computing problems in the real world.

#### Course Outcomes :

1. Understand the concept of basics of C, data types and variables.
2. Understand the concept of operators, precedence of operators, conditional statements and looping statements.
3. Explore the concept of strings, functions, recursive functions and differences between call by value and call by reference.
4. Explore the concept of storage classes, preprocessor directives, pointers and files.
5. Understand the concept of file handling functions, searching and sorting methods and real time applications of C.

  
 [Prof. A. Shyamala]

  
 [Prof. L. K. Suresh Kumar]

  
 Sr. Vaidhi



## LIST OF EXPERIMENTS

### Concept: Basic I/O, Operators

1. Write a C program to check and print a given number is even or odd using ternary operator.
2. Write a C program to calculate area and circumference of a circle.
3. Write a C program to solve given expression

### Concept: Basic I/O, conditional execution, loops, Jump Statement

4. Write a C program to accept student roll, marks, calculate total, average and print grade of student.
5. Write a C program to print Fibonacci series
6. Write a C program to check and print Armstrong Number
7. Write a C program to check and print Prime No.
8. Write a C program to add sum of only positive integers using continue statement.

### Concept: Basic I/O, Conditional execution, loops, Arrays (integer 1D,2D)

9. Write a C program to print sum of integers of a 1D array.
10. Write a C program to perform matrix addition for a 2D array.
11. Write a C program to perform matrix multiplication of a 2D array.

### Concept: Sub Programs: User Defined Functions, Recursion

12. Write a C program to perform different prototypes of user defined function.
13. Write a C program to perform factorial of given number using functions.
14. Write a C program to perform factorial of given number using recursive functions.

### Concept: Strings

15. Write a C program to determine if the given string is a palindrome or not
16. Write a C program to apply inbuilt string functions

### Concept: Structures and Unions:

17. Write a C program to apply Nested structures and array of structures.
18. Write a program to demonstrate structure and union.

### Concept: Pointers

19. Write a C program to access 1D Array and 2D array using Pointers
20. Write a C program to concatenate two strings using pointers.
21. Write a C program to find the length of string using pointers.

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*Prof. Vaidhyanathan*

**Concept: Files, Searching, Sorting**


22. Write a C program to display the contents of a file.
23. Write a C program to copy the contents of one file to another.
24. Write a C program apply binary search.
25. Write a C program apply bubble sorting.


**Text Books:**

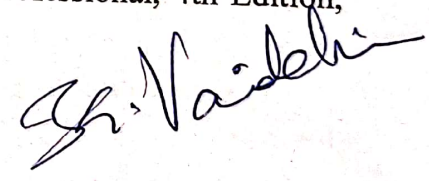
1. Somasekhara, "Problem Solving with C", PHI.
2. Byron Gottfried, "Programming with C", Schaum's Outlines Series, McGraw Hill Education, 3rd Edition, 2017.
3. E. Balagurusamy, "Programming in ANSI C", McGraw Hill Education, 6th Edition, 2012.

**Reference Books :**

1. B. A. Forouzan, R. F. Gillberg, "C Programming and Data Structures", Cengage Learning, India, 3rd Edition, 2014.
2. W. Kernighan Brian, Dennis M. Ritchie, "The C Programming Language", PHI Learning, 2nd Edition, 1988.
3. Yashavant Kanetkar, "Exploring C", BPB Publishers, 2nd Edition, 2003.
4. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014.
5. R. S. Bichkar, "Programming with C", Universities Press, 2nd Edition, 2012.
6. Dey Pradeep, Manas Ghosh, "Computer Fundamentals and Programming in C", Oxford University Press, 2nd Edition, 2006.
7. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.

  
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 [Prof. K. K. Sureshkumar]

  
 Dr. Vaidehi

Course Code	Course Title					Core/Elective	
SHS916AD SHS0911AD	Design Thinking (Common to CSE,CME,IT and ADE)					Mandatory	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	-	-	-	50	-	0

**Course Objectives:**

The main objectives of this course is to inculcate interdisciplinary engineering skills in students for taking real time engineering problems available in our society/industry and to come-up with the grass root innovation, which can be helpful to all levels of human beings.

**Course Outcomes: At the end of this course, the student will be able to**

1. Understand the importance of Design Thinking.
2. Evaluate the quality of your information and your emotions, Keep thinking straight.
3. Identify skills and personality traits of successful problem solving.
4. Apply standard problem-solving heuristics to aid in problem solving.
5. Apply problem-solving techniques to programming activities.
6. Formulate and successful communicate the solutions to problems.

**Module 1: Design Thinking Skills**

Understand the critical design thinking skills needed to either improve an existing product or design a new product.

**Module 2: Identifying Customer Needs**

Learn to identify customer needs and draft customer needs statements as your first step towards user innovations.

**Module 3 : Product Specifications**

Learn how to translate user needs into product specifications quantitatively, and how establishing product metrics can help to define those specifications.

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Kumar

Dr. Vaidehi

**Module 4 : Applied Creativity**

Learn to apply creativity, brainstorming, and concept generation process in designing needs solutions.

**Module 5 : Prototyping**

Explore prototyping methods, strategies, and real-life examples where these have been applied to create a design that represents customer needs and product specifications.

**Module 6 : Design for Services**

Understand design of services, identify the potential for innovations within them, and learn how to apply product development frameworks to the service context

**Module 7 : Product Architecture**

Learn to use the modular and integral product architectures in determining the building blocks of a product.

**Module 8 : Financial Analysis**

Learn to perform financial analysis of your project idea and decide if it is backed by a strong business rationale (Worth-It).

**Module 9 : Design for Environment**



Learn how to apply design for environment principles to a product life cycle.

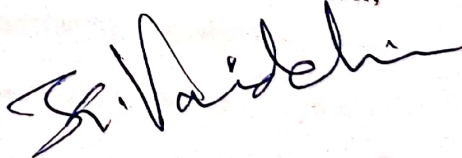
**Module 10 : Product Development Processes**

Learn to select and implement a product development process (staged, spiral, and agile) that's aligned to your project needs.

**References :**

1. H. S. Fogler and S. E. LeBlanc, Strategies for Creative Problem Solving, 2nd edition, Pearson, Upper Saddle River, NJ, 2008.
2. Whimbey and J. Lochhead, Problem Solving & Comprehension, 6th edition, Lawrence Erlbaum, Mahwah, NJ, 1999.
3. M. Levine, Effective Problem Solving, 2nd edition, Prentice Hall, Upper Saddle River, NJ, 1994.

  
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 [Prof. K.K. Suresh  
 Kumar]

  
 S. Vaidich

Course Code	Course Title				Core/Elective		
SES201AD	DATA STRUCTURES				Core		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
C Programming Language	3	-	-	-	40	60	3

**Course Objectives:**

1. To impart the basic concepts of data structures and algorithms.
2. To understand writing algorithms and making step by step approach in solving problems with the help of fundamental data structures.
3. To understand the applications of linear and nonlinear data structures.

**Course Outcomes:**

At the end of this course, the student will be able to

1. Implement sorting and searching algorithms.
2. Understand the concept of ADT, identify data structures suitable to solve problems.
3. Develop and analyze algorithms for stacks, queues using arrays and linked list.
4. Develop algorithm for Binary trees, Balanced Trees, and Graphs.
5. Implement various Hashing and Collision Resolution Technique.

**UNIT-I INTRODUCTION TO DATA STRUCTURES, SEARCHING AND SORTING**

**Basic concepts:** Introduction to data structures, classification of data structures - Linear and Non-Linear data structures, operations on data structures;

**Searching techniques:** Linear Search, Binary search, and Fibonacci Search;

**Sorting Techniques:** Quick Sort, Merge Sort and Heap Sort.

**UNIT-II LINEAR DATA STRUCTURES**

**Stacks:** Stack ADT, definition and operations, Implementations of stacks using array, applications of stacks, Arithmetic expression conversion and evaluation;

**Queues:** Primitive operations; Implementation of queues using Arrays, applications of linear queue, circular queue, and double ended queue (deque).

**UNIT-III LINKED LISTS**

**Linked lists:** Introduction, singly linked list, representation of a linked list in memory, operations on a single linked list; Applications of linked lists: Polynomial representation and sparse matrix manipulation.

**Types of linked lists:** Circular linked lists, doubly linked lists; Linked list representation and operations of Stack, linked list representation and operations of queue.

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*G. Vaidhyanathan*

#### UNIT-IV NON-LINEAR DATA STRUCTURES

**Trees:** Basic concept, binary tree, binary tree representation, array and linked representations, binary tree traversal, binary tree variants, threaded binary trees, application of trees.

**Graphs:** Basic concepts, graph terminology, Graph Representations, Adjacency matrix, Adjacency lists, graph implementation, Graph traversals – BFS, DFS.

#### UNIT-V BINARY TREES AND HASHING

**Binary search trees:** Binary search trees, properties, and operations; **Balanced search trees:** AVL trees; Introduction to M-Way search trees, B trees;

**Hashing and collision:** Introduction, hash tables, hash functions, collisions, applications of hashing.

#### Text Books:

1. Aaron M. Tenenbaum, Yedidyah Langsam, and Moshe J. Augenstein, Data Structures Using C, Pearson Education India
2. Reema Thareja, Data Structures Using C, Oxford, Second Edition, 2014

#### References:

1. S. Lipschutz, "Data Structures", Tata McGraw Hill Education, 1<sup>st</sup> Edition, 2008.
2. D. Samanta, "Classic Data Structures", PHI Learning, 2nd Edition, 2004.

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*Dr. Vaidelin*

Course Code	Course Title				Core / Elective		
SES211AD	DATA STRUCTURES LAB				Core		
	Contact Hours per Week				CIE	SEE	Credits
Pre Requisite	L	T	D	P			
Programming in C	-	-	-	4	40	60	2

### Course Objectives :

1. Develop programs for various searching and sorting techniques.
2. Differentiate Linear and Non Linear Data Structures.
3. Implement various operations on trees and graphs

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


1. Understand the concept of data structures, C Programming and apply algorithm for solving problems like Sorting, searching, insertion and deletion of data.
2. Understand linear data structures for processing of ordered or unordered data.
3. Explore various operations on dynamic data structures like single linked list and doubly linked list.
4. Explore the concept of non linear data structures such as trees and graphs.
5. Understand the binary search trees, hash function, and concepts of collision and its resolution methods.


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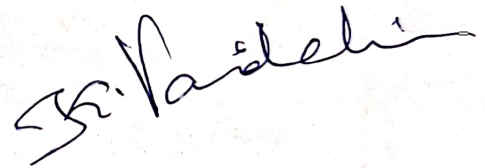
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Prof. K. K. Suresh  
Kunal

*Dr. P. S. Sridhar*

1. Write C programs for implementing the following searching techniques: Linear, Binary and Fibonacci search.
2. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order: Merge, Quick and Heap Sort.
3. Write a C program to implement stack: using arrays and linked list.
4. Write a C program to implement queue: using arrays and linked list.
5. Write a C program that uses stack operations to convert a given infix expression into its postfix equivalent, implement the stack using an array.
6. Write a C program that uses stack operations to evaluate postfix expression, implement the stack using an array.
7. Write a C program to implement single linked list.
8. Write a C program to implement double linked list.
9. Write a C program for implementing Graph Traversal Techniques: Depth First Traversal and Breadth First Traversal.
10. Write a C program to create Binary Search Tree, perform insertion and traversal (in order, pre order, post order)
11. Write a C program to implement hashing.

  
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Prof. L. K. Suresh Kumar

  
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Course Code	Course Title				Core/Elective		
SPW211AD SPW0221AD	IDEA Lab						
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
--	-	-	-	2	-	-	0

**Course Objectives:**

1. To learn all the skills associated with the tools and inventory associated with the IDEA Lab.
2. Learn useful mechanical and electronic fabrication processes.
3. Learn necessary skills to build useful and standalone systems/ projects with Closures.

**Course Outcomes:**

**At the end of this course, the student will be able to:**

1. Demonstrate an understanding of conventional manufacturing processes.
2. Design and fabricate machine components using a 3D printer machine.
3. Demonstrate skills in laser cutting, vinyl cutting machine and 3D Scanner.
4. Design and fabricate machine components using PCB boards.
5. Demonstrate an understanding of the use of various sensors and its application with Arduino

**LIST OF EXPERIMENTS**

1. Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
2. Machining of 3D geometry on soft material such as soft wood or modelling wax.
3. 3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.
4. 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.
5. 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6. Familiarity and use of welding equipment.
7. Familiarity and use of normal and wood lathe.
8. Embedded programming using Arduino and/or Raspberry Pi.
9. Design and implementation of a capstone project involving embedded hardware, software and

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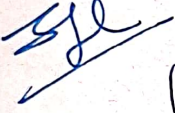
machined or 3D printed enclosure.


**Text Books:**

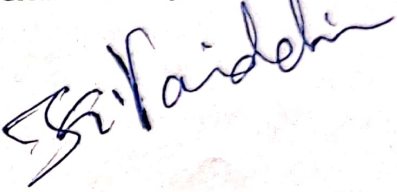
1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), Khanna Book Publishing.
2. All-in-One Electronics Simplified, A.K. Maini; 2021. ISBN-13: 978-9386173393, Khanna Book Publishing Company, New Delhi.

**Reference Books:**

1. Simplified Q&A - Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Rajiv Chopra, ISBN: 978-9355380821, Khanna Book Publishing Company, New Delhi.
2. 3D Printing & Design, Dr. Sabrie Soloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi.
3. The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018. ISBN-13: 978-1681884325

  
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Prof. L.K. Suresh  
Kumar

  
Sri Arindhan

4th BOS

**FACULTY OF ENGINEERING**  
**Scheme of Instructions & Detailed Syllabus of**  
**III& IV Semester**  
**For**  
**Four Year Degree Programme of**  
**Bachelor of Engineering (B.E)**  
**in**  
**ARTIFICIAL INTELLIGENCE & DATA SCIENCE**  
(With effect from the academic year 2023-24)



Issued by  
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**Stanley College of Engineering and Technology for Women**  
**(Autonomous)**  
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Abids, Hyderabad – 500 001, Telangana.

*Sr. Baidhi*  
*BOS - chairperson*  
*Dept. of AI&DS*  
*SCETW (A)*

**AI&DS Scheme of Instruction & Examination for  
Semester III**

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination				Credits
			L	T	P/D	Cont act Hours	CIE	SE E	SEE Durati		
<b>Theory Courses</b>											
1	SBSX01MT	Mathematics-III	3	1	-	4	40	60	3	4	
2	SESX01EC	Digital Electronics	3	-	-	3	40	60	3	3	
3	SPC301AD	Discrete Mathematics	3	-	-	3	40	60	3	3	
4	SPC302AD	OOPs using Java	3	1	-	4	40	60	3	4	
5	SPC303AD	Concepts in Computer Organization & Microprocessor	3	-	-	3	40	60	3	3	
6	SMC901HS	Indian Constitution	2	-	-	2	-	-	-	0	
<b>Practical/ Laboratory Courses</b>											
7	SHS912EG	Advanced Communications Skills Lab	-	-	2	2	40	60	3	1	
8	SPC312AD	OOPs using Java Lab	-	-	2	2	40	60	3	1	
9	SPC313AD	Concepts in Computer Organization & Microprocessor Lab	-	-	2	2	40	60	3	1	
10	SPC314AD	Python Programming Lab	-	-	2	2	40	60	3	1	
<b>Total</b>			<b>17</b>	<b>02</b>	<b>08</b>	<b>27</b>	<b>360</b>	<b>540</b>		<b>21</b>	

*Z. Vaidya*

*P. V. S. S. S.*

DU-NOMINEE

**HEAD**

Department of Computer Science & Engineering  
University College of Engineering (A)  
Osmania University  
Hyderabad-500 007.

Course Code	Course Title				Core/Elective		
SPC301AD	Discrete Mathematics (Common to AI&DS, CME)				Core		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
---	3	-	-	-	40	60	3
<b>Course Objectives:</b> The course should enable the students to: <ol style="list-style-type: none"> <li>1. Solve the practical examples of sets, functions and relations.</li> <li>2. Describe the logical and mathematical foundations, and study abstract models of computation.</li> <li>3. Illustrate the limitations of predicate logic.</li> <li>4. Define modern algebra for constructing and writing mathematical proofs.</li> <li>5. Recognize the patterns that arise in graph problems and use this knowledge for constructing the trees and spanning trees.</li> </ol> <b>Course Out comes:</b> At the end of this course, the student will be able to <ol style="list-style-type: none"> <li>1. Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, and functions</li> <li>2. Apply mathematical Logic to solve problems.</li> <li>3. Apply and formulate problems using predicate logic.</li> <li>4. Analyze and solve Algebraic Structures and counting problems on finite &amp; discrete structures</li> <li>5. Apply graphs and trees in solving computing problems.</li> </ol>							

#### UNIT I

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, lattices, Hasse diagram, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Recurrence Relations

#### UNIT II

Mathematical logic: Statements and notations, connectives, well-formed formulas, truth tables, tautology, equivalence implication; Normal forms: Disjunctive normal forms, conjunctive normal forms, principle disjunctive normal forms, principle conjunctive normal forms.

#### UNIT III

Predicate calculus: Predicative logic, statement functions, variables and quantifiers, free and bound variables, rules of inference, consistency, proof of contradiction, automatic theorem proving.

#### UNIT IV

Algebraic structures: Algebraic systems, examples and general properties, semi groups and monoids, groups, sub groups, homomorphism, isomorphism, rings.

Combinatory: The fundamental counting principles, permutations, disarrangements, combinations, permutations and combinations with repetitions, the binomial theorem, multinomial theorem, Principle of inclusion exclusion, pigeon hole principle.

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*P.V. Soder*

OU-NOMINEE



## UNIT V

Graphs: Basic concepts of graphs, isomorphic graphs, Euler graphs, Hamiltonian graphs, planar graphs, graph coloring, digraphs, directed acyclic graphs, weighted digraphs, region graph, chromatic numbers

Trees: Trees, spanning trees, minimal spanning trees.

### Text Books:

1. J. P. Tremblay, R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, India, 1st Edition, 1997.
2. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", Tata Mcgraw-Hill, New Delhi, India, 6th Edition, 2012.

### Reference Books:

1. Joe L. Mott, Abraham Kandel, Theodore P. Baker, "Discrete Mathematics for Computer Scientists and Mathematics", Prentice Hall of India Learning Private Limited, New Delhi, India, 2nd Edition, 2010.
2. D S Chandra shekaraiah, "Mathematical Foundations of Computer Science", Prism Books Pvt. Ltd., 2nd Reprint, 2007.
3. C.L.Liu, D.P.Mohapatra, "Elements of Discrete Mathematics", Tata Mcgraw-Hill, India, 3rd Edition, 2008.
4. Ralph P.Grimaldi, B.V.Ramana, "Discrete and Combinatorial Mathematics-An Applied Introduction", Pearson Education, India, 5th Edition, 2011.
5. D. S. Malik, M. K. Sen, "Discrete Mathematical Structures: Theory and Applications", Thomson Course Technology, India, 1st Edition, 2004.

*Sr. Daidelhi*

P. V. Suresh, OU-NOMINEE

Course Code	Course Title					Core/Elective	
SPC302AD	OOPS USING JAVA (Common to AI&DS, CSE & IT , CME)					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Programming for Problem Solving	3	1	-	-	40	60	4
<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>To understand fundamentals of object-oriented programming in Java and create Java application programs using core concepts of OOP like interfaces, Exception handling, multithreading, polymorphism, packages.</li> <li>Use I/O streams for Input output operations in various streams and also perform serialization.</li> <li>Explore Collection framework and also design GUI application with different layout managers with event handling.</li> </ol> <p><b>Course Outcomes:</b> At the end of this course, the student will be able to</p> <ol style="list-style-type: none"> <li>Understand the concepts of classes, objects, and polymorphism.</li> <li>Apply concepts of interfaces, user-defined packages during application development.</li> <li>Develop Java Applications using Exception Handling and Multithreading concepts.</li> <li>Compose programs using the Java Collection API.</li> <li>Design GUI Application with Event Handling &amp; Layout Designing concepts</li> </ol>							

#### UNIT-I

**Introduction:** OOP concepts, benefits of OOP, history of Java, data types, variables, scope and life time of variables, operators, expressions, control statements, type conversion and casting.

**Classes and Objects:** Concept of classes, objects, constructors, methods, this keyword, super keyword, garbage collection, overloading methods and constructors, parameter passing, Arrays String handling: String, String Buffer, String Builder

#### UNIT -II

**Inheritance:** Base class object, subclass, member access rules, super uses, using final with inheritance, method overriding, abstract classes.

**Interfaces:** Defining and implementing an interface, differences between classes and interfaces and extending interfaces Polymorphism.

**Packages:** Defining, creating and accessing a package, importing packages, exploring packages

#### UNIT -III

**Exception handling:** Concepts and benefits of exception handling, exception hierarchy, checked and unchecked exceptions, usage of-try, catch, throw, throws and finally, built in exceptions, creating User defined exceptions.

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*P.V. Sridhar*

**Multithreading:** Difference between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups.

#### UNIT -IV

**Basic I/O Streams:** Java I/O classes and interfaces, Files, Stream and Byte classes, Character streams, Serialization Exploring java.lang: Object class, Wrapper classes Exploring java.util: Scanner, StringTokenizer.

**Collections:** Overview of Java Collection frame work, commonly used Collection classes – Array List, Linked List, Hash Set, Tree Set, Collection Interfaces – Collection, List, Set. Accessing Collection via iterator, working with Map.

#### UNIT -V

**GUI Programming with Java:** The AWT class hierarchy, MVC architecture.

**Exploring Swing:** JLabel, ImageIcon, JTextField, the Swing buttons, JTabbedPane, JScrollPane, JList, JComboBox.

**Layout manager:** Border, Grid, Flow, Card and Grid Bag Layouts.

**Event Handling:** Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces, Handling mouse and keyboard events, Adapter classes.

**New Features in Java:** Major enhancement made in Java5, Java6, Java7 and Java8 like auto-boxing, generics, var-args, java annotations, enum, lambda expressions, functional interface, method references

#### Text Books:

1. Schildt and Herbert, Java The complete reference, McGraw, 9th edition, TMH.
2. E. Balagurusamy, Programming with Java, seventh edition, Tata McGraw Hill.
3. H. M. Dietel and P. J. Dietel, Java How to Program, Sixth Edition, Pearson Education / PH
4. James M Slack, Programming and Problem Solving with JAVA, Thomson Learning, 2002.

#### References Books:

1. Dr R. Nageswara Rao, Core Java: An Integrated Approach, Dreamtech.
2. Prem Kumar, Getting Inside Java - Beginners Guide : Programming with Java by,Notion Press.
3. Bert Bates, Kathy, Head First Java, Sierra Publisher: O'Reilly Media, Inc, 2nd Edition.
4. T. Budd, An Introduction to OOP, Pearson Education, second edition.

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*P.V. Suresh*



Course Code	Course Title					Core/Elective	
SPC 303AD	<b>Concepts in Computer Organization and Microprocessor</b> (Common to AI&DS& CME, CSE)					<b>Core</b>	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3
<b>Course Objectives:</b> <ol style="list-style-type: none"> <li>To impart the basic concepts of computer organization and design.</li> <li>To understand the difference between microprocessor and micro controller.</li> <li>To understand 8085, 8086 and 8051 architectures.</li> </ol> <b>Course Outcomes:</b> At the end of this course, the student will be able to <ol style="list-style-type: none"> <li>To understand various ways of representing data and data transfer through bus and register</li> <li>To explore basic organization of computer components, various computer instructions and memory hierarchy.</li> <li>To understand Micro programmed Control unit, Central processing unit and Pipelining Process.</li> <li>To differentiate Micro Processor and Micro Controller.</li> <li>To analyze 8085, 8086 and 8051 architectures, with their addressing modes and programming techniques.</li> </ol>							

#### UNIT-I

Data Representation: Fixed- and Floating-Point representations. Overview of Computer Function and Interconnections: Computer components, Interconnection structures, Bus interconnection, Bus structure, and Data transfer. Register Transfer Microoperations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic, Logic and Shift micro-operations, Arithmetic Logic Shift Unit

#### UNIT-II

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory reference instruction, Input-Output, and Interrupt. Microprogrammed Control: Control memory, Address Sequencing, Microprogram example, Design of Control Unit.

#### UNIT-III

Central Processing Unit: General Register Organization, Stack Organization, Instruction formats, Addressing modes, Data Transfer and Manipulation, and Program control. Pipeline Processing: Arithmetic, Instruction and RISC Pipelines.

Memory Organization: Cache memory, Virtual memory, Memory Management hardware

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*P.V. Sudhan*

#### UNIT-IV

Assembly Language Programming: Introduction to microprocessors and microcontrollers, 8085 Processor Architecture, Internal operations, Instructions, and timings, 8085 instructions, addressing modes. Assembly Language Programming in 8085. 8086 Processor Architecture and Pin diagram.

Basic Interfacing concepts with 8085, Programmable Interrupt Controller (8259A). Direct Memory Access (DMA) - DMA Controller (Intel 8257)

#### UNIT-V

Introduction to Microcontrollers, 8051 – Architecture, Instruction set, Addressing modes and Programming techniques. Comparison of various families of 8-bit micro controllers. Parallel Communication Interface (8255), Keyboard/ Display Controller (8279).

#### Text Books:

1. M Morris Mano, Computer System Architecture - Third Edition, Pearson Education Limited
2. Ramesh S Gaonkar, Micro Processor and Peripherals - Sixth Edition, Penram Publications
3. A Kay Ray, K M Bhurchandi, Advanced Microprocessors and Peripherals – Second Edition, Mcgraw Hill Education.
4. Mohammed Ali Mazidi, Janice Gillispe Mazidi, Rolin D. McKinlay, The 8051 Micro Controller and Embedded Systems - Second Edition, Pearson

#### Reference Books:

1. William Stallings, Computer Organization and Architecture – Sixth Edition, Pearson/PHI
2. Carl Hamacher, Zvonko Vranesic, SafwatZaky, Computer Organization, Fifth Edition, McGraw Hill, 2002
3. P. Pal Chaudhuri, Computer Organization and Design - Third edition, PHI Publications

*P. V. Sridhar*

*P. V. Sridhar*

Course Code	Course Title					Core / Elective	
SPC312AD	OOPS Using JAVA Lab (Common to AI & DS, CSE, IT & CME)					Core	
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
Programming for Problem Solving Lab	-	-	-	2	40	60	1
<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>To understand fundamentals of object-oriented programming in Java and create Java application programs using core concepts of OOP like interfaces, exception handling, multithreading, polymorphism, packages.</li> <li>Use I/O streams for Input output operations in various streams and also perform serialization.</li> <li>Explore Collection framework and also design GUI application with different layout managers with event handling.</li> </ol> <p><b>Course Outcomes:</b> At the end of this course, the student will be able to</p> <ol style="list-style-type: none"> <li>Understand the concepts of classes, objects, and polymorphism.</li> <li>Apply concepts of interfaces, user-defined packages during application development.</li> <li>Develop Java Applications using Exception Handling and Multithreading concepts.</li> <li>Compose programs using the Java Collection API.</li> <li>Design GUI Application with Event Handling &amp; Layout Designing concepts</li> </ol>							

**List of Experiments: Write Programs using Java Language**

- To implement the concept of class with method overloading
- To implement the concept of Single level and Multi level Inheritance.
- To create an interface Shape with the getArea() method. Create three classes Rectangle, Circle, and Triangle that implement the Shape interface. Implement the getArea() method for each of the three classes. (Using the concept of Interfaces).
- To create an abstract class Shape with abstract methods calculateArea() and calculatePerimeter(). Create subclasses Circle and Triangle that extend the Shape class and implement the respective methods to calculate the area and perimeter of each shape. (Using the Abstract Class concept).
- To implement Checked Exception (IOException).
- To implement Unchecked Exceptions. (ArithmeticException, Null Pointer Exception, Array Index Out Of Bounds Exception).
- To implement User defined exception handling. (ex: when user enters marks for a subject beyond the minimum and maximum range).

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8. To create and start multiple threads that increment a shared counter variable concurrently. (Using the Multithreading Concept)
9. To implement the concept of Thread synchronization.
10. To create an Array List for adding, removing, printing, searching employee names.
11. To create a Linked List for adding, removing, printing, searching student names that are ordered by index position. (addFirst(),addLast(),add(),remove(),removeLast(),peekLast()).
12. To create TreeMap of employee name and their age, print sorted employee data by employee name.
13. To create a Hash map that maps employee names to employee salary.
14. To execute iteration over Collection using Iterator interface and List Iterator Interface.
15. To read a file name from the user, and display information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.
16. To copy contents of one file into another file using command line arguments. (simulation of copy command).
17. To create an (Employee) object, serializes it, and then-deserializes (serialization concept).

**Additional Programs (Optional)**

1. To implement event handler concept using mouse and key board events.
2. To design a simple application using swings, layout, event handling (Basic calculator or sign-in screen or billing screen etc).

**Text Books:**

1. Schildt and Herbert, Java The complete reference, McGraw, 9th edition, TMH.
2. E. Balagurusamy, Programming with Java, seventh edition, Tata McGraw Hill.
3. H. M. Dietel and P. J. Dietel, Java How to Program, Sixth Edition, Pearson Education / PH
4. James M Slack, Programming and Problem Solving with JAVA, Thomson Learning, 2002.

**References Books:**

1. Dr R. Nageswara Rao, Core Java: An Integrated Approach, dreamtech.
2. Prem Kumar, Getting Inside Java - Beginners Guide: Programming with Java by,Notion Press.
3. Bert Bates, Kathy, Head First Java, Sierra Publisher: O'Reilly Media, Inc, 2nd Edition.
4. T. Budd, An Introduction to OOP, Pearson Education, second edition.

**Software Required: Java 8**

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Course Code	Course Title					Core/Elective	
SPC313AD	CONCEPTS IN COMPUTER ORGANIZATION AND MICROPROCESSOR LAB (Common to AI&DS, CME & CSE)					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	40	60	1
<p><b>Course Objectives :</b></p> <p>The objectives of the course are to impart knowledge of the:</p> <ol style="list-style-type: none"> <li>1. To become familiar with the architecture and Instruction set of Intel 8085 microprocessor.</li> <li>2. To provide practical hands on experience with Assembly Language Programming.</li> <li>3. To familiarize the students with interfacing of various peripheral devices with 8085 microprocessors</li> </ol> <p><b>Course Outcomes :</b></p> <p>After the completion of the course, the student will be able to:</p> <ol style="list-style-type: none"> <li>1. Interpret the principles of Assembly Language Programming, instruction set in developing microprocessor based applications.</li> <li>2. Develop Applications such as: 8-bit Addition, Multiplication, and Division, array operations, swapping, negative and positive numbers.</li> <li>3. Analyze the interfaces like serial ports, digital-to-analog Converters and analog-to-digital converters etc.</li> <li>4. Build interfaces of Input-output and other units like stepper motor.</li> <li>5. Analyze the function of traffic light controller.</li> </ol>							

### List of Experiments

#### PART A:

##### Programs using VERILOG

1. Review of the different logic design circuits., a) Gates b) Flip/Flop (RS, JK, D, T)
2. Familiarity with state of art IC-chips, e.g. a) Multiplexer, b) Decoder, c) Encoder, d) Counter, e) Shift-Register, f) adder Truth Table verification and clarification from Data-book.
3. Design a BCD adder.
4. Design an Adder/ Subtractor composite unit
5. Design a carry-lookahead Adder

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6. Design ALU and 4-bit processor

#### PART B

##### 8085 Programming using Microprocessor Trainer Kit

1. Sample programming examples using 8085 instruction set. To understand the use of various Instructions and addressing modes.
2. Interfacing Traffic Light Controller using 8255.
3. Interfacing seven segment LED using 8255.
4. Interfacing keyboard & Displaying controller using 8279

#### PART C

##### 8051 Programming (Additional Experiments-optional)

1. Simple programming examples using 8051 Microcontroller
2. A/D and D/A converter interface
3. Stepper motor interface

##### Software Required:

ModelSim (VERILOG)

DOSBox

JUBIN'S 8085 ASSEMBLER

##### Text Books:

1. Samir Palnitkar, "Verilog HDL A Guide to Digital Design and Synthesis", 2<sup>nd</sup> Edition, Pearson Education, 2006.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D, McKinlay, "The 8051 Microcontroller and Embedded Systems", 2<sup>nd</sup> Edition, Pearson Education.

##### Reference Books:

1. A Kay Ray, K M Bhurchandi, Advanced Microprocessors and Peripherals –Second Edition, Mcgraw Hill Education.
2. Ramesh S Gaonkar, Micro Processor and Peripherals - Sixth Edition, Penram Publications

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Course Code	Course Title				Core/Elective		
SPC 314 AD	Python Programming Lab				Core		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-			-	2	40	60	1

**Course Objectives:**

The students will be able to:

1. Learn basic Programming using Python
2. Perform File Operations
3. Learn Object Oriented Programming principles

**Course Outcomes:**

After completing this course, the student will be able to:

1. Understand basic programming concepts such as variables, data types, operators, and control structures in Python.
2. Apply conditional control structures for problem solving
3. Apply functions and recursive techniques to solve complex problems in Python.
4. Apply various data structures in Python according to the problem
5. Solve the complex problems using advanced Python concepts

- 1) **Python Installation and Environment Setup**
  - a) Conduct the installation of Python and configure the development environment.
  - b) Verify the installation by executing a simple Python command in IDLE and Command Prompt.
- 2) **Working with Data Types and Operators**
  - a) Display the following information: Your name, Full Address, Mobile Number, College Name, Subjects
  - b) Perform all arithmetic operations with minimum two numbers
  - c) Compute distance between two points taking input from the user
- 3) **Control Structures in Python**
  - a) Check whether a given number is even or odd.
  - b) Find the largest three integers using if-else
  - c) To read a number (1-7) and display corresponding day using if\_elif\_else?

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- d) Receives a series of positive numbers and display the numbers in an ascending order and calculate the sum.
- e) Get any number from user, Generate the series with reverse order (n to 1) using While loop
- 4) **Functions and Recursion**
- a) Write a program to find mean, median, mode for the given set of numbers in a list
- b) Write a program to check whether two strings are nearly equal or not. Display how many characters are matching.
- c) Write a program to print Fibonacci Sequence up to a given number n
- d) Write a function to find GCD of two integers.
- e) Write a program to display prime number from 2 to n.
- f) Write a Function that accept a string as an argument and return the number of vowels and consonants that the string contains.
- 5) **String Operations and Regular Expressions**
- a) Execute various string manipulation techniques.
- b) To check whether the given string is palindrome or not.
- c) To remove the nth index character from a nonempty string
- d) Write a python program to check the validity of a password given by the user. The password should satisfy the following criteria:
1. Contain at least 1 letter between a and z
  2. Contain at least 1 number between 0 and 9
  3. Contain at least 1 letter between A and Z
  4. Contain at least 1 character from \$, #, @
  5. Minimum length of password: 6
  6. Maximum length of password: 12
- Write a Python program to validate mobile number.
- 6) **List Operations**
- To create a list and perform the following methods 1) insert() 2) remove() 3) append() len() 5) pop() 6) clear()
- To remove duplicates from a list
- 7) **Dictionaries**
- Create a dictionary and apply the following methods 1) Print the dictionary items 2) access items 3) use get() 4) change values
- To count the number of characters in the string and store them in a dictionary data structure
- To convert nested list into dictionary
- 8) **Tuples**
- a) Create a program that uses tuples to store configuration settings that should not change during runtime.
- Example: config = ("localhost", 8080, "admin", "password")

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- b) Write a program to store employee records using tuples. Each record should contain an employee ID, name, and department. Implement a function to display all employee details.
- 9) **Python Sets**
- Write a program to find all unique words in a given text.
  - Write a program to remove duplicate items from a list.
- 10) **File Handling Techniques**
- Generate 1 to n random numbers and write it in a file then read from a file.
  - To display a list of all unique words in a text file
  - To print each line of a file in reverse order.
  - To count frequency of words in a given file.
- 11) **Exception Handling in Python**
- Read two numbers  $n_1$  and  $n_2$ . Write a function to compute  $n_1/n_2$  and use try/except to catch the exceptions.
  - To detect and handle the exception while solving the quadratic equation.
  - To handle the run time errors while doing the file handling operation.
  - To create and raise user defined exceptions.

**Additional Programs (Optional):****Object-Oriented Programming (OOP) Concepts**

Program to implement the inheritance

Program to implement the polymorphism

**12) Numpy (Optional)**

- Write a basic array of operations on single array to add  $x$  to each element of array and subtract  $y$  from each element of array.
- Write a program to add, subtract and multiply two matrices.
- Create multi-dimensional arrays and find its shape and dimension.
- Create a null matrix and unit matrix.
- Reshape and flatten data in the array

**13) Introduction to GUI Programming with Tkinter (Optional)**

- Design a GUI based calculator to perform arithmetic operations like addition, subtraction, multiplication and division.
- Design a GUI based application to convert temperature from Celsius to Fahrenheit.
- Python program to perform various database operations (create, insert, delete, update)

**Case Study: Library Management System (Optional)****Problem Statement**

You are tasked with developing a simple Library Management System (LMS) using Python. The LMS should allow librarians to manage books, patrons, and borrowing transactions. Your program should incorporate the following features:

- Create a class Book to represent book information (title, author, ISBN, etc.) using appropriate data types.
- Write a function to check if a book is available for borrowing.

*S. Sridhar*

*P. V. Sridhar*

- Use if, if-else, and nested if statements to handle different scenarios (e.g., book availability, overdue books).
- Maintain a list of borrowed books.
- Use list comprehensions to filter books based on specific criteria (e.g., overdue books).
- Dictionary Operations:
  - Create a dictionary to store patron information (name, contact details).
  - Manipulate dictionary keys and values (e.g., adding new patrons).
  - Represent book genres using tuples (e.g., (1, 'Fiction'), (2, 'Non-Fiction')). Demonstrate tuple immutability
- Maintain a list of borrowed books.
- Implement try-except blocks to handle potential errors (e.g., invalid input).
- Remember to design your LMS with user-friendly interfaces (text-based menus or prompts) for librarians to interact with

**Text Books:**

1. Martin C. Brown, "PYTHON: The Complete Reference", McGraw-Hill, 2018
2. Monu Singh Rakesh K. Yadav, Srinivas Arukonda "Zero To Mastery In Python Programming", Vayu Education Of India, 2021
3. Allen Downey, "Learning with Python", Dreamtech Press; 1st edition, 2015

**Reference Books:**

1. Wesley J Chun, "Core Python Applications Programming", Prentice Hall, 2012.
2. R. Nageswara Rao, "Core Python Programming" Dreamtech Press India Pvt Ltd 2018.
3. Allen B Downey, "Think Python", O'Reilly, 2012.

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## AI&DS Scheme of Instruction & Examination for Semester IV

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/	CIE	SEE	SEE Duration	
<b>Theory Courses</b>										
1	SHS901BM	Managerial Economics & Financial Accountancy	2	-	-	3	40	60	3	2
2	SPC401AD	Database Management System	3	1	-	4	40	60	3	4
3	SPC402AD	Design & Analysis of Algorithms	3	-	-	3	40	60	3	3
4	SPC403AD	Operating System	3	-	-	3	40	60	3	3
5	SPC404AD	Foundations of Data Science	3	1	-	4	40	60	3	4
6	SAC903CH	Environmental Science	2	-	-	2	50	-	-	0
<b>Practical/ Laboratory Courses</b>										
7	SPC411AD	Database Management System Lab	-	-	2	2	40	60	3	1
8	SPC413AD	Operating System Lab	-	-	2	2	40	60	3	1
9	SPC414AD	Foundations of Data Science Lab	-	-	2	2	40	60	3	1
10	SPC415AD	Lab on Software Tools & Techniques	-	-	2	2	40	60	3	1
Internship-I (SPW421AD)			Student must undergo internship for 4 weeks during summer vacation which will be assessed in the forthcoming V semester.							
<b>Total</b>			<b>16</b>	<b>02</b>	<b>08</b>	<b>26</b>	<b>410</b>	<b>540</b>		<b>20</b>

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**HEAD**  
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Course Code	Course Title				Core/Elective		
SPC401AD	Database Management Systems (Common to AI&DS, CME, CSE, IT)				Core		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
---	3	1	-	-	40	60	4

**Course Objectives:**

1. Understand the basic concepts and the applications of database systems.
2. Master the basics of SQL and construct queries using SQL.
3. Understand the relational database design principles.
4. Become familiar with the basic issues of transaction processing and concurrency control, database storage structure and recovery mechanisms

**Course Outcomes:**

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

1. Understand concepts and the applications of database systems and implement in real time applications.
2. Construct an Entity-Relationship (E-R) model from specifications and transform to relational model.
3. Demonstrate the concepts of relational database management system
4. Apply normalization on database.
5. Understand principles of database transaction management, storage and recovery of database.

**UNIT 1:**

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages-DDL, DML, Relational Databases, Data Storage and Querying, Transaction Management, Database Architecture, Database Users and Administrators.

Introduction to the Relational Model: Structure of Relational Databases, Database Schema, Schema Diagrams, the Relational Algebra.

**UNIT 2:**

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Integrity Constraints, Set Operations, Null Values, Aggregate Functions, Nested Sub queries

Advanced SQL: Join Expressions, Views, Triggers, Cursors, Procedures and Functions

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**UNIT 3:**

Database Design and the E-R Model: The Entity- Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational schemas, Entity-Relationship Design Issues, Extended E-R Features.

Normalization: Functional Dependencies, Lossless decomposition, 1NF, 2NF, 3NF, Dependency Preservation, BCNF, Multi-valued dependencies, 4NF. Denormalization.

**UNIT 4:**

Indexing:

File Structures: Sequential files, Sparse index and dense index, B and B+ trees.

Transaction Management: Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels.

**UNIT 5:**

Concurrency Control: Lock-Based Protocols, Multiple Granularity, Timestamp- Based Protocols, Validation-Based Protocols.

Backup and Recovery System: Failure Classification, Recovery Algorithm, Failure with loss of non-volatile storage, Remote Backup systems.

Overview and History of NoSQL Databases: Types of NoSQL Database.

**Text Books:**

1. A. Silberschatz, Henry. F. Korth and S. Sudarshan, Database System Concepts, 6th Edition, McGraw Hill Education (India) Private Limited.
2. C.J.Date, A. Kannan, and S. Swami Nadhan, An Introduction to Database systems, 8th Edition, Pearson Education.

**Reference Books:**

1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill Education (India) Private Limited.
2. R Elmasri, Shamkant B. Navathe, Database Systems, 6th Edition, Pearson Education.

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*P.V. Sridhar*

Course Code	Course Title					Core/Elective	
SPC402AD	DESIGN & ANALYSIS OF ALGORITHMS (Common to AI&DS, CME)					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Data Structures	3	-	-	-	40	60	3
<b>Course Objectives :</b> <ol style="list-style-type: none"> <li>To explore elementary data structures, order notation and algorithm analysis.</li> <li>To learn algorithm design strategies such as Divide-and-Conquer, Greedy method, Dynamic programming, Back Tracking and Branch &amp; Bound Technique.</li> <li>To describe the concepts of NP-hard, NP-complete and Text compressions.</li> </ol> <b>Course Outcomes:</b> Upon completion of the course, the students will be able to: <ol style="list-style-type: none"> <li>Identify basic data structure and the different algorithm design strategies such as Divide and Conquer, Greedy Method, Dynamic Programming, Backtracking, Branch and Bound.</li> <li>Relate different algorithm design strategies, NP-Completeness and pattern matching algorithms to real world problems.</li> <li>Apply performance analysis to real world problems by using different algorithm design strategies.</li> <li>Recommend different algorithm design strategies, string pattern matching algorithms and tries construction to real world problems</li> <li>Evaluate different algorithm design strategies, Tries and Text Compression construction methods, string pattern matching algorithms.</li> </ol>							

### UNIT – I

**Introduction:** Algorithm definition, algorithm Specification, Performance Analysis: Time complexity, Space complexity, asymptotic notations, and Practical complexities.

**Sets and Disjoint set Union:** Disjoint set operations, Union and find algorithms.

**Basic sorting techniques:** Selection sort, Bubble sort and Insertion sort.

### UNIT – II

**Divide and Conquer:** General method, Binary search, finding maximum and minimum, Merge sort, Quick sort.

**Greedy Method:** General Method, Knapsack problem, Job sequencing with deadlines, Minimum Spanning Trees: Minimum cost Spanning trees-Prims and Kruskal algorithms, Single

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source shortest path problem.

### UNIT-III

**Dynamic Programming:** General Method, All pairs shortest path problem, single source shortest path problem, Optimal Binary search trees, 0/1 knapsack problem. Travelling sales person problem.

**Backtracking:** General Method: Recursive backtracking algorithm, Iterative backtracking method, 8- Queen Problem, Graph coloring, Hamiltonian Cycle, Knapsack problem.

### UNIT- IV

**Branch and Bound:** The method: Control abstraction for Least Cost search, Bounding, FIFO branch and bound LC branch and bound, 0/1 Knapsack problem, Traveling sales person problem.

**Tries and Text Compression:** Standard Tries, Compressed Tries, Suffix Tries, Huffman coding algorithm,

### UNIT – V

**Strings and Pattern Matching Algorithms:** String operations, Brute Force pattern matching, Boyer- Moore Algorithm, Knuth-Morris-Pattern matching algorithm.

**NP- Completeness:** Basic concepts: P and NP, NP-Completeness, NP Hard, Important NP-Complete Problems, NP-Hard graph problems.

### Text Books:

1. Horowitz E, Sahni S, Rajasekaran S, Fundamentals of Computer Algorithms, 2nd Edition, Universities Press, 2007.
2. Michael T. Goodrich. Roberto Tamassia. Algorithm Design: Foundations, Analysis and Internet Examples, John Wiley & Sons, second edition, Reprint 2011.

### Reference Books:

1. Alfred V Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures Algorithm", Pearson Education, Reprint 2006.
2. Thomas H. Cormen ,Charles E. Leiserson Ronald L. Rivest ,Clifford Stein , "Introduction to Algorithms", 4<sup>th</sup> Edition, MIT Press Cambridge.
3. Anany Levitin, Introduction to the Design and Analysis of Algorithms, 3/e, Pearson, 2017.

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Course Code	Course Title					Core/Elective	
SPC 403 AD	<b>Operating System</b> (Common to AI&DS& CME, CSE, IT)					<b>Core</b>	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3
<p><b>Course Objectives:</b> Students will be able:</p> <ol style="list-style-type: none"> <li>To learn fundamentals of Operating Systems.</li> <li>To understand the functions of Operating Systems.</li> <li>To learn memory management.</li> </ol> <p><b>Course Outcomes:</b> After completion of this course, students will be able to:</p> <ol style="list-style-type: none"> <li>Understand functional architecture of operating systems and file systems.</li> <li>Analyze various algorithms for CPU Scheduling</li> <li>Implement programs on multi-threading libraries for an OS.</li> <li>Explore application programs using system calls.</li> <li>Solve synchronization problems.</li> </ol>							

**UNIT-I**

**Introduction:** Batch, iterative, time sharing, multiprocessor, distributed, cluster and real time systems, UNIX system introduction and commands.

**Operating system structures:** Computer system structure, Network structure, I/O Structure, Storage Structure, Dual mode operation, System components, Operating System Services, System Calls, System Programs, System structure, Virtual Machines, System Design and Implementation, System Generation.

**UNIT-II**

**Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process ControlBlock (PCB), Context switching.

**Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads. **Process Scheduling:** Foundation and Scheduling objectives, Types of Schedulers, Scheduling Criteria, Scheduling algorithms, multi-processor scheduling.

**UNIT-III**

**Process Synchronization:** Inter- process Communication: Critical Section, Race Conditions, Mutual Exclusion, Peterson's Solution, classical problems of synchronization:

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The Bounded buffer problem, Producer\Consumer Problem, reader's & writer problem, Dining philosopher's problem. Semaphores, Event Counters, Monitors, Message Passing.

**Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Methods for Handling deadlocks: Deadlock prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

#### UNIT-IV

**Memory Management:** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation, fragmentation, and Compaction; Paging: Principle of operation—Page allocation—Hardware support for paging, structure of page table, Protection and sharing, Disadvantages of paging.

**Virtual Memory:** Basics of Virtual Memory—Hardware and control structures—Locality of reference, Page fault, Working Set, Dirty page/Dirty bit—Demand paging, Page Replacement algorithms, Trashing.

#### UNIT-V

**File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods, Free-space management, directory implementation, efficiency, and performance.

**Secondary Storage Structure:** Disk structure, Disk scheduling algorithms, Disk Management, RAID structure.

#### Textbooks:

1. Avi Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts Essentials, 9<sup>th</sup> Edition, Wiley Asia Student Edition, 2017
2. William Stallings, Operating Systems: Internals and Design Principles, 5 Edition, Prentice Hall of India, 2016.
3. Maurice Bach, Design of the Unix Operating Systems, 8<sup>th</sup> Edition, Prentice-Hall of India, 2009.

#### Reference Books:

1. Dhananjay Dhamdhere, Operating Systems. A Concept approach, 3<sup>rd</sup> Edition, McGraw Hill Education.
2. Deitel & Deitel (2008), Operating systems, 3<sup>rd</sup> edition, Pearson Education, India.
3. Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, 3<sup>rd</sup> Edition, O' Reilly and Associates.
4. Naresh Chauhan, Principles of Operating Systems, Oxford University Press, 2014.

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Course Code	Course Title				Core / Elective		
SPC404AD	Foundations of Data Science				Core		
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
--	3	1	-		40	60	4
<b>Course Objectives:</b> <ol style="list-style-type: none"> <li>1. To obtain a comprehensive knowledge of various tools and techniques for data science.</li> <li>2. Acquire the skills for visualization to be able to present data science projects.</li> <li>3. Understand data warehouse</li> </ol>							
<b>Course Outcomes:</b> <p>At the end of this course, the student will be able to</p> <ol style="list-style-type: none"> <li>1. Implement a Data science life cycle.</li> <li>2. Calculate and interpret different diagnostic analytics</li> <li>3. Classify the different stages of data pre-processing and their respective techniques.</li> <li>4. Implement a Time series model</li> <li>5. Understand and apply visualization concepts for both analyzing data and presenting results.</li> </ol>							

### Unit-1

**Introduction to Data Science:** What is Data Science? Where do we see data science? Finance, Public Policy, Politics, Healthcare, Urban Planning, Education, Libraries. Relation between Data Science and Information science, Computation thinking, Skills and Tools for data science, Issues of Ethics, Bias, and Privacy, Life Cycle of Data Science

**Data:** Different kinds of data (structured, unstructured and semi structured), Database data, Data warehouse, Transactional data.

### Unit-2

**Getting to know your Data:** Data objects, Types of Data: Attribute types, measuring data Similarity and Dissimilarity.

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*P.V. Sudha*

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With effect from Academic Year 2023-24

**Data Pre-Processing:** Overview and issues, Data Cleaning: Missing Values, dealing with noisy data, Spread, outliers data. Transformation: Transformation strategies overview, transformation by normalization, Discretization: Discretization by binning. Data Encoding and types of encoding, Feature selection. Preprocessing of unstructured data.

### Unit-3

**Statistics:** Descriptive Statistics, Central Tendency, Standard Deviation, Calculating Skewness, kurtosis , Variance, Statistical Hypothesis Testing, Univariate, Bivariate and Multivariate Analysis (ANOVA)

**Diagnostic Analytics:** Correlation, Predictive Analytics, Prescriptive Analytics, and Exploratory Analysis (Basic Data - charts (Scatter plots, Line graphs, Barcharts, Histogram, Box plots and Pie Chart), Mechanistic Analysis: Regression

### Unit-4

#### **Model Implementation, Validation and Monitoring: Time Series data**

Introduction to Time series and Forecasting, forecasting process, Different types of data- Internal structures of Time series, Time series plots, Regression models for general time series data, evaluating and monitoring forecasting model performance.

**Data Visualization :** Visualization Process, Eight visual variables, Gestalt Principles, Visualization of one dimension, two dimensional and multidimensional data, Information overload and misleading visualization techniques.

### Unit-5

**Data warehousing:** What is a data warehouse? Difference between OLTP and OLAP, data warehousing multi-tier architecture, data warehousing Models and Modeling, data CUBE and OLAP, OLAP operations. Star schema, snowflake schema and fact constellation.

#### **Text Books:**

1. Chirag shah , "A hands – on introduction to data science" by Cambridge University Press, 2020
2. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques" Morgan Kaufmann Publishers, 2018.
3. Kennedy R. Behrmann, "Foundation Python for Data Science", Addison-Wesley, 2021.
4. Douglas C.Montgomery, Cheryl L. Jen, "Introduction to time series analysis and forecasting", Wiley Series in probability and statistics by (2015)

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5. Matthew Ward, Techniques, and Applications "Interactive Data Visualization - Foundation, Techniques, and Application"

**Reference Books:**

1. Avinash Navlani, Armando Fandango, Ivan Idris , "Python Data Analysis: Perform data collection, data processing, wrangling, visualization, and model building using Python", 3<sup>rd</sup> Edition., Packt Publishing, 2021
2. Jain VK, "Data Science and Analytics", Khana Publishing House, Delhi.
3. Max Kuhn and Kjell Johnson , "Feature engineering and selection a practical approach for predictive models", CRC Press, Chapman & Hall book
4. Ronen Feldman and James Sanger, "The Text Mining Handbook Advanced Approaches in Analyzing Unstructured Data", Cambridge University Press.
5. Julie Steele and Noah Iliinsky "Beautiful Visualization - Looking at data through the eyes of experts"
6. Stephanie D.H, Evergreen "Effective visualization - Right Chart for the Right Data"

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Course Code	Course Title					Core / Elective	
SPC411AD	DATABASE MANAGEMENT SYSTEM LAB					Core	
	Contact Hours per Week				CIE	SE E	Credits
Pre Requisite	L	T	D	P			
-	-	-	-	2	40	60	1
<b>Course Objectives:</b> The course should enable the students to : <ol style="list-style-type: none"> <li>To understand the fundamental concepts of database systems and database management.</li> <li>To apply SQL for database creation, manipulation, and querying and to handle complex queries, joins, sub queries and set operations.</li> <li>To understand create and use stored procedures, functions, and triggers.</li> <li>To become familiar with the basic transaction processing and concurrency control, database storage.</li> <li>To provide a basic understanding of NoSQL databases and their operations.</li> </ol>							
<b>Course Outcomes:</b> <ol style="list-style-type: none"> <li>Design and implement databases using relational schemas.</li> <li>Write and execute basic to advanced SQL queries.</li> <li>Implement and manage constraints and indexes for data integrity and performance.</li> <li>Perform basic CRUD operations in NoSQL databases.</li> </ol>							

**Lists of Experiments:**

- 1. Introduction to SQL**
  - Creating a simple database.
  - Basic SQL Queries,
  - Writing basic SQL queries using SELECT, FROM, WHERE, ORDER BY, and DISTINCT.
- 2. Data Definition Language (DDL)**
  - Creating and Managing Tables
  - Creating tables with different data types.
  - Adding constraints such as PRIMARY KEY, FOREIGN KEY, UNIQUE, and NOT NULL.
  - Altering and dropping tables.
- 3. Data Manipulation Language (DML)**
  - Inserting, Updating, and Deleting Data
  - Inserting records into tables.
  - Updating existing records.
  - Deleting records from tables.

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**4. Advanced SQL Queries**

- a) Complex Queries
- b) Writing queries using JOIN operations (INNER JOIN, LEFT JOIN, RIGHT JOIN).
- c) Using sub queries and nested queries.
- d) Performing set operations (UNION, INTERSECT, EXCEPT).

**5. Aggregate Functions and Grouping**

- a) Using aggregate functions like COUNT, SUM, AVG, MAX, MIN.
- b) Grouping data using GROUP BY.
- c) Filtering groups with HAVING.

**6. Constraints and Indexes**

- a) Working with Constraints and Indexes
- b) Implementing and managing different constraints.
- c) Creating and using indexes to improve query performance.

**7. Transactions and Concurrency Control**

- a) Understanding and implementing transactions.
- b) Using COMMIT and ROLLBACK.

**8. Stored Procedures and Functions**

- a) Creating Stored Procedures
- b) Writing and executing stored procedures.
- c) Passing parameters to stored procedures.
- d) Writing and executing user-defined functions.

**9. Triggers**

- a) Implementing Triggers
- b) Creating and testing triggers.
- c) Implementing triggers for insert, update, and delete operations.

**Additional programs (Optional):**

**10. NoSQL Databases**

- a. Introduction to NoSQL
- b. Basic CRUD operations in a NoSQL database (e.g., MongoDB).
- c. Understanding document-based data modeling.

**Text Books:**

1. Silberschatz, Henry. F. Korth and S. Sudarshan, Database System Concepts, 6th Edition, McGraw Hill Education (India) Private Limited.
2. C.J.Date, A. Kannan, and S. Swami Nadhan, An Introduction to Database systems, 8th Edition, Pearson Education.

**Reference Books:**

1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill Education (India) Private Limited.
2. R Elmasri, Shamkant B. Navathe, Database Systems, 6th Edition, Pearson Education.

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Course Code	Course Title					Core/Elective	
SPC413AD	OPERATING SYSTEM LAB (Common to AI&DS, IT, CME & CSE)					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Programming for Problem Solving	-	-	-	2	40	60	1
<p><b>Course Objectives:</b> Students will be able:</p> <ol style="list-style-type: none"> <li>1. Understand Unix commands.</li> <li>2. Implement Process management related techniques.</li> <li>3. Implement memory management techniques</li> </ol> <p><b>Course Outcomes:</b> After completion of this course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Explore application programs using system calls.</li> <li>2. Implement CPU scheduling algorithms.</li> <li>3. Apply the Banker's algorithm for deadlock avoidance.</li> <li>4. Implement page replacement and disk scheduling techniques.</li> <li>5. Solve producer-consumer problem, reader-writer problem, dining philosophers problem</li> </ol>							

#### List of Experiments

1. Program to implement Unix system calls(fork(),wait(),exec(),sleep())and file management.
2. Program to implement multithread concepts.
3. Program to implement CPU scheduling algorithms:(i)FCFS(ii)SJF(iii)Round Robin
4. Program to implement Shared memory and Inter Process Communication (IPC) techniques.
5. Program to implement Process Synchronization for Dining Philosopher problem
6. Program to implement Process Synchronization for Producer-Consumer problem.
7. Program to implement Process Synchronization for Readers-Writers problem.
8. Program to implement deadlock detection.
9. Program to implement Bankers Algorithm for Deadlock Avoidance.
10. Program to implement Page Replacement Algorithm using FIFO
11. Program to implement the following Page Replacement Algorithms using LRU and LFU.
12. Program to implement FCFS Disk Scheduling Algorithm.
13. Program to implement SSTF Disk Scheduling Algorithms.
14. Case study on Linux Systems

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**Additional programs (Optional):**

**Memory Management Simulator:**

Develop a simulator that demonstrates the effects of different memory allocation strategies (e.g., first fit, best fit, and worst fit) and shows how fragmentation occurs.

Include a visualization of memory blocks and their allocation status.

**Priority-based Process Scheduling Algorithm:**

Implement a priority-based scheduling algorithm with a real-world scenario, such as scheduling tasks in a hospital emergency room where patients are treated based on the severity of their condition.

**Text Books:**

1. Avi Silberschatz, Peter Galvin , Greg Gagne, Operating System Concepts Essentials, 9<sup>th</sup> Edition, Wiley Asia Student Edition, 2017.
2. Naresh Chauhan, Principles of Operating Systems, Oxford University Press, 2014

**Programming Language:** C programming

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Course Code	Course Title				Core/Elective		
<b>SPC 414 AD</b>	<b>Foundations of Data Science Lab</b>				<b>Core</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-			-	2	40	60	1

**Course Objectives**

The students will be able to:

1. Learn basic Data Science using Python
2. Perform basic Data Cleaning, Preprocessing and Model Implementations
3. Communicate insights effectively through visualizations

**Course Outcomes**

After completing this course, the student will be able to:

1. Apply Python Programming for Data science
2. Implement various statistics concepts for the real world problems.
3. Implement descriptive and inferential statistics.
4. Execute regression analysis on Time Series data
5. Visualize and improvise plots for client-side presentations

**1. Data Loading and Exploration:**

- Write a Python program that loads a dataset (e.g., a CSV file, .xls, json and XML format)
- Display the first few rows of the dataset
- Calculate summary statistics (mean, median, etc.) for numerical columns in the dataset.

**2. Data Cleaning and Preprocessing:**

- Write a program to handle missing values (either by imputing them or dropping rows/columns).
- Remove duplicate records from the dataset.
- Normalize or standardize the features (scaling).

**3. Basics of Numpy:**

- Create a Python script that demonstrates numpy array creation.
- Reading and writing with different types of file formats using numpy.
- Implement indexing and slicing operations on numpy arrays.
- Perform basic mathematical operations (e.g., addition, multiplication) using numpy.

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**4. Introduction to Pandas:**

- Reading and writing with different types of file formats using pandas.
- Write a program that showcases Pandas Series and DataFrames.
- Load a sample dataset and clean it (if needed) using Pandas functions.

**5. Data Manipulation with Pandas:**

- Create a Python script that filters, groups, and aggregates data in a DataFrame.
- Write a program to merge or join two datasets using Pandas.

**6. Basic Statistical Tests:**

- Implement t-tests or chi-square tests using appropriate Python libraries.
- Calculate confidence intervals for sample means.

**7. Exploratory Data Analysis (EDA):**

- Write Python code to create scatter plots, line graphs, bar charts, histograms, box plots, and pie charts.
- Calculate correlations between variables using Pandas or other libraries.

**8. Time Series Analysis:**

- Load time series data (e.g., stock prices) into a Pandas DataFrame.
- Calculate moving averages for the time series.
- Build a regression model to predict future values.

**9. Data Visualization:**

- Bar charts, Line charts, Scatter plots and Box plots using Gestalt's Principles.
- Use Matplotlib and Seaborn to create various plots (line plots, bar plots, etc.).
- Plot geographical data (e.g., points on a map) if applicable.

**Additional Programs (Optional):****10. Creating Dashboards using Python Libraries**

- Explore libraries like Plotly or Dash to build interactive data dashboards.

**Text Books:**

1. Chirag shah , "A hands – on introduction to data science" by Cambridge University Press, 2020
2. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques" Morgan Kaufmann Publishers, 2018.
3. Kennedy R. Behrmann, "Foundation Python for Data Science", Addison-Wesley, 2021.
4. Douglas C.Montgomery, Cheryl L. Jen, "Introduction to time series analysis and forecasting", Wiley Series in probability and statistics by (2015)
5. Matthew Ward, Techniques, and Applications "Interactive Data Visualization - Foundation, Techniques, and Application"

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Course Code	Course Title					Core/Elective	
SPC 415 AD	Lab on Software Tools and Techniques					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	-	-	-	40	60	1

**Course Objectives:**

The course should enable students to

1. Learn fundamental R concepts such as variables, data structures. Acquire skills in importing data from various sources (CSV, Excel, SAS, databases), manipulating data (selecting, merging, sorting, aggregating), and managing data types.
2. Develop proficiency in R control structures (loops), enabling effective programming for data analysis and manipulation tasks.
3. Create pie charts and bar charts in R to visualize data insights effectively.
4. Gain familiarity with Power BI, including installation, connecting data sources, creating basic reports and generating various chart types.

**Course Outcomes:** Students will be able to

1. Implement Power BI functionalities and various ways to establish data connection from a single source or multiple sources
2. Clean data, explore various charts, features and techniques used for visualization
3. Create Reports with Power BI
4. Demonstrate how to install and configure R Studio, Apply OOP concepts in R programming.
5. Proficiently use R and Power BI for data manipulation, analysis, and visualization tasks.

**List of Experiments:**

1. **Introduction to R** — Installing R, R environment. **Understanding R data structure** — Variables in R, Scalars, Vectors, Matrices, List, Data frames, Using c, Cbind, Rbind, attach and detach functions in R
  - a. Create a data frame of student details with attributes such as roll number, GPA, soft\_skills, aptitude and placement status.
  - b. Create a matrix with internal marks of students.

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- c. Create a Grocery list using List.
  - d. Create a vector of a specified type and length. Create vector of numeric, complex, logical and character types of length 6.
2. **Importing data:** Reading Tabular Data files, Reading CSV files, Importing data from excel , Importing data from SAS , Accessing database, Saving in R.
  - a. Import and read Iris dataset.
  - b. Visualize the Iris Dataset.
  - c. Summarize the Iris Dataset.
3. **Manipulating Data :** Selecting rows/observations, Selecting columns/fields, Merging data, Relabeling the column names, Converting variable types, Data sorting, Data aggregation.
  - a. Create an organization's employee dataset which should include information about their employees, such as emp\_name, emp\_id, emp\_salary, doj, contact\_no, address, and their role and select first three rows.
  - b. Relabel the column doj as "date-of-joining", emp\_name as "Name".
  - c. Sort the data by Highest Salary to lowest salary.
  - d. Convert the date of joining from String type to Date type.
4. **R Control Structures:** Implement R-Loops with different examples.
  - a. Write a for loop that iterates over the numbers 1 to 7 and prints the cube of each number using print().
  - b. Write a for loop that iterates over the column names of the inbuilt iris dataset and print each together with the number of characters in the column name in parenthesis. Example output: Sepal.Length (12), Use the following functions , print(), paste() and nchar()
5. Create **pie charts** and **bar charts** using R.
  - a. Write a R program to create a simple bar plot of five subjects marks.
  - b. Create a simple pie chart of the employee dataset.
6. **Introduction to Power BI:** Overview of Power BI and its features and setting up PowerBI Desktop
7. **Prepare data in Power BI:** Get data from a csv file, load the data and perform transformations.
8. **Data Modeling:** Create model relationships for the student dataset.
9. **Data Visualization:** Visualize the employees dataset using different charts, maps and plots
10. **Create a Report using Power BI:** Create a report named Student Performance Analysis using the student dataset.

**Additional Programs (Optional):**

1. Introduction and Features of MATLAB and basic command syntax.
2. Writing simple programs to practice knowledge of variable, data types and operators.

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3. Writing different programs with the help of control structures and control loops in MATLAB.
4. Write a programs related with arrays, matrices and vectors.

**Text Books:**

1. Roger, D. Peng, R Programming for Data Science, Leanpub, 2015
2. Brett Powell, Mastering Microsoft Power BI: Expert techniques for effective data analytics and business intelligence, Packt Publishing, 2018.
3. Stormy Attaway, MATLAB: A Practical Introduction to Programming and Problem Solving", Elsevier.

**Reference Books:**

1. Holly Moore, "MATLAB for Engineers", Pearson Education Inc, 2022.
2. Dan Clark, Beginning Power BI: A Practical Guide to Self-Service Data Analytics with Excel 2016 and Power BI, Apress.

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Course Code	Course Title				Core/Elective		
SPW421AD	INTERNSHIP-I				Core		
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	-	-	-	-	50	-	1
<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>To provide students with a skill based training in cutting edge technologies.</li> <li>To develop real time problem solving skills.</li> <li>To expose students to team work, soft skills, technical report writing and presentations</li> </ol> <p><b>Course Outcomes:</b></p> <p>On successful completion of the course, the students will be able to</p> <ol style="list-style-type: none"> <li>Up skill in cutting edge technologies.</li> <li>Acquire practical experience on various stages of software development.</li> <li>Design and develop software to solve real world social problems.</li> <li>Generate reports and deliver effective presentations.</li> <li>Demonstrate effective written and oral communication skills that are needed in software industry.</li> </ol>							

Summer Internship is an important activity of an engineering programme where a student is provided a skill based training. This is introduced as a part of the curriculum for encouraging students to work on problems of interest that is specific to an industry. Internship-I is aimed at providing a primary exposure of industrial project work. This offers the student an opportunity to use the knowledge, gained through fundamental theory and laboratory courses studied in classrooms, for real-time implementation.

Every individual student must enroll for internship in an industry for a period of 4 weeks. The student must submit the internship enrolment details like name and address of the industry, broad area of internship etc. to the Internship Coordinator at the end of the first month after commencement of Semester-IV. The industry must be a Government/Private or any designated R&D organization. This will be during the summer vacation following the completion of the Semester-IV of the B.E. programme. One faculty member (Internal Guide) will be provided to each student to monitor the continuous progress of the project work and to interact with the industry coordinator.

After the completion of the Internship-I, each student will be required to submit technical (i) report and (ii) presentation of the work carried out to the Internship Review Committee (IRC) of the department for evaluation.

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*With effect from Academic Year 2023-24*

A Continuous Internal Evaluation (CIE) of Internship-I for total 50 marks will be done by the Internal Guide (25 Marks) followed by the IRC of the department (25 Marks). One faculty member will coordinate the overall activities related to Internship-I.

**Note:** Credits of Internship-I will be awarded after evaluation in V Semester.

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