Multidisciplinary Courses (MDC)

Course Code	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2501EE01	Basic Electrical & Electronics Engineering	FC	2	-	2	4	50	50	100	-
2501CS01	Programming for Problem Solving Using C	FC	2	-	2	4	50	50	100	-
2501ME18	Operations Research	IC	2	1		3	50	50	100	-
Total			**6**	**1**	**4**	**11**				

Basic Electrical & Electronics Engineering
(Common to CE,ME,ECE,CSE,IT,AIML,CSE(DS),PT&Min.E)

Course Code: 2501EE01	**L**	**T**	**P**	**C**
	2	**0**	**2**	**4**

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

- **CO1:** Analyze the concepts associated to AC and DC circuits.
- **CO2:** Explain the operating principles of motors, generators and measuring instruments.
- **CO3:** Analyze the different energy resources and equipment safety measures.
- **CO4:** Explain the concept and the applications of semiconductor diodes.
- **CO5:** Analyze the basic electronic circuits and interpret numeric information in different code formats.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	3	1	-	1	-	-	2	2	-	-
CO2	2	3	1	-	-	-	-	2	2	-	-
CO3	3	2	1	-	-	-	-	2	2	-	-
CO4	3	2	1	-	-	-	-	2	2	-	-
CO5	3	2	1	-	-	-	-	2	2	-	-

UNIT – I

DC & AC Circuits: DC circuits: Ohm's and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits excited by independent voltage sources for R, L, C parameters, current division, voltage division

AC circuits: Generation of sinusoidal voltage, frequency of generated voltage, average value, RMS value, form, and peak factors. Real power, reactive power, apparent power, and Power factor.

Practice:

1. Verification of Ohm's Law.
2. Verification of KCL and KVL.
3. Verification of KCL, KVL and ohm's law using simulation

UNIT – II

Machines and Measuring Instruments: Principles and operation of DC machines, Transformers – Synchronous Machines - three Phase and single phase induction motors - Moving coil and moving iron instruments, Wheatstone bridge and Megger.

Practice:

1. To study Magnetisation Characteristics of DC shunt generator
2. Measurement of Power and Power factor using Single-phase wattmeter
3. Measurement of Resistance using Wheat stone bridge
4. Measurement of Earth Resistance using Megger.

UNIT – III

Energy Resources, Electricity Bill & Safety Measures: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Thermal, Solar & Wind power generation. Calculation of electricity bill for domestic

appliances. Working principle of Fuse and Miniature circuit breaker (MCB). Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Practice:

1. Calculation of Electrical Energy for Domestic Premises

UNIT – IV

Semiconductor Devices: Intrinsic semiconductors – Extrinsic semiconductors - P type and N type - P-N junction characteristics of P N Junction Diode — Zener Effect — Zener Diode and its Characteristics. Working of simple zener voltage regulator and amplifier - Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics.

Practice:

1. Sketch the V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Sketch the V-I characteristics of Zener Diode and its application as voltage Regulator
3. Plot Input & Output characteristics of BJT in CE and CB configurations.
4. Obtain Frequency response of CE amplifier.

UNIT – V

Basic Electronic Circuits: Block diagram description of a dc power supply, working of a half and full wave, bridge rectifier, filters.

Digital Electronics: Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders.

Practice:

1. Implementation of half wave and full wave rectifiers.
2. Design Half Adder and Full Adder circuits.
3. Verification of truth table for Logic gates using ICs.

Text Books:

1. Basic Electrical and Electronics Engineering, Salivahanan S, Tata McGraw Hill Education (India) Private Limited, New Delhi, 2009, ISBN : 978-0070146129.
2. Principles of Electrical Engineering, V. K. Mehta, R. Mehta, S. Chand & Company Ltd., New Delhi, 2014, ISBN :9352837193.
3. Digital Fundamentals, Thomas Floyd, Prentice Hall, 10th Edition, 2009, ISBN: 9780138146467.

Reference Books:

1. Electronic Devices & Circuit Theory, Robert L. Boylestad and Louis Nashelsky, Pearson 11th Edition, ISBN 9789332542600.
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2009, ISBN: 8177000209.

Web Links:

1. https://nptel.ac.in/courses/108/101/108101091/ (NPTEL Video by Dr. Mahesh B. Patil from IIT Bombay)
2. https://nptel.ac.in/courses/117/106/117106108/ (NPTEL Video by Prof. Nagendra Krishnapura from IIT Madras).

Programming for Problem Solving Using C
(Common to CE,EEE,ME,ECE,CSE,IT,AIML,CSE(DS),PT&Min.E)

Course Code: 2501CS01	**L**	**T**	**P**	**C**
	2	**0**	**2**	**4**

Course Outcomes: At the end of the Course, Student will be able to:

- **CO1:** Demonstrate basics of computer, algorithm and flow chart for problem solving.
- **CO2:** Make use of an appropriate control structures to solve given problems.
- **CO3:** Solve complex problems using arrays and strings.
- **CO4:** Develop modular programming using functions.
- **CO5:** Demonstrate dynamic memory allocations and file handling using file operations.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	3	2	1	3	-	-	2	-	-	1
CO2	2	3	2	1	3	-	-	2	-	-	1
CO3	2	3	2	1	3	-	1	2	-	-	1
CO4	2	3	2	1	3	-	1	2	-	-	1
CO5	2	3	2	1	3	-	1	2	-	-	1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2

UNIT – I

Introduction to Programming and Problem Solving

Introduction to Programming Languages, Basics of a Computer Program- Algorithms, Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms, flowcharts (Using Dia Tool), pseudo code. Structure of C Program, Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, operators, keywords, identifiers, Type Conversion, and Casting.

Practice 1:

1. Explore different platforms
   a. Basic linux environment and its editors like Vi, Vim & Emacs etc.
   b. Exposure to turbo C, gcc.
   c. Explore to hacker rank or any other Online coding platform and compiler environment.
   d. "Hello world" in C.
      https://www.codechef.com/learn/course/c/CDEVINTRO/problems/CDEV004B
   e. Objective: Learn about the syntax of reading from stdin and writing to stdout.
      https://www.hackerrank.com/challenges/hello-world-c/problem?isFullScreen=true

f. Write a simple program to read int, float, char and string using scanf() and display using printf() in all the above given platforms.

2. Basics and Operators
   a. Sum and Difference of 2 numbers.
      Objective: Learn int and float data types.
      https://www.hackerrank.com/challenges/sum-numbers-c/problem?isFullScreen=true
      https://maya.technicalhub.io/owl-program-details/668b9ec2e069313510b0235a
   b. Playing with Characters.
      Objective: Learn how to take a character, a string and a sentence as input in C.
      https://www.hackerrank.com/challenges/playing-with-characters/problem?isFullScreen=true

   c. Bitwise Operators
      Objective: Learn how to work with bits (0,1) and bitwise operators.
      https://www.hackerrank.com/challenges/bitwise-operators-in-c/problem?isFullScreen=true

   d. Conversion of Fahrenheit to Celsius and vice versa.
      https://www.codechef.com/practice/course/c/LPCAS03/problems/LCAS30
      https://maya.technicalhub.io/owl-program-details/66a0c0dda7d31805366af641

   e. Distance travelled by an object.
      https://maya.technicalhub.io/owl-program-details/6687c4e9fd042085d9ec254a

   f. Calculate Simple interest and compound interest.
      https://maya.technicalhub.io/owl-program-details/6687b498dfe02cea4b53e0ab

3. Operators and Expressions, Variables and Type conversions.
   a. Evaluate the following expressions
      i. a/b*c-b+a*d/3
      ii. j = (i++) + (++i)
   b. Square root of a given number.
   c. Find the area of circle, square, rectangle and triangle.
      https://maya.technicalhub.io/owl-program-details/6686546930bfbd35127c869c
      https://maya.technicalhub.io/owl-program-details/6688cf91e467bfe336f8352f
      https://www.hackerrank.com/challenges/rectangle-area/problem?utm_source=chatgpt.com

      https://maya.technicalhub.io/owl-program-details/6688ea3ce467bfe336f8ab9d
   d. Find the maximum of three numbers using conditional operator.
      https://maya.technicalhub.io/owl-program-details/668690d230bfbd35127c9bf5

   e. Take marks of 5 subjects in integers, find the total in integer and average in float.

UNIT – II
Control Structures
Simple sequential programs, Conditional Statements (if, if-else, else if ladder, switch), Loops (for, nested for loop, while, do-while), break and continue, goto statement.

Practice:

1. Conditional Statements
   a. Objective: Understand if and else Conditional statements in C.
      https://www.hackerrank.com/challenges/conditional-statements-in-c/problem?isFullScreen=true
   b. Roots of a Quadratic Equation.
   c. Generate electricity bill.
      https://maya.technicalhub.io/owl-program-details/66868f6730bfbd35127c9ba7
   d. Simulate a calculator using switch case.
   e. Find the given year is a leap year or not.
2. Loops
   a. Objective: Learn the usage of the for loop in C.
      https://www.hackerrank.com/challenges/for-loop-in-c/problem?isFullScreen=true
   b. Sum of the digits of a 5-digit number.
      Objective: Learn the usage of while loop and usage of operators - % and /.
      https://www.hackerrank.com/challenges/sum-of-digits-of-a-five-digit-number/problem?isFullScreen=true
      https://maya.technicalhub.io/owl-program-details/66864717f56afec5c0c917e1
   c. Given number is a prime or not. (Also Prime numbers between a given range.)
      https://maya.technicalhub.io/owl-program-details/6687b69ddfe02cea4b5404a3
   d. Armstrong Number or not.
   e. Palindrome or not.
      https://maya.technicalhub.io/owl-program-details/6687af17dfe02cea4b5376ae
   f. Objective: Print a pattern of numbers using Loops.
      https://www.hackerrank.com/challenges/printing-pattern-2/problem?isFullScreen=true
   g. Construct a Pyramid pattern.
      https://www.codechef.com/practice/course/c/LPCAS02/problems/LCAS20

UNIT – III

Arrays: Arrays indexing, Accessing programs with array of integers, two dimensional arrays, Introduction to Strings, string handling functions.
Sorting Techniques: bubble sort, selection sort.
Searching Techniques: linear, Binary search.

Practice:

1. 1-Dimensional Arrays
   a. Objective: Print the sum and free the memory where the array is stored.
      https://www.hackerrank.com/challenges/1d-arrays-in-c/problem?isFullScreen=true
   b. Objective: Working with indices in array.
   c. Search an element in array (Linear Search).
      https://maya.technicalhub.io/owl-program-details/6687c40ffd042085d9ec15d6
   d. Find min and max elements in array.
      https://maya.technicalhub.io/owl-program-details/66879493dfe02cea4b529041
   e. Insert an element into array.

f. Eliminate duplicate elements from array.
https://maya.technicalhub.io/owl-program-details/66e920a1aca93b27f3364b57
g. Sorting of elements in an array using Bubble sort.

2. 2-Demensional Arrays
   a. Sum of two 2-D arrays.
   https://maya.technicalhub.io/owl-program-details/66864fa9f56afec5c0c924f6
   b. Multiplication of two 2-D arrays.
   c. Transpose of a Matrix.
   d. Trace of a Matrix.
   e. Lower Triangular Matrix.
3. Hacker Rank
   a. Objective: print each word of the sentence in a new line.
   b. Count number of alphabets (lowercase, uppercase, consonants, vowels) and digits Lowercase to Uppercase, Uppercase to Lowercase, Toggle case, Sentential case
   https://maya.technicalhub.io/owl-program-details/6698e2fbcb6bd470f35b73d8
   https://maya.technicalhub.io/owl-program-details/6698ef03cb6bd470f35b7c3e
   c. find the frequency of each digit in the given string.
   https://www.hackerrank.com/challenges/frequency-of-digits-1/problem?isFullScreen=true
   d. Find string length, concatenate 2 strings, reverse a string using built-in and without built-in string functions.
   https://maya.technicalhub.io/owl-program-details/6698ed2dcb6bd470f35b7ae7

UNIT – IV

Functions: Introduction to Functions, Function Declaration and Definition, Function call Return **Types and Arguments**, arrays as parameters, Scope and Lifetime of Variables, **storage classes**, **recursion**, functions and arrays.

Practice: Functions in C

1. Objective: Learn simple usage of functions.
   https://www.hackerrank.com/challenges/functions-in-c/problem?isFullScreen=true
2. Objective: Fibonacci Numbers using recursive function.
   https://www.hackerrank.com/challenges/ctci-fibonacci-numbers/problem
3. Objective: N^{th} factorial using recursion.
4. Objective: Find the super digit of the integer.
5. Implement LCM
6. Objective: Calculate the Nth term of series.
   https://www.hackerrank.com/challenges/recursion-in-c/problem?isFullScreen=true

UNIT – V

Pointer: Introduction to Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, **functions & pointers** modifying parameters inside functions using pointers, Command line Arguments, Dynamic memory allocation, Null Pointer, generic pointer, dangling pointer.

File Handling:-Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.

Practice:

1. Pointers

a. Objective: learn to implement the basic functionalities of pointers in C. https://www.hackerrank.com/challenges/pointer-in-c/problem?isFullScreen=true
b. Objective: Learn using Pointers with Arrays and Functions. https://www.hackerrank.com/challenges/students-marks-sum/problem?isFullScreen=true
c. Objective: sort a given array of strings into lexicographically increasing order or into an order in which the string with the lowest length appears first. https://www.hackerrank.com/challenges/sorting-array-of-strings/problem?isFullScreen=true
d. Find the sum of a 1D array using malloc().
e. Swap two numbers using functions and pointers - call by value and reference.
f. Objective: Dynamic Handling requests by a Librarian to place the books in the shelves. https://www.hackerrank.com/challenges/dynamic-array-in-c/problem?isFullScreen=true

2. File handling concepts
   a) Write text into and read text from a file.
   b) Write text into and read text from a binary file using fread() and fwrite().
   c) Copy the contents of one file to another file.
   d) Merge two files into the third file using command-line arguments
   e) Find no. of lines, words and characters in a file.

Text Books:

1 Programming in C, Rema Theraja, Oxford, 2nd edition. ISBN 93-5497-9
2 "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall. ISBN 13: 9780131103627

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education. ISBN.No: 9352604172
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill. ISBN No. 0071367993
3. Let Us C Yashwanth,Kanetkar, Eighth edition, BPB Publications.ISBN No. 1934015253
4. Programming in C A-Practical Approach, Ajay Mittal. Pearson Education.ISBN No. 9788131729342
5. R G Dromey How to Solve It by Computer (Prentice-Hall International Series in Computer Science.ISBN-13 : 978-0134340012

Web Links:

1 https://www.hackerrank.com/
2 https://onlinecourses.nptel.ac.in/noc22_cs40/preview
3 https://archive.nptel.ac.in/courses/106/104/106104128/

Additional Practice:

S.No.	Difficulty	Problem Name	Link
1	Easy	Add Two Numbers	https://www.codechef.com/practice/course/cpp/PCPP05/problems/FLOW001
2	Easy	Enormous Input Test	https://www.codechef.com/practice/course/basic-programming-concepts/DIFF500/problems/INTEST
3	Easy	ATM	https://www.codechef.com/practice/course/1-star-difficulty-problems/DIFF1200/problems/ATM2
4	Easy	Number Mirror	https://www.codechef.com/practice/course/python/PPY01/problems/START01
5	Easy	Sum of Digits	https://www.codechef.com/practice/course/basic-math/BASICMATH/problems/FLOW006
6	Easy	Remainder	https://www.codechef.com/practice/course/basic-math/BASICMATH/problems/FLOW002
7	Easy	First and Last Digit	https://www.codechef.com/practice/course/basic-programming-concepts/DIFF500/problems/FLOW004
8	Easy	Reverse The Number	https://www.codechef.com/practice/course/logical-problems/DIFF800/problems/FLOW007
9	Easy	Life, the Universe, and Everything	https://staging.codechef.com/practice/course/cpp/PRACTICECPP2/problems/TEST
10	Easy	Chef and Operators	https://www.codechef.com/practice/course/logical-problems/DIFF800/problems/CHOPRT
11	Easy	Difference and Sum	https://www.codechef.com/problems/DIFFSUM
12	Easy	Second Largest	https://www.codechef.com/practice/course/arrays/ARRAYS/problems/LARGESECOND
13	Easy	Two Sum	https://leetcode.com/problems/two-sum/
14	Easy	Reverse Integer	https://leetcode.com/problems/reverse-integer/
15	Easy	Palindrome Number	https://leetcode.com/problems/palindrome-number/
16	Easy	Roman to Integer	https://leetcode.com/problems/roman-to-integer/
17	Easy	Remove Duplicates from Sorted Array	https://leetcode.com/problems/remove-duplicates-from-sorted-array/
18	Easy	Remove Element	https://leetcode.com/problems/remove-element/
19	Easy	Find the Index of the First Occurrence in a String	https://leetcode.com/problems/find-the-index-of-the-first-occurrence-in-a-string/
20	Easy	Length of Last Word	https://leetcode.com/problems/length-of-last-word/
21	Easy	Plus One	https://leetcode.com/problems/plus-one/
22	Easy	Merge Sorted Array	https://leetcode.com/problems/merge-sorted-array/
23	Easy	Majority Element	https://leetcode.com/problems/majority-element/
24	Easy	Single Number	https://leetcode.com/problems/single-number/
25	Easy	Move Zeroes	https://leetcode.com/problems/move-zeroes/

26	Easy	Missing Number	https://leetcode.com/problems/missing-number/
27	Easy	Contains Duplicate	https://leetcode.com/problems/contains-duplicate/
28	Easy	Valid Anagram	https://leetcode.com/problems/valid-anagram/
29	Easy	Valid Parentheses	https://leetcode.com/problems/valid-parentheses/
30	Easy	Fibonacci Number	https://leetcode.com/problems/fibonacci-number/
31	Easy	Climbing Stairs	https://leetcode.com/problems/climbing-stairs/
32	Easy	Binary Search	https://leetcode.com/problems/binary-search/
33	Easy	Number of 1 Bits	https://leetcode.com/problems/number-of-1-bits/
34	Easy	Hamming Weight	https://leetcode.com/problems/number-of-1-bits/description/
35	Easy	Power of Two	https://leetcode.com/problems/power-of-two/
36	Easy	Power of Three	https://leetcode.com/problems/power-of-three/
37	Easy	Same Tree	https://leetcode.com/problems/same-tree/
38	Easy	Maximum Subarray	https://leetcode.com/problems/maximum-subarray/
39	Medium	Chef and Notebooks	https://www.codechef.com/problems/CNOTE
40	Medium	Chef and Wildcard Matching	https://www.codechef.com/search?q=TWOSTR
41	Medium	Minimum Moves	https://www.codechef.com/search?q=SALARY
42	Medium	Lucky Four	https://www.codechef.com/search?q=LUCKFOUR
43	Medium	Maximum Difference	https://www.codechef.com/search?q=MAXDIFF
44	Medium	Uncle Johny	https://www.codechef.com/search?q=JOHNY
45	Medium	Chef and Strings	https://www.codechef.com/search?q=CHEFSTLT
46	Medium	Two vs Rib	https://www.codechef.com/search?q=TWOVRIB
47	Medium	Chef and Array	https://www.codechef.com/search?q=CHEFARRP
48	Medium	Add Two Numbers	https://leetcode.com/problems/add-two-numbers/
49	Medium	Longest Substring Without Repeating Characters	https://leetcode.com/problems/longest-substring-without-repeating-characters/
50	Medium	Longest Palindromic Substring	https://leetcode.com/problems/longest-palindromic-substring/
51	Medium	3Sum	https://leetcode.com/problems/3sum/
52	Medium	Container With Most Water	https://leetcode.com/problems/container-with-most-water/

53	Medium	Integer to Roman	https://leetcode.com/problems/integer-to-roman/
54	Medium	String to Integer (atoi)	https://leetcode.com/problems/string-to-integer-atoi/
55	Medium	Divide Two Integers	https://leetcode.com/problems/divide-two-integers/
56	Medium	Rotate Image	https://leetcode.com/problems/rotate-image/
57	Medium	Set Matrix Zeroes	https://leetcode.com/problems/set-matrix-zeroes/
58	Medium	Spiral Matrix	https://leetcode.com/problems/spiral-matrix/
59	Medium	Jump Game	https://leetcode.com/problems/jump-game/
60	Medium	Permutations	https://leetcode.com/problems/permutations/
61	Medium	Combination Sum	https://leetcode.com/problems/combination-sum/
62	Medium	Search in Rotated Sorted Array	https://leetcode.com/problems/search-in-rotated-sorted-array/
63	Medium	Group Anagrams	https://leetcode.com/problems/group-anagrams/
64	Medium	Sort Colors	https://leetcode.com/problems/sort-colors/
65	Medium	Subsets	https://leetcode.com/problems/subsets/
66	Medium	Reverse Linked List II	https://leetcode.com/problems/reverse-linked-list-ii/
67	Medium	Add Two Numbers II	https://leetcode.com/problems/add-two-numbers-ii/
68	Medium	Reorder List	https://leetcode.com/problems/reorder-list/
69	Medium	Linked List Cycle II	https://leetcode.com/problems/linked-list-cycle-ii/
70	Medium	K-th Largest Element in an Array	https://leetcode.com/problems/kth-largest-element-in-an-array/
71	Medium	Product of Array Except Self	https://leetcode.com/problems/product-of-array-except-self/
72	Medium	Word Search	https://leetcode.com/problems/word-search/
73	Medium	Unique Paths	https://leetcode.com/problems/unique-paths/
74	Medium	Minimum Path Sum	https://leetcode.com/problems/minimum-path-sum/
75	Medium	Temperature Converter - II	https://www.codechef.com/practice/course/c/LPCAS03/problems/LCAS30B
76	Medium	Reverse	https://www.hackerrank.com/challenges/reverse-array-c/problem?isFullScreen=true

77	Medium	Sentence in a new line	https://www.hackerrank.com/challenges/printing-tokens-/problem?isFullScreen=true
78	Hard	Median of Two Sorted Arrays	https://leetcode.com/problems/median-of-two-sorted-arrays/
79	Hard	Regular Expression Matching	https://leetcode.com/problems/regular-expression-matching/
80	Hard	Wildcard Matching	https://leetcode.com/problems/wildcard-matching/
81	Hard	Trapping Rain Water	https://leetcode.com/problems/trapping-rain-water/
82	Hard	First Missing Positive	https://leetcode.com/problems/first-missing-positive/
83	Hard	Longest Valid Parentheses	https://leetcode.com/problems/longest-valid-parentheses/
84	Hard	Merge k Sorted Lists	https://leetcode.com/problems/merge-k-sorted-lists/
85	Hard	Reverse Nodes in k-Group	https://leetcode.com/problems/reverse-nodes-in-k-group/description/
86	Hard	Sudoku Solver	https://leetcode.com/problems/sudoku-solver/
87	Hard	N-Queens	https://leetcode.com/problems/n-queens/description/
88	Hard	Edit Distance	https://leetcode.com/problems/edit-distance/
89	Hard	Word Ladder II	https://leetcode.com/problems/word-ladder-ii/
90	Hard	Maximal Rectangle	https://leetcode.com/problems/maximal-rectangle/
91	Hard	Binary Tree Maximum Path Sum	https://leetcode.com/problems/binary-tree-maximum-path-sum/
92	Hard	Serialize and Deserialize Binary Tree	https://leetcode.com/problems/serialize-and-deserialize-binary-tree/
93	Hard	Variadic functions in C	https://www.hackerrank.com/challenges/variadic-functions-in-c/problem?isFullScreen=true
94	Hard	Small Triangles, Large Triangles	https://www.hackerrank.com/challenges/small-triangles-large-triangles/problem?isFullScreen=true
95	Hard	Permutations of Strings	https://www.hackerrank.com/challenges/permutations-of-strings/problem?isFullScreen=true

Maya Programs

S.No.	Problem Name	Maya Program Link
1	Can Cross the Bridge	https://maya.technicalhub.io/owl-program-details/6686308df56afec5c0c8e2dd
2	Hypotenuse	https://maya.technicalhub.io/owl-program-details/6686404ef56afec5c0c90135
3	Heron's Formula	https://maya.technicalhub.io/owl-program-details/66864474f56afec5c0c911f5
4	Loss Percentage	https://maya.technicalhub.io/owl-program-details/66864868f56afec5c0c91a4a
5	King Tours	https://maya.technicalhub.io/owl-program-details/66864c96f56afec5c0c921f1

6	Profit Percentage	https://maya.technicalhub.io/owl-program-details/66865237f56afec5c0c92694
7	Area and Perimeter of Square	https://maya.technicalhub.io/owl-program-details/6686546930bfbd35127c869c
8	Volume of Sphere	https://maya.technicalhub.io/owl-program-details/6686565530bfbd35127c8818
9	Required Points	https://maya.technicalhub.io/owl-program-details/66865b1130bfbd35127c8a04
10	Instant Noodles	https://maya.technicalhub.io/owl-program-details/66865ddb30bfbd35127c8c0a
11	Find Second Number	https://maya.technicalhub.io/owl-program-details/668660a530bfbd35127c8cde
12	Kmph to Mps	https://maya.technicalhub.io/owl-program-details/668663ce30bfbd35127c8dfb
13	Inches to Centimeters	https://maya.technicalhub.io/owl-program-details/6686665e30bfbd35127c8f3a
14	Capacity	https://maya.technicalhub.io/owl-program-details/668678aa30bfbd35127c95b9
15	Average of Two Numbers	https://maya.technicalhub.io/owl-program-details/6687b002dfe02cea4b5389d6
16	Compound Interest	https://maya.technicalhub.io/owl-program-details/6687b498dfe02cea4b53e0ab
17	Average Weight	https://maya.technicalhub.io/owl-program-details/6687b93edfe02cea4b54367a
18	Arithmetic Operations	https://maya.technicalhub.io/owl-program-details/6687bda0dfe02cea4b5488a1
19	Distance Between Two Points	https://maya.technicalhub.io/owl-program-details/6687c4e9fd042085d9ec254a
20	Days into Years, Weeks	https://maya.technicalhub.io/owl-program-details/6687cad1fd042085d9ec95a8
21	Convert Seconds to Hours, Minutes and Seconds	https://maya.technicalhub.io/owl-program-details/6688c926e467bfe336f8007b
22	Hours and Minutes	https://maya.technicalhub.io/owl-program-details/6688e4f0e467bfe336f89673
23	Romeo and Juliet	https://maya.technicalhub.io/owl-program-details/6688e068e467bfe336f87a8b
24	Gross Salary of an Employee	https://maya.technicalhub.io/owl-program-details/6688dd95e467bfe336f87682
25	Surface Area and Volume of a Cube	https://maya.technicalhub.io/owl-program-details/6688d909e467bfe336f872ca
26	Area of Trapezium	https://maya.technicalhub.io/owl-program-details/6688d637e467bfe336f86c5e
27	Swap Two Numbers	https://maya.technicalhub.io/owl-program-details/6688d2d0e467bfe336f84f55
28	Last Two Digits of a Given Year	https://maya.technicalhub.io/owl-program-details/6688ccfae467bfe336f81f90
29	Arithmetic Operations	https://maya.technicalhub.io/owl-program-details/6687bda0dfe02cea4b5488a1
30	Uppercase Letters in a String	https://maya.technicalhub.io/owl-program-details/669a2453c03fc56b320b215c
31	Factors Finding	https://maya.technicalhub.io/owl-program-details/66866c4a30bfbd35127c90b4

32	String Copy	https://maya.technicalhub.io/owl-program-details/669a03ded62716a9c6d4fa9a
33	Recursive Digit Sum	https://www.hackerrank.com/challenges/recursive-digit-sum/problem

	Basic Programs	**Aditya's Internal Coding Platform (Maya)**	**Code chef**	**Hacker rank**	**Leet code**	**Total**
Unit-1	4	8	2	5	0	**19**
Unit-2	4	4	1	4	0	**13**
Unit-3	8	7	0	2	0	**17**
Unit-4	3	0	0	3	0	**6**
Unit-5	7	0	4	4	0	**15**
Additional Practice	0	33	22	5	68	**128**
Total	**26**	**52**	**29**	**23**	**68**	**198**

Operations Research

Course Code: 2501ME18	L	T	P	C
	2	1	0	3

Course Outcomes:

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

- **CO1:** Formulate and solve a real-world problem using Graphical and Simplex algorithms
- **CO2:** Analyse the optimal solution in Transportation and Assignment problems
- **CO3:** Analyse the optimal solutions in theory of games and sequencing problem using graphical and analytical methods
- **CO4:** Analyse the optimal and minimal solutions in the network models using PERT & CPM and Project crashing
- **CO5:** Examine the queue characteristics and optimal solutions using Queueing and Simulation Models

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	-	-	-	1	1	-	-	-	2
CO2	3	2	-	-	-	1	1	-	-	-	2
CO3	3	2	-	-	-	1	1	-	-	-	2
CO4	3	2	-	-	-	1	1	-	-	2	2
CO5	3	2	-	-	-	1	1	-	-	-	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

UNIT – I

Linear programming: Formulation of linear programming problem, Graphical solution, Simplex method, Big-M method, Two Phase method, Duality, Post-optimality and Sensitivity analysis.

UNIT – II

Transportation Problem: Mathematical model, Methods for finding initial solution: North West Corner Method, Least Cost method, Vogel's approximation method (VAM), Test for optimality, Degeneracy, Modified Distribution(MODI) method.

Assignment problem: Hungarian method, Travelling Salesman problem

UNIT – III

Theory of Games: Two person- zero sum games, Saddle point, Value of the game, Pure and mixed strategies, Rules of dominance, Algebraic method, Graphical method.

Job Sequencing: Introduction to job sequencing - n jobs-1 machine case- Johnson's algorithm- n jobs -2 machines, 3 machines cases- 2 jobs-m machines case-Graphical Solution.

UNIT – IV

Network flow models: Min cost flow problem, Max flow problem.

Project Planning: Critical path computations in CPM/PERT- Project Crashing.

UNIT – V

Queuing theory and its applications: Introduction, components of a queuing problem, classification of queues, steady, transient and explosive states of a queue, Roles of Poisson process and exponential distribution in queuing theory, Queuing models, Kendall's Notation, Single Server and Multi Server Models with Limited population. (M/M/1: ∞ /FIFO, M/M/1: N/FIFO, M/M/C: ∞ /FIFO)

Simulation: Monte Carlo simulation; Random number generation; Discrete and continuous simulation-Applications to Inventory and Queueing models.

Text Books:

1. Operations Research: An Introduction ,H. A. Taha, , Pearson Education Limited, 11th Edition, 2019, ISBN: 978-9352865277.
2. Operations Research applications, A.Ravi Ravindra, CRC Press, 1st edition, 2019, ISBN: 9780367386467

Reference Books:

1. Introduction to Operations Research, Hillier and Lieberman, CBS Publishers and Distributors, 7th edition, 2002, ISBN: 9780072535105.
2. Operation Research: Theory and Applications, Sharma, J. K. - Macmillan Publishers, 5th edition, 2012, ISBN: 9789350593363.

Web Links:

1. https://orc.mit.edu/academics/master%E2%80%99s-operations-research
2. https://or.stanford.edu/