MALNAD COLLEGE OF ENGINEERING, HASSAN

(An Autonomous Institution Affiliated to VTU, Belagavi)

Autonomous programme
Bachelor of Engineering

DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING

SYLLABUS

III Semester & IV Semester

(2023-24 Admitted Batch)

Academic Year 2024-2025

VISION

To become a prominent department of Computer Science & Engineering producing competent professionals with research and innovation skills, inculcating moral values and societal concerns.

MISSION

1. Impart world class engineering education to produce technically competent engineers.
2. Provide facilities and expertise in advanced computer technology to promote research.
3. Enhance Industry readiness and entrepreneurial abilities through innovative skills
4. Nurture ethical values and social responsibilities

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1 : Graduates will be efficient software developers in diverse fields and will be successful professionals and/or pursue higher studies.

PEO 2 : Graduates will be capable to adapt to new computing technology for professional excellence and Research and will be lifelong learners.

PEO 3 : Graduates will work productively exhibiting ethical qualities for the betterment of society.

PEO 4 : Graduates will possess leadership qualities, work harmoniously in a team with effective communication skills.

PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, andengineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information toprovide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports anddesign documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering andmanagement principles and apply these to one's own work, as a member and leader in a team, to manageprojects and in multidisciplinary environments.

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Upon graduation, students with a degree B.E. in Computer Science & Engineering will be able to:

PSO – 1: To make the students industry ready by facilitating them with software tools in recent technologies

PSO – 2: To develop IT based solutions for problems in diverse domains

Admitted Batch : 2023-24
Academic Year : 2024-25
Scheme & Syllabus for II Year

THIRD SEMESTER					
Course Category	**Course Code**	**Course Title**	**L-T-P (Hours)**	**Credits**	**Contact Hours**
BSC	23MACS301	Mathematics for Computer Science - III	3-1-0	3	4
IPCC	23CS302	Digital Design and Computer Organization	3-0-2	4	5
PCC	23CS303	Operating Systems	3-0-0	3	3
PCC	23CS304	Data Structures and its Applications	3-1-0	3	4
PCCL	23CS305	Data Structures Laboratory	0-0-2	1	2
PCCL	23CS306	Unix and Shell Programming Laboratory	0-0-2	1	2
(ESC/ETC /PLC)	23CS307X	Engineering Science Course (ESC/ETC/PLC)	2-0-2	3	4
AEC	23CS308X	Ability Enhancement Course	0-0-2	1	2
UHV	23SCR	Social Connect and Responsibility	0-0-2	1	2
BSC	23BCM301	Bridge Course Mathematics -I (Mandate Non-CreditCourse)	3(A)-0-0	AUDIT	3
MC	23NYP1	NSS, YOGA, PE	0-0-2	AUDIT	2
			Total	**20**	**33**

Engineering Science Course (ESC/ETC/PLC)		
ESC/ETC/PLC	23CS307A	OOP with Java
ESC/ETC/PLC	23CS307B	OOP with C++

Ability Enhancement Course		
AEC	23CS308A	R Programming
AEC	23CS308B	Data Analytics with Excel
AEC	23CS308C	Data Visualization with Python
AEC	23CS308D	Version Controller with GiT

FOURTH SEMESTER					
Course Category	**Course Code**	**Course Title**	**L-T-P (Hours)**	**Credits**	**Contact Hours**
BSC	23MACS401	Mathematics for Computer Science - IV	3-1-0	3	4
PCC	23CS402	Design and Analysis of Algorithms	3-0-0	3	3
IPCC	23CS403	Microcontroller and Embedded Systems	3-0-2	4	5
IPCC	23CS404	Database Management Systems	3-0-2	4	5
PCCL	23CS405	Algorithms Laboratory	0-0-2	1	2
ESC/ETC/ PLC	23CS406X	Engineering Science Course (ESC/ETC/PLC)	3-0-0	3	3
AEC	23CS407X	Ability Enhancement Course	0-0-2	1	2
BSC	23CS408	Biology for Engineers	0-0-2	1	2
UHV	23UHV	Universal Human Values	0-0-2	1	2
MC	23NYP2	NSS, YOGA, PE	0-0-2	AUDIT	3
			Total	**21**	**31**

Engineering Science Course (ESC/ETC/PLC)		
ESC/ETC/PLC	23CS406A	Optimization Techniques
ESC/ETC/PLC	23CS406B	Discrete Mathematical Structures
ESC/ETC/PLC	23CS406C	Graph Theory and Combinatorics

Ability Enhancement Course		
AEC	23CS407A	Computer Assembly and Networking
AEC	23CS407B	Introduction to Power Bi
AEC	23CS407C	Technical writing using Latex

Course Title	MATHEMATICS FOR COMPUTER SCIENCE ENGINEERING - III		
Course Code	23MACS301	L-T-P	(3-1-0) 3
Exam	3 Hrs.	Hours/Week	4
SEE	50 Marks	Total Hours	40L+13T

Course Objective: Students will be able to use appropriate data structures for solving problems.
Course outcomes: At the end of course, student will be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Utilise the concept of consistency of system of equations tosolve the engineering application problems and compute the number of linearly independent vectors.	1	-
2.	Examine for the existence of diagonalization of matrix, find the suitable matrix of transformations so as to get the required image and analyse the system of equations to compute the number of linearly independent Eigen vectors.	1,2	-
3.	Compute Laplace transform on simple functions , Fourier series of periodic functions, the orthogonal basis, QR factors of Matrices, and solve homogeneous differential equations using matrices	1	-
4.	Examine for adopting different techniques of integration so as to compute Fourier series, Laplace transform of a given function.	1,2	-
5.	Model the real-life problems/engineering application problems and solve the same.	1,2	-

MODULE – 1	10 Hrs.

Laplace Transforms: Introduction, Definition, Importance of Laplace transform in engineering applications, properties, Laplace transform of standard functions, Laplace transform of derivatives, Laplace transform of periodic functions, unit-step functions.
Inverse Laplace Transforms: Definition and general properties, Convolution theorem – illustrative examples, Initial value problems. To solve Applications of initial value problems in engineering using Laplace transform
Self-Study--Unit impulse functions (Dirac – delta function). Application of Fourier series to Laplace equation.

MODULE – 2	10 Hrs.

Fourier Series: Periodic functions and their graphical representation, to find the function for standard graphs, to find Fourier series by change of interval method, to represent the experimental data as a Fourier series using the method - Practical harmonic analysis. application of Fourier series in engineering-To represent the signal (wave form) in terms of Fourier series, Fourier series representation for the excitation described by the wave form, graphs of Fourier series approximating the given function.
Self-Study-- Half range series method. Applications of Fourier transforms/ fast Fourier transforms in computer science engineering.

MODULE – 3	10 Hrs.

Linear Algebra: Importance of Matrices in engineering. Rank of a matrix. Consistency of non-homogeneous and homogeneous system of equations, Solution of the system of linear equations by Gauss elimination method and Gauss – Seidel iterative method. Linearly dependent and independent vectors. Special matrices-matrix of rotation, reflection, translation. To find the matrix of transformation whenthe image of some points is given**. Applications** of solution of system of equations to balance the chemical equations.

Self-Study-- Traffic flow problem, to find the suitable combination of food stuff so as to get the desired nutrients as prescribed by a dietician.

MODULE – 4	**10 Hrs.**

Linear Algebra: Eigen values and Eigenvectors, properties, Illustrative examples, Applications-Stretching of an elastic membrane, to determine the growth of a population model. Roleof Eigen values, eigenvectors in determining natural frequency Rayleigh power method to find the highest Eigen value. Diagonalization and powers of 3X3 matrices when Eigen values are already given. Gram Schmidt process, QR-factorization, symmetric matrices and quadratic forms, Matrix method to solve homogeneous differential equations of order 2, degree 1.

Self-Study--Stability analysis of differential equations which governs the dynamical systems using the concept of Eigen value, eigenvectors. Applications of system of equations, Eigen value, eigenvectors, linear transformation in computer science. Application of Eigen value Eigen vectors in data compression, Signature testing, Face recognition. Google page ranking**.**

TUTORIAL:

1. Need to study in rank of a matrix -L3
2. Examples on rank of a matrix and consistency -L3
3. Importance of solution of system of equation in application problems traffic flow –L4
4. Examples on Eigen values and Eigen vectors and dioganalization -L3
5. A report on role of Eigen values and Eigen vector in engineering –L4
6. To fit a Fourier series to the experimental data –L4
7. Examples on Fourier series(change of interval method)-L4
8. Examples on Laplace transform of periodic functions -L3
9. Examples on Laplace transform of unit step- function -L3
10. Examples on Laplace transform of initial value problem -L3
11. A report the application of Fourier series in engineering –L4
12. A report the application of Laplace transform in engineering –L4
Importance of solution of system of equation in application problems chemical reaction-L4

ACTIVITIES:

1. To represent saw tooth periodic motion of a follower operated by a Cam which rotates uniformly, in the form of Fourier series
2. Application of Fourier series to Laplace equation, heat conduction.
3. Fourier series representation for the excitation described by the wave form,
4. Role of Eigen values, eigenvectors in determining natural frequency, mode shapes of equations ofmotions (Spring mass system).
5. Lenovo input output method – application to balance the economy of a Country.
6. Applications of factorization of matrices-Google recommendation.
7. Jordan canonical form when minimal polynomial and characteristic polynomial is given and itsapplication in Engineering.
8. Diagonalize a matrix and determining the principal stresses.
9. Application of Laplace transformation.
10. Application of Eigen value and Eigen vectors in data compression, Signature testing, Face recognition. Google page ranking.
11. Least square solution of system of equations- a matrix approach
12. Unit impulse functions (Dirac – delta function)- application.

Note – 1. Theorems and properties without proof. Applicable to all the Modules.
2. Self study part is not included for Semester End

Text Books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44th edition, 2016.
2. Linear algebra by David c lay, 3rd edition, Pearson education, 2002.

Reference Books:

1. R K Jain and S R K Iyengar, Advanced engineering mathematics by Narosa publishers, 2nd edition, 2005.
2. Calculus by Thomas Finney, 9th edition, Pearson education, 2002.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd. 8th Edition (Wiley student edition) 2004.

Web links

- http://nptel.ac.in/courses.phd?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicerath.org/

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-

Course Title	DIGITAL DESIGN AND COMPUTER ORGANIZATION		
Course Code	23CS302	L-T-P-C	(3-0-2)4
Exam Hrs.	3	Hours / Week	5
SEE	50 Marks	Total Hours	48L+12P

Course Objective: Understand organization of a computer system and design logic circuits.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain architecture and functioning of a digital computer components.	1	-
2.	Illustrate working of combinational and sequential logic circuits	1	-
3.	Design combinational and sequential logic circuit for a given problem.	3	-
4.	Apply arithmetic operations and cache mapping methods on a given problem.	2	-

Course Contents:

MODULE – 1	12 Hrs

Digital Logic : The Basic Gates, The Universal Gates, Boolean Laws and Theorems, Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications - Overlapping, Eliminating Redundant Groups, Don't Care Condition **Data-Processing Circuits:** Multiplexers, Decoders

MODULE – 2	12 Hrs

Flip-Flops: RS flip flop, Gated Flip Flop, Edge triggered flip-flop, D FLIP-FLOP, Edge-triggered D FLIP-FLOP, Edge-triggered FLIP-FLOP, JK Master-slave FLIP-FLOP. Various Representation of FLIP-FLOPs. Analysis of sequential Circuits, Conversion of Flip Flops**, Registers:** Types of Registers **Counters:** Counter Design as a Synthesis problem

Self-Study: Applications of Registers **,**Asynchronous and Synchronous Counters

MODULE – 3	12 Hrs

Basic Structures of Computers: Functional units; Basic Operational Concepts: Bus Structures, Performance. **Data Organization**: Numbers, Arithmetic operations and characters, Memory Locations and Addresses: Byte addressability, Big-endian & Little-endian assignments, Word Alignment, Accessing Numbers, Characters & Character strings, Addressing Modes. **Input/ Output Organization:** Accessing I/O devices, Interrupts: Interrupt Hardware, Enabling & Disabling Interrupt, Handling Multiple devices, Controlling Device Requests, Exceptions

Self-Study: Computer types ,Generation of Computers

MODULE – 4	12 Hrs

Direct Memory Access: Bus Arbitration. **The Memory System:** Basic Concepts, Cache Memories: Mapping functions, Performance considerations: Interleaving, Hit Rate & Miss Penalty. Arithmetic: Multiplication of Positive numbers: Signed-Operand Multiplication: Booth Algorithm; Fast Multiplication; Bit-pair Recoding of Multipliers; Integer division, IEEE Standard for Floating-Point Numbers

Text Book :

1. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015.
2. Carl Hamacher, Z. Vranesic & S. Zaky, Computer Organization , 5th Edition, McGraw Hill, 2012

Reference Books:

1. William Stallings, Computer Organization and Architecture, 9th Edition, Pearson India, 2013
2. M Morris Mano: Digital Logic and Computer Design, 1st Edition, Pearson, 2013.

MOOC:

http://www.nptelvideos.in/2012/11/computer-organization.html

Laboratory Component

1. In a battery powered computer, the diskette driver motor 1 should be ON iff
   - There is a diskette in the drive
   - The diskette drive door is closed
   - Diskette drive motor 2 is not ON
   - The battery low signal is not present and
   - The computer has started a read operation or the computer has started a write operation

   Design a circuit to solve the above scenario using basic gates.
2. You will gain weight if you eat too much or you do not exercise enough, and your metabolism rate is too low. Design a system such that it alarms you when you gain weight using NAND gates.
3. The circuit breaker will trip iff
   - The hair drier is turned ON
   - The microwave oven is used
   - All the lights in the room are ON or
   - There is a short circuit in any appliance

   Solve the above issue using relevant MUX.
4. In an automated house, two lamps L1 and L2 are controlled by 3 switches: A, B,C. Any one of the lamps should be ON, following the below conditions
   - L1 is ON if switch A and B are open but not C
   - L1 is ON if switch B and C are open but not A
   - L2 is ON if only switch C is open
   - L2 is ON if only switch B is open
   - L2 is ON if switch A or C is open, but not B

   Design a circuit to make the lamp ON using decoder.
5. Assume you are generating and transmitting binary data from one place to another. Check whether the sent data is transmitted properly.
6. Assume you need to send a secret message consisting of numbers from 1 to 9 and letters from A to F. Secret message is encoded using excess 3 code. Design a circuit using ADDER IC to send a secret message to your friend.
7. Consider a computer operator who needs to generate a sequence 1011 continuously which is transmitted across the network. Design a circuit to implement this job.
8. Consider a scenario where in you want to take print out of few selected random pages in sequence numbered from 0 to 15. Design a circuit to achieve this task using J-K Flip-flops.
9. Design and implement a 3-stage up/down counter that counts from a preset value using Decade presentable counter ICs. Display the result suitably.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	3		-	-	-	-	-	-	-	-	-	-	-

Course Title	OPERATING SYSTEMS			
Course Code	23CS303		(L-T-P) C	(3-0-0)3
Exam. Hours	3		Hours / Week	3
SEE	50 Marks		Total Hours	40

Course Objective: Understand the role of Operating system in managing computer resources.

Course Outcomes (COs) : Upon completion of the course, students shall be able to :

COs	Statement	Mapping to POs	Mapping to PSOs
1.	Explain fundamental concepts of operating system.	1	-
2.	Apply resource management strategies in operating system.	3, 5, 9, 10	2
3.	Explore various process synchronization techniques.	2	-
4.	Use Suitable algorithms to handle deadlock.	3	2

Course Contents:

MODULE – 1	10 Hrs

Introduction to Operating Systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation;

MODULE – 2	10 Hrs

Operating System structure; Virtual machines. **Process Management**: Process concept; Process scheduling; Operations on processes; Inter- process communication, Threads: Overview; Multithreading models; Threading issues. Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling;

MODULE – 3	10 Hrs

Process Synchronization: Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization.

Deadlocks: Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

MODULE – 4	10 Hrs

Memory Management: Main Memory: Background; Swapping; Contiguous memory allocation; Paging; Segmentation. Virtual Memory Management: Background; Demand paging; Page replacement. **Mass-Storage Structures:** Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management

Text Book:

Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley-India, 2012.

Reference Books:

1. D.M. Dhamdhere: Operating systems - A concept based Approach, 3rd Edition, Tata McGraw- Hill, 2006.
2. P.C.P. Bhatt: Operating Systems, 2nd Edition, PHI, 2006.
3. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 1990.

MOOC:

http://nptel.ac.in/courses/106108101/

Activity:

1. Consider the banking service and use the appropriate scheduling algorithm for the below scenarios.
    - Physically handicap
    - Senior citizen
    - Lapsed token
    - Based on token
    - Different services offered by the bank
2. In an online shopping you wish to purchase an item which is out of stock. Apply producer consumer problem technique to address the given scenario
3. Simulate the concept of Dining-Philosophers problem.
4. Assume that your wardrobe is full and you want to replace with new ones. Make use of the available replacement technique and solve.

Course Articulation matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	3	-	3	-	-	-	2	1	-	-	-	2
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	2

Course Title	DATA STRUCTURES AND ITS APPLICATIONS		
Course Code	23CS304	L-T-P-C	(3-1-0)3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	40L+10T

Course Objective: To be able to use appropriate data structures for designing programs.

Course Outcomes (COs) : Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe the operations of linear and non-linear data structures	1	-
2.	Implement operations of linear and non-linear data structures	1	-
3.	Apply suitable data structures to solve a problem	2,3	-
4.	Develop a program using linear and non-linear data structures for a given scenario	2,3	2

Course Contents:

MODULE – 1	10 Hrs

Introduction: Structures and pointers revisited. Introduction to data structures - Basic terminology, Classification, Operations.

The Stack - Definition, Operations, Array Representation of stacks in C Applications of stack: Infix, postfix and prefix, Basic definitions and examples, evaluating a postfix expression, Program to evaluate a postfix expression, converting an expression from infix to postfix, Program in C to convert an expression from infix to postfix.

MODULE – 2	10 Hrs

Recursion - finding GCD, Fibonacci Series, Recursion Types, Tower of Hanoi, and Recursion versus iteration.

Queues - Definition, Array representation of Queues, Operations on Queues, Types of Queues- Circular Queue and its implementation in C, Applications of Queues.

Linked List: Introduction to linked list, linked list versus arrays, Singly linked list operations - Insert, Delete, Display, Search and Traverse.

MODULE – 3	10 Hrs

Other Lists structures: Circular Lists - C Implementation by adding and deleting nodes, Doubly Linked List - C implementation by adding and deleting nodes, Circular doubly linked list, Linked list Applications: Linked Implementation of stacks and Queues, Polynomial Representation.

MODULE – 4	10 Hrs

Trees: Basic Terminology, Types, Representation using array and Linked List. Creating a binary tree from a general tree, Traversing a binary tree- In-order, Pre-order, Post order, Level order, Constructing a binary tree from traversal results**.**

Efficient Binary Trees: Binary Search trees - definition, Operations- Create, Insert, delete, display, Finding height, Finding number of nodes. AVL trees - Definition, Rotations, Constructing an AVL tree.

Text Book:

Data Structures Using C, Second edition, Reema Thereja, Oxford Press, 2017.

Reference Books:

1. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003.
2. Richard F. Gilberg and Behrouz A. Forouzan: Data Structures A Pseudocode Approach with C, Cengage Learning, 2005.
3. Debasis Samanta: Classic Data Structures, 2nd Edition, PHI, 2009.
4. Balagurusamy E, Programming in ANSI C, 7th Edition, Tata McGraw Hill, 2017.

MOOC:

http://nptel.ac.in/keyword_search_result.php?word=data+structures

Problems solved in tutorial classes:

1. Sort array elements using pointers.
2. Design a structure COMPLEX that represents the complex number. Write program to
   i. add complex numbers
   ii. subtract complex numbers
3. Find the factorial of a given number using pointers
4. Reverse an array using pointers
5. Given an array A[] and a number x, check for pair in A[] with sum as x
6. Find the Number Occurring Odd Number of Times
7. Find Median of two sorted arrays
8. Problems on linked list
9. Split a Circular Linked List into two halves
10. Check for balanced parentheses in an expression
11. Find the first circular tour that visits all petrol pumps
12. Maximum Depth or Height of a Tree
13. Check if a binary tree is BST or not
14. AVL Tree construction.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	-	3	2	-	-	-	-	-	-	-	-	-	-	3

Course Title	DATA STRUCTURES LABORATORY		
Course Code	23CS305	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	14P

Course Objective: Design and implement various data structures.

Course Outcomes (COs): Upon the completion of the course the students will be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Implement operations of linear and non-linear data structures statically or dynamically	3	2
2.	Develop programs to demonstrate applications of data structures	3	2
3.	Document the programs executed	10	-

Course Contents:

	Practice Programs
1.	Write a C program to find the maximum and minimum element in an array of n integers. Use onlypointers for referencing the array.
2.	Write a C program for Dynamic Memory allocation of 10 elements and find the largest element.
3.	Write a C program to represent a complex number using structure variable. Write user definedfunctions that accept two complex numbers and finds their sum and difference.
4.	Define a structure Author name with fields: First name, Middle name and Last name. Using the above structure, design another structure Book: ISBN, Author name, Book Title, Price, Publisher, and Edition.Write a function to search a book given the Author name. Using the above function write a C Program tostore N books information and display the details of a book given the author name.
	Exercise Programs
1.	Files are placed one over another in my study room. The file which is at the top is the first one to be removed, i.e. the file which has been placed at the bottom most position remains in the pile of files for the longest period of time. Help me out to add a file and remove the bottom most file from the pile of files.
2.	Consider an algebraic expression which needs to be evaluated by a computer system. Operating System (OS) consumes less time to evaluate if it is in postfix form of the expression. Thus, help your OS to evaluate by converting the expression into its postfix form.
3.	Assume you have converted an algebraic expression into its postfix form to process the expression fast.This expression need to be evaluated for a given set of values. Implement the above.
4.	Assume you come across a toll gate while you are on your way to home town. Illustrate the working of the toll gate using suitable data structure
5.	a) Suppose you want to search a text book in a huge library where books are arranged in alphabetical order. Optimize your search by using recursion. b) Implement Tower of Hanoi problem using recursion.
6.	Consider a traffic signal controlled by a computer system. Traffic signal has three colors: Red, yellowand Green. All these glow in a circular fashion based on the traffic. Implement the above using suitable data structure.

7.	The parking lot has a fixed number of parking spaces. Cars can enter the parking lot and occupy an available space, and they can also exit the parking lot, freeing up the space for other cars. Designing a parking lot management system using a circular queue.
8.	Consider a treasure hunt task where a series of clues are given. Clue1 gives hint to clue2, clue2 Provides hint for clue3 and so on until you can get a hint to the final treasure. Develop an illustration to demonstrate the above scenario.
9.	Consider a list of numbers. Find i. Maximum number ii. Minimum number iii. Sum of all the numbers
10.	The phonebook will contain a list of contacts sorted in ascending order based on their names. Each contact will have a name and a phone number. Developing a phonebook management system using an ordered linked list.
11.	Assume you have an iPod, where in you have stored plenty of songs so that you get engaged during a long journey. If you want to hear a particular song, you need to use forward button to reach that song and can also traverse back using backward button. Implement the following using relevant data structure.
12.	Your text book contains chapters, sections, subsections, subdivisions, etc. Illustrate this scenario of text book using tree structure.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	3	-	-	-	-	-	-	-	-	-	-	3
CO2	-	-	3	-	-	-	-	-	-	-	-	-	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-

Course Title	UNIX AND SHELL PROGRAMMING LABORATORY		
Course Code	23CS306	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	14P

Course Objective: Develop shell scripts.

Course Outcomes (COs) : Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Execute the UNIX commands.	1	-
2.	Develop shell script for a given problem and document the same.	3,10	1,2

Course Contents:

Practice Programs

Execute basic UNIX commands, VI editor commands and File comparing commands.

Exercise Programs

1. a) Write a shell script to read a message "Good Morning" and display it 10 times at regular intervals of 60 seconds.
   b) Write a shell script that accepts a string as a command line argument and reverse it.
2. a) Write a shell script to generate multiplication table.
   b) Write a shell script to print sum of individual digits of a number.
3. a) Write a shell script to search a given pattern in file, if found display the message "Found" or else display "Not found". Accept the pattern and input file as command line arguments.
   b) Write a shell script to accept the pattern and file to be used. If the pattern is not entered display a message "String not entered". If file name is not mentioned display appropriate message.
4. Write a shell script to check whether the given file as read and write and execute permission.
5. Write a shell script that searches a given string in a given file and prints the number of times it repeats, else display proper error message. The script should accept the file has command line argument.
6. Write a shell script to display all the process running in the system every 30 seconds for 5 times using a) while b) for.
7. Write a shell script that takes a command –line argument and reports on whether it is directory, a file, or something else.
8. Write a shell script that accepts one or more file name as arguments and converts all of them to uppercase, provided they exist in the current directory.
9. Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it
10. Write a shell script that computes the gross salary of an employee according to the following rules: i) If basic salary is < 1500 then HRA =10% of the basic and DA =90% of the basic. ii) If basic salary is >=1500 then HRA =Rs500 and DA=98% of the basic the basic salary is entered interactively through the key board.
11. Write a shell script that accepts two integers as its arguments and computes the value of first number raised to the power of the second number.

12. Write an interactive file-handling shell program. Let it offer the user the choice of copying, removing, renaming, or linking files. Once the user has made a choice, have the program ask the User for the necessary information, such as the file name, new name and so on.
13. Write shell script that takes a login name as command – line argument and reports when that Person logs in.
14. Write a shell script which receives two file names as arguments. It should check whether the two file contents are same or not. If they are same then second file should be deleted.
15. Write a shell script to perform the following string operations:
    i. To extract a sub-string from a given string.
    ii. To find the length of a given string.
16. Write a menu driven shell script to perform the following:
    i) List of users who are logged in
    ii) List of files in the current directory
    iii) List of processes of users
    iv) Today's date
    v) Quit to Unix

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	2	-	-	2	2

Course Title	OBJECT ORIENTED PROGRAMMING WITH JAVA		
Course Code	23CS307A	L-T-P-C	(2-0-2)3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	36L+10P

Course Objective: Develop java application programs using object-oriented concepts.
Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain the fundamentals of Object Oriented Programming and Java syntax	1	-
2.	Develop java programs for a given problem using suitable Object Oriented concepts	3,5	1,2
3.	Analyze the syntax and semantics of a given java code/snippet.	2	1

Course Contents:

MODULE – 1 **9 Hrs**

Object Oriented Concepts and Java: Concepts of Object-Oriented programming language: Object, Class, Message passing, inheritance, encapsulation, and polymorphism Difference between OOP and other conventional programming – advantages and disadvantages of OOP.

Java Programming Fundamentals: Java and Java Applications, Java Development Kit (JDK), The Byte Code, The Java Buzzwords, A first Simple program, handling syntax errors, The Java Keywords, Identifiers in Java.

Data Types and Operators: Java's Primitive Types, ACloser Look at Variables, The Scope and Lifetime of Variables, Operators: Arithmetic, Bitwise, Relational, Boolean Logical, Assignment Operators, the '?' Operator, Type conversion and Casting, Arrays, Strings.

MODULE – 2 **9 Hrs**

Program Control Statements:Input characters from the Keyboard, if statement, Nested ifs, if-else-if Ladder, Switch Statement, Nested switch statements, for Loop, Enhanced for Loop, While Loop, do-while Loop, Nested Loops, Use of break and continue.

Introducing Classes, Objects and Methods: Class Fundamentals, Declaring Objects, Object Reference Variables, Methods, Constructors, the "This" keyword, Garbage collection, Overloading Methods and constructors, Argument Passing, Returning Objects, Access Control, Understanding Static, Nested and Inner Classes.

MODULE – 3 **9 Hrs**

Inheritance: Inheritance Basics, Member Access and Inheritance, Constructors andinheritance, Using super to C all Superclass constructors, Using super to Access Superclass Members, Creating a Multilevel Hierarchy, When are Constructors Executed, Superclass References and Subclass Objects, Method Overriding, Overridden Methods support polymorphism, Why overridden Methods, Using Abstract Classes, Using final, The object class.

MODULE – 4 **9 Hrs**

Interfaces: Interface Fundamentals, Creating an Interface, Implementing an Interface, Implementing Multiple Interfaces, Interfaces can be extended, NestedInterfaces. Packages: Package Fundamentals, Packages and Member Access, Importing Packages, Static import.

Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and Catch, Multiple catch Clauses, throw, finally, Java's Built-in Exceptions, Customized exceptions.

Text Books:

1. Java Fundamentals, A comprehensive Introduction by Herbert Schildt, Dale Skrien.Tata McGraw Hill Edition 2013 (Chapters 1,2,3,4,5,6,7,8,9,10,12)
2. Java –The complete Reference, by Herbert Schildt Eight Edition Tata Mcgraw Hill Education (Chapter 19).

Reference Books:

1. Programming in JAVA2 by Dr K Somasundaram ,Jaico publications
2. Java Programming by Hari Mohan Pandey, Pearson Education, 2012.
3. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson**.**

MOOCs:

1. http://nptel.ac.in/courses/106106147/
2. http://www.nptelvideos.com/java/java_video_lectures_tutorials.php
3. https://www.youtube.com/watch?v=0KL_zftem4g
4. https://www.coursera.org/specializations/object-oriented-programming

Laboratory component:

Write and execute the following programs in java:

1. Write java programs
    a. To print Fibonacci series without using recursion and using recursion.
    b. To check prime numbers.
    c. To sort an array elements using bubble sort algorithm.
2. Create a class called account with the data members (accNum: integer, name: string, phoneNum:integer, balAmt:float) and following methods:
    a. getInput() to get input from the user.
    b. deposit() method which takes the amount to be deposited in to his/her account and do the calculation.
    c. withdraw() method which gets the amount to be withdrawn from hi/her account.
    d. Print the appropriate results.
3. Define a stack class to implement the stack data structure. Include constructors to perform initialization, method push to push an element into the stack, method pop to remove an element from the stack and display method to display the elements of the stack.
4. Define a class Complex with data members as two complex numbers, constructors for initialization these numbers, members, methods to add and subtract two complex numbers.
5. Write a java program to work with strings:
    a. Program to check whether a string is a Palindrome
    b. Read a text and count all the occurrences of a particular word.
    c. Replace a substring in the given string,
    d. Rearrange the string and rewrite in alphabetical order.
    e. Compare two string ignoring case.
    f. Concatenate two strings.
6. Write a Java program to create a class called Shape with a method called getArea(). Create a subclass called Rectangle that overrides the getArea() method to calculate the area of a rectangle.
7. Write a Java program to create an abstract class BankAccount with abstract methods deposit () and withdraw(). Create subclasses: SavingsAccount and CurrentAccount that extend the BankAccount class and implement the respective methods to handle deposits and withdrawals for each account type.
8. Write a Java program that reads a list of integers from the user and throws an exception if any numbers are duplicates.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	2	3	-	-	-	-	-	-	-	-	-	-	-

Course Title	OBJECT ORIENTED PROGRAMMING WITH C++		
Course Code	23CS307B	L-T-P-C	(2-0-2)3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	36L+10P

Course Objective: Students will be able to solve real world problems using Object oriented concepts.

Course Outcomes (COs): Upon completion of the course, students shall be able to

#	Course outcomes	Mapping to POs	Mapping to PSOs
1.	Explain the object-oriented programming concepts.	1	-
2.	Develop reusable and extensible programs using Inheritance.	3	-
3.	Implement the concept of Encapsulation, Polymorphism and exception handling.	3	-
4.	Design the solution to a real world problem using Object – Oriented programming concepts.	3	-

Course Contents:

MODULE – 1	9 Hrs.

Introduction to Object Oriented Programming: A Look at Procedure-Oriented Programming, Object-Oriented Programming Paradigm, Basic Concepts of Objet-Oriented Programming, Benefits of OOP, Object-Oriented Languages, Applications of OOP. A Simple C++ Program, More C++ Statements, Structure of C++ Program, An Example with Class, Tokens, Keywords, Identifiers and constants, Reference Variables, Operators in C++, Scope resolution operator, Expressions and their types– Special assignment expressions.

MODULE – 2	9 Hrs.

Functions in C++: Function prototyping, Call by reference, Return by reference, Inline functions, Default arguments, Function overloading.

Classes and Objects: Specifying a Class, Defining Member Functions, A C++ Program with Class, Static Data Members, Static Member Functions, Arrays of Objects, Objects as Function Arguments, Friend Functions, Returning Objects, Constructors, Parameterized Constructors, Multiple Constructors in a class, Copy Constructor, Destructors.

MODULE – 3	9 Hrs.

Operator Overloading: Defining Operator Overloading – Overloading Unary Operators – Overloading Binary Operators - Overloading Binary Operators using Friend function – Manipulation of strings using Operators – Rules for Overloading Operators. **Inheritance:** Derived class Constructors, destructors, Types of Inheritance, Defining Derived classes, Single Inheritance, Multiple, Hierarchical Inheritance, Hybrid Inheritance.

MODULE – 4	9 Hrs.

Templates: Class Templates – Class Templates with Multiple Parameters, Function templates, Function Templates with Multiple Parameters, Overloading of Template functions, Member Function Templates.

Exception Handling: Introduction to Exception, Benefits of Exception handling, Try and catch block Throw statement, Pre-defined exceptions in C++.

Text Book:

E. Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill Education Pvt.Ltd , 8th Edition 2020.

Reference Book:

Bhushan Trivedi, "Programming with ANSI C++", Oxford Press, Second Edition, 2012.

Laboratory Component:

Sl. No.	Experiments
1.	Develop C++ program to demonstrate the use of scope resolution operator.
2.	Develop C++ program to demonstrate Call by reference.
3.	Develop C++ program to demonstrate Inline functions.
4.	Develop C++ program to demonstrate Default arguments.
5.	Develop C++ program to demonstrate Function overloading.
6.	Develop C++ program to demonstrate Constructors and Destructors.
7.	Develop C++ program to demonstrate Operator Overloading.
8.	Develop C++ program to demonstrate Friend function.
9.	Develop C++ program to demonstrate Single Inheritance.
10.	Develop C++ program to demonstrate Multiple Inheritance.
11.	Develop C++ program to demonstrate Hierarchical Inheritance.
12.	Develop C++ program to demonstrate Class Templates.
13.	Develop C++ program to demonstrate Function templates.
14.	Develop C++ program to demonstrate Exception handling.

Course Articulation matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	-

Course Title	R PROGRAMMING		
Course Code	23CS308A	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	14P

Course Objective: To learn and Practice Programming techniques using R Programming.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Prepare the dataset in suitable format with required preprocessing.	1	-
2.	Apply suitable R programming language constructs to write a program.	2, 3, 5	-
3.	Use visualization packages and file handlers for data analysis.	1, 2	-

Course Contents:

Practice Programs:

1. Installation of R Studio
2. Write an R Program to take input from the user (name and age) and display the values. Also print the version of R installation.
3. Write an R Program to get the details of the objects in memory.
4. Write an R Program to create a sequence of numbers from 20 to 50 and find the mean and product of numbers from 20 to 60 and sum of numbers from 51 to 91.
5. Write an R Program to multiply two vectors of integer's type and length 3.

Guided Laboratory Experiments

1. Demonstrate the steps for installation of R and R Studio. Perform the following:
   a) Assign different type of values to variables and display the type of variable. Assign different types such as Double, Integer, Logical, Complex and Character and understand the difference between each data type.
   b) Demonstrate Arithmetic and Logical Operations with simple examples.
   c) Demonstrate generation of sequences and creation of vectors.
   d) Demonstrate Creation of Matrices
   e) Demonstrate the Creation of Matrices from Vectors using Binding Function.
   f) Demonstrate element extraction from vectors, matrices and arrays
2. Assess the Financial Statement of an Organization being supplied with 2 vectors of data: Monthly Revenue and Monthly Expenses for the Financial Year. You can create your own sample data vector for this experiment) Calculate the following financial metrics:
   a. Profit for each month.
   b. Profit after tax for each month (Tax Rate is 30%).
   c. Profit margin for each month equals to profit after tax divided by revenue.
   d. Good Months – where the profit after tax was greater than the mean for the year.
   e. Bad Months – where the profit after tax was less than the mean for the year.
   f. The best month – where the profit after tax was max for the year.
   g. The worst month – where the profit after tax was min for the year.

Note: a. All Results need to be presented as vectors b. Results for Dollar values need to be calculated with $0.01 precision, but need to be presented in Units of $1000 (i.e 1k) with no decimal points c. Results for the profit margin ratio need to be presented in units of % with no decimal point. d. It is okay for tax to be negative for any given month (deferred tax asset) e. Generate CSV file for the data.

3. Develop a program to create two 3 X 3 matrices A and B and perform the following operations a) Transpose of the matrix b) addition c) subtraction d) multiplication
4. Develop a program to find the factorial of given number using recursive function calls.
5. Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.
6. The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to:
   a) Find the Pearson and Spearman correlation coefficients. Are they similar?
   b) Plot the data using the plot command.
   c) Plot the logarithm (log) of each variable and see if that makes a difference.
7. Develop R program to create a Data Frame with following details and do the following operations.

Item code	Item category	Item price
1001	Electronics	700
1002	Desktop Supplies	300
1003	Office Supplies	350
1004	USB	400
1005	CD Drive	800

   a) Subset the Data frame and display the details of only those items whose price is greater than or equal to 350.
   b) Subset the Data frame and display only the items where the category is either “Office Supplies” or “Desktop Supplies”
   c) Create another Data Frame called “item-details” with three different fields item_Code, ItemQtyonHand and ItemReorderLvl and merge the two frames
8. Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements.
   a) Assigning names, using the air quality data set.
   b) Change colors of the Histogram
   c) Remove Axis and Add labels to Histogram
   d) Change Axis limits of a Histogram
   e) Add Density curve to the histogram
9. Design a data frame in R for storing about 20 employee details. Create a CSV file named “input.csv” that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis.

a) Find the total number rows & columns

b) Find the maximum salary

c) Retrieve the details of the employee with maximum salary

d) Retrieve all the employees working in the IT Department.

e) Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file "output.csv"

10. Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors

    Develop R program, to solve the following:

    a) What is the total number of observations and variables in the dataset?

    b) Find the car with the largest hp and the least hp using suitable functions

    c) Plot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness?

    d) What is the average difference of gross horse power (hp) between automobiles with 3 and 4 number of cylinders (cyl)? Also determine the difference in their standard deviations.

    e) Which pair of variables has the highest Pearson correlation?

Text Book :

Cotton, R. (2013). Learning R: A Step by Step Function Guide to Data Analysis. 1st ed. O'Reilly Media Inc.

Reference Books:

1. Jones, O., Maillardet. R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC, The R Series.
2. Davies, T.M. (2016) The Book of R: A First Course in Programming and Statistics. No Starch Press.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	3	-	3	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

Course Title	DATA ANALYTICS WITH EXCEL		
Course Code	23CS308B	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	14P

Course Objective: To learn and Practice various Data analytics using Excel tool.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply the mathematical calculations in Excel	1, 2	2
2.	Apply sorting, Filtering and condition format for various problems	2, 3, 5	1
3.	Create different excel charts for the given problem.	1,5,12	1,2

Course Contents:

Guided Laboratory Experiments

1. In a company, 30 employee details (name, Date of Joining, Qualification, and Salary) are stored in Microsoft Access Database and text file. Using Excel tool import the data from different sources for analysis and perform the following:

    a. Show average salary.
    b. Show salary between 30000/- and 50000/-
    c. Sort the employee list on the date of joining.

2. Suppose a class of size 40 having SGPA of 8 semesters between 5 to 10. Calculate the CGPA of each student in below Grade form:

O	S	A	B	C
100>=9	8 - 8.9	7 – 7.9	6 – 6.9	5 – 5.9

3. Create 40 students name in the form of First name, Middle name and Last name. Concatenate all the names and store in one column and also find the length of each name.

4. Suppose your customer survey results from the east and west regions, month wise are

Month	East	West	Low (<50%)	Medium (50%-80%)	High (>80%)
Apr-15	86.4%	63.0%	50%	30%	20%
May-15	45.8%	58.9%	50%	30%	20%
Jun-15	44.1%	81.6%	50%	30%	20%
Jul-15	77.6%	86.1%	50%	30%	20%
Aug-15	80.7%	95.0%	50%	30%	20%

   For the above date, display customer satisfaction survey using Band Chart.

5. A Person takes a loan of Rs. 5,00,000/- for a tenure of 30 years, find the monthly payments (EMI) for the varied interest rates (Assume interest rate start with 12% and incremented by 2% in each month). Calculate the amount of interest and Principal that is paid in the second year. (use what if Analysis tool)

6. Suppose there is a bookstore that has 100 books in storage. The original price of the book is 250 and certain number of books was sold at that price. Later, the bookstore announced a 10% discount on that book and cleared off the stock. You might want to know how many books are sold at the original price to obtain total revenue of 24,500.

7. Suppose you want to have a report displaying the following – (Explore Data using Pivot Table)

a. Data for five disciplines - Archery, Diving, Fencing, Figure Skating and Speed Skating.
b. Regions that scored more than 80 medals in these 5 disciplines.
c. The count of medals in each of the five disciplines in each of these regions.
d. Total count of medals for the five disciplines in each of these regions.

8. Consider the data of 30 employees are stored in two different tables. First table consists of name, employee ID and Second table consists of employee ID, salary. Find the employee salary using lookup table from second table to first.

9. In Olympic, 20 countries participated and won various medals by male and female in equal propositions. Display the medal count for each country with the charts (Pie, Column, Bar, Line, Scatter, and Bubble).

10. Consider the sequence of data from 1 to 100, where Male are 48% and Female are 52% in the data. For the given data create Male vs Female Info-graphic Chart, Male vs Female Ratio Chart and Wafffle chart.

Course Articulation matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	2
CO2		3	3		3	-	-	-	-	-	-	-	2	-
CO3	3	-	-	-	3	-	-	-	-	-	-	2	2	2
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Course Title	DATA VISUALIZATION WITH PYTHON		
Course Code	23CS308C	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	14P

Course Objective: To explore principles and techniques of data visualization using Python.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Demonstrate the use of IDLE or PyCharm IDE to create Python Applications	1, 5	-
2.	Apply various visualization techniques using suitable python libraries.	2, 5, 9	2
3.	Implement, document and present the data visualization projects for the chosen problems.	2, 5, 9, 10	2

Course Contents:

1. Write a Python program to read data from a CSV file and create a line plot to visualize the trend over time. Customize the plot with appropriate labels, title, and color.
2. Load a dataset containing information about students' scores in different subjects. Create a scatter plot to visualize the relationship between two variables (e.g., math score vs. science score). Use Seaborn to enhance the plot with appropriate styling and add labels.
3. Given a dataset with multiple variables, create a figure with two subplots: one displaying a line plot and the other showing a bar chart. Customize the subplots with appropriate titles, legends, and colors.
4. Load a dataset containing information about employees' salaries across different departments. Create a box plot and a violin plot to visualize the distribution of salaries by department. Customize the plots and add appropriate labels and titles.
5. Load a dataset containing stock prices over time. Create a line plot to visualize the stock prices and add appropriate labels and titles. Format the x-axis tick labels to display the dates properly.
6. Load a dataset containing temperature readings over time. Create an interactive line plot using Plotly, which displays the temperature when hovering over the data points. Add appropriate labels and customize the plot's appearance.
7. Load a dataset with information about population density by country. Create a choropleth map using GeoPandas to visualize the population density. Customize the map's appearance and add a color legend.
8. Design and implement an interactive dashboard using Dash to display various visualizations. Include at least two interactive controls (e.g., dropdowns, sliders) to update the visualizations dynamically.
9. Select a dataset related to a specific topic of interest (e.g., climate change, COVID-19). Design a series of visualizations that tell a compelling data story, highlighting key insights and trends. Present the visualizations with appropriate annotations and captions.
10. Choose a dataset related to a real-world problem (e.g., retail sales, customer behavior). Explore the dataset, identify interesting patterns, and design a set of visualizations to present the findings effectively. Present the visualizations along with a brief explanation of the insights gained.

MOOC:

1. https://www.coursera.org/learn/python-for-data-visualization
2. https://www.edx.org/learn/data-visualization/ibm-visualizing-data-with-python

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	2	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	3	-	-	-	3	-	-	-	-	3
CO3	-	3	-	-	3	-	-	-	3	3	-	-	-	3

Course Title	VERSION CONTROLLER WITH GiT		
Course Code	23CS308D	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	14P

Course Objective: To use GitLab/Git and utilize it for software development.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Construct the repository using various Git commands.	3, 5	1, 2
2.	Demonstrate and document the work carried out	5, 9, 10	1, 2

Course Contents:

1. Initializing a Repository: Initialize a new Git repository for a simple project. Add a few files to the repository and commit them.
2. Committing Changes: Make changes to the files in the repository and commit them. Practice creating meaningful commit messages
3. Creating and Switching Branches: Create a new branch in the repository, make changes in the branch, and switch between branches.
4. Merging Branches: Create a branch, make changes in both the main branch and the new branch, and merge the changes back into the main branch.
5. Resolving Merge Conflicts: Create a merge conflict by making conflicting changes in two different branches. Practice resolving the conflict using Git's conflict resolution tools.
6. Working with Remote Repositories: Clone a remote repository to your local machine. Make changes locally and push the changes back to the remote repository.
7. Collaborating with Others: Practice collaborating with others using Git. Clone a shared repository, make changes, push the changes, and pull changes made by others.
8. Reverting and Rolling Back Commits: Experiment with reverting commits and rolling back changes to a previous state in the repository using Git commands.
9. Tagging Releases: Tag a specific commit in the repository as a release version. Practice creating annotated tags and lightweight tags.
10. Ignoring Files: Create a .gitignore file to exclude certain files or directories from being tracked by Git.
11. Viewing Repository History: Use Git commands to view the commit history, explore differences between commits, and track changes made over time.
12. Branch Management: Practice creating, deleting, and renaming branches in the repository using Git commands.

eBook:

https://www.oreilly.com/library/view/version-control-with/9781492091189/

MOOC:

1. https://www.coursera.org/learn/version-control-with-git
2. https://www.classcentral.com/course/microsoft-learn-introduction-to-version-control-with-git-2391

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	3	-	3	-	-	-	-	-	-	-	2	3
CO2	-	-	-	-	3	-	-	-	2	2	-	-	2	3

Course Title	SOCIAL CONNECT & RESPONSIBILITY		
Course Code	23SCR	L-T-P	(0-0-2)1
Exam	3 Hrs.	Hours/Week	2
CIE	100 Marks	Total Hours	20 hours

Course Objective: Provide a formal platform for students to communicate and connect with their surroundings and create a responsible connection with society.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Describe societal challenges and build solutions to alleviate these complex social problems through immersion, design & technology.	3,5,6	
2.	Communicate and connect with their surroundings.	7,12	

Course Content

MODULE – 1	5 Hrs

Plantation and adoption of a tree: Plantation of a tree that will be adopted by a group of students. They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.

MODULE – 2	5 Hrs

Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms.

MODULE -3	5 Hrs

Organic farming and waste management: Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus.

MODULE -4	5 Hrs

Water Conservation: knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices. **Food Walk** City's culinary practices, food lore, and indigenous materials of the region used in cooking.

Course Conduction

A total of 15-20 hours engagement per semester is required for the course. Students will be divided into teams and each team will be handled by two **faculty mentors**. Faculty mentors will design the activities for evaluation.

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE)

After completion of, the social connect, the student shall prepare, with daily **diary** as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluatedon the basis of the following criteria and/or other relevant criteria pertaining to the activity completed.

- Dairy recording the details of activity conducted
- Planning and scheduling the social connect
- Information/Data collected during the social connect
- Analysis of the information/data and report writing

Considering all above points allotting the marks as mentioned below

Excellent	80 to 100

	Good	60 to 79
	Satisfactory	40 to 59
	Unsatisfactory and fail	<=39

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	3	-	2	3	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	3	-	-	-	-	3	-	-

Course Title	BRIDGE COURSE MATHEMATICS		
Course Code	23BCM301	L-T-P	(3-0-0)
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	42

Course Objective: Students will be able to use appropriate data structures for solving problems.
Course outcomes: At the end of course, student will be able to:

#	Course Outcomes	Mapping to PO's	Mapping To PSO's
1.	Solve simple problems on determinants, matrix multiplication, partial differentiation, and integration.	1	-
2.	Compute the roots of transcendental equations and interpolate when the experimental data is given.	1	-
3.	Expand the given function in terms of Taylor/ Macluarin's series.	1	-

Course Content

MODULE – 1	10Hrs.

Basic Formulas: Partial fractions. Matrices and determinants: matrix multiplication, evaluation of determinants, finding inverse.
Differentiation-I: Review of limit and Continuity, differentiation- Basic formulas, Sum rule, product rule, quotient rule, chain rule and problems.
Differentiation-II: Taylor's series, and Macluarin's series of simple functions for single variable, simple problems.

MODULE – 2	10 Hrs.

Partial Differentiation: Definition, Illustrative examples on Partial differentiation, Total differentiation, chain rule, Differentiation of composite and implicit functions, Jacobians, illustrative examples and problems, simple problems.

MODULE -3	10 Hrs.

Integration: Basic formulas, Illustrative examples, evaluation of definite integrals, Integration by parts,Bernoulli's rule of Integration.
Integral calculus: Reduction formula for functions sin^n, $cos^n x$(without proof), Simple problems, Double & triple integration, simple problems with standard limits.

MODULE -4	12 Hrs.

Numerical Methods - Numerical Solution of algebraic & transcendental equations by Bisection method, Newton Raphson method.
Numerical Interpolation-Definition of forward, backward differences, Newton's forward and backward interpolation formulae, Lagrange's interpolation formula, central difference formulas-Bessel and

Note –1. Theorems and properties without proof. Applicable to all the modules.
2. Self study part is not included for Semester End Examination.

Text Books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 40th edition (2007).
2. Erwin Kreyszig, Advanced Engineering Mathematics, Tata McGraw Hill, Publications, 8thedition (2007).

Reference Books:

1. Calculus by Thomas Finney, 9th edition, Pearson education, 2002.

2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010..

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**1**	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	**1**	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	**1**	-	-	-	-	-	-	-	-	-	-	-	-	-

Course Title	MATHEMATICS FOR COMPUTER SCIENCE - IV		
Course Code	23MACS401	L-T-P	(3-1-0) 3
Exam	3 Hrs.	Hours/Week	4
SEE	50 Marks	Total Hours	53(40L+13T)

Course Objective: Students will be able to use appropriate data structures for solving problems.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Correlate the experimental data using correlation coefficient. Predict the output corresponding to input using regression, fit a curve to the data, solve simple problems on probability and joint probability.	1	-
2.	Validate an assumption through "hypothesis testing" (that is the assumption is not simply because of chance).	1,2	-
3.	Analyze the problems connected with probability to apply suitable probability distribution and also, predict the probability in the long run for Markov chain based problems.	1,2	-
4.	Model real life problems/engineering application problems and solve the same.	1,2	-

MODULE – 1	10Hrs.

Statistics: Correlation, Karl Pearson coefficient of correlation and Spearman's rank correlation coefficient. Physical interpretation of numerical value of the rank correlation coefficient. Linear Regression analysis (when the experimental output depends on one input). Illustrative examples from engineering field, multiple linear regression analysis (When the experimental output depends on two inputs). Curve fitting-exponential.

Continuous Random Variables: Definition of PDF and CDF, Expectation and Variance, illustrative examples.

Self-study/Applications: Curve fitting-linear, quadratic.

MODULE – 2	10 Hrs.

Continuous Probability distribution: Exponential pdf, Normal/Gaussian pdf. Discussion on the choiceof PDF. Illustrative examples from engineering field.

Sampling theory: Population & sampling, sampling with & without replacement, sampling distribution of means, sampling distribution of Proportions, sampling distribution of differences & sums.

Applications: Current measurement problems and Digital transmission channel connected with pdf.

Self-study: Uniform pdf, Detection of signal connected with pdf.

MODULE -3	10 Hrs.

Confidence intervals & Hypothesis Testing: Brief introduction to confidence intervals, Testing a hypothesis, central limit theorem-statement, Level of significance, Simple sampling of attributes, Test of significance for large samples, Comparison of large samples, Student's t-distribution, Chi-square distribution.

Applications: Propellant burning rate, process-capacity problem, drying time problem, Two catalyst effect on chemical reaction

Self-study: F-test, Analysis of variance.

MODULE -4	10Hrs.

Joint Probability Distribution & Stochastic Processes: Concept of joint probability, Joint distributions of discrete random variables, Independent random variables-problems. Joint expectation, co- variance, and correlation.

Markov Chains: Introduction, stochastic matrices, fixed probability vectors and regular stochastic matrices.

Applications: Application of Markov chain to determine the voting tendencies.

Self-study: Estimating the population distribution of a city due to migration.

Tutorial:

1. A report on the need of studying Correlation & Linear Regression -L4
2. Examples on Correlation & Linear Regression- L3
3. A report on the need of studying Multiple Regression. -L4
4. Examples on Multiple Regression. - L3
5. Examples on Continuous Random Variable. - L3
6. Examples on Normal probability distribution & exponential probability distribution. - L3
7. Discussion on the applications connected with Normal probability distribution. -L4
8. Discussion on the applications connected with Exponential probability distribution. -L4
9. Examples on Hypothesis testing such as student-t test, Chi-square. - L3
10. Examples on Joint probability distribution. - L3
11. Application of Joint probability distribution in engineering. -L4
12. Examples on Markov chain. - L3
13. Application of Markov chain in engineering. -L4

Activity:

1. Negative binomial distribution: Failure of server's problems,
2. Poisson distribution: Contamination problem, flaws in wires.
3. Exponential distribution: lack of memory property.
4. Continuous random variable: Shaft conforms.
5. Continuous random variable: detection of signal, Digital transmission channel.
6. Hypothesis analysis Depression treatment.
7. Hypothesis analysis defect in printed circuit board.
8. Confidence levels: Doping the cement with lead effect on percentage of calcium.
9. Current measurement problems, Propellant burning rate, process-capacity problem, drying timeproblem, two catalyst effect on chemical reaction.
10. Application of Markov chain in estimating the population distribution of a city due to migration.

Note

1. Theorems and properties without proof. Applicable to all the modules.
2. Self study part is not included for Semester End Examination.

Text Books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44thEdition, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd 9th edition, 2014.
3. B V Ramana Higher Engineering Mathematics, Tata McGraw Hill Publications, 2nd edition, 2007.

Reference Books:

1. Scott L.Miller, Donald G. Childers: "Probability and Random Process with application to Signal Processing", Elsevier Academic Press, 2nd Edition, 2013.
2. Statistics for engineers and Scientists, William Navide, Mc-Graw hill education, India pvt. Ltd., 3rd edition 2014.
3. T.Veerarajan: "Probability, Statistics and Random Process", 3rd Edition, Tata McGraw Hill Co., 2008.
4. Theory and problems of probability, Seymour Lipschutz and marclarslipson, Schaum out lineseries, 2nd edition.

MOOC Course:

1. http://nptel.ac.in/courses.phd?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicerath.org/

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-

Course Title	DESIGN AND ANALYSIS OF ALGORITHMS		
Course Code	23CS402	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: To develop algorithms using suitable design technique and analyze it.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe the algorithm analysis framework and design strategies.	1	-
2.	Apply algorithms to solve a given computational problem.	1	2
3.	Analyze algorithms with respect to time complexity.	2	2
4.	Design algorithm for a given problem using suitable algorithm design strategy.	3	2

Course Contents:

MODULE – 1 **10 Hrs**

Introduction: Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithm Efficiency**:** Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical analysis of Recursive and Non-recursive algorithms, Examples.

Brute Force: Selection Sort and Bubble Sort, Sequential Search and String Matching, Depth First and Breadth First Search,

Self Study: *Exhaustive Search.*

MODULE – 2 **10 Hrs**

Decrease-and-Conquer: Insertion Sort, Topological Sorting, Algorithms for Generating, Combinatorial Objects, Binary Search.

Divide-and-Conquer: Merge sort, Quick sort

MODULE – 3 **10 Hrs**

Transform-and—Conquer: Presorting, Heaps and Heapsort.

Space and Time Tradeoffs: Sorting by Counting**,** Input Enhancement in String Matching-Horspool algorithm, Hashing.

Dynamic Programming: The knapsack Problem, Warshall's Algorithm, Floyd's Algorithm,

Self Study: *Memory Functions.*

MODULE – 4 **10 Hrs**

Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees. **Limitations of Algorithm Power** Lower-bound Arguments, Decision Trees, P, NP and NP-Complete Problems. Coping with the Limitations of Algorithm Power**:** Backtracking – N Queens, Branch-and-Bound – Assignment Problem.

Text Books :

1. Anany Levitin, Introduction to The Design and Analysis of Algorithms, 3rd Edition, Pearson Education, 2022
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, 2nd Edition, Press 2014.

Reference Books:

1. Coremen T.H., Leiserson C. E., and Rivest R. L., Introduction to Algorithms, 3rd edition, PHI,2015.
2. R.C.T. Lee, S.S. Tseng, R.C. Chang and Y.T.Tsai, Introduction to the Design and Analysis of Algorithms A Strategic Approach, 1st Edition, Tata McGraw Hill, 2005.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	3
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	3

Course Title	MICROCONTROLLER AND EMBEDDED SYSTEMS		
Course Code	23CS403	L-T-P-C	(3-0-2)4
Exam Hrs.	3	Hours/Week	5
SEE	50 Marks	Total Hours	48L+10P

Course Objective: To make familiar with programming a microcontroller based embedded systems.

Course Outcomes(COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe the concepts of embedded system, ARM core and its instruction set.	1	-
2.	Illustrate interfacing for different hardware devices.	1	-
3.	Analyze the given assembly language code snippet for its correctness and output.	2	-
4.	Develop ARM based programs using IDE for a given problem.	2,3,5	2

Course Contents:

MODULE – 1 **12 Hrs**

Introduction to Embedded Systems: Embedded system, Processor Embedded into a system, Embedded software in a system, Examples of Embedded systems, Classification of Embedded systems, Skills required for an Embedded system designer.

ARM Systems: The RISC Design Philosophy, The ARM Design Philosophy, ARM based Embedded System Hardware and Software.

MODULE – 2 **12 Hrs**

ARM Processor Fundamentals : ARM core data flow model, Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts and the Vector Table, Core Extensions

Introduction to the ARM Instruction Set: Data Processing Instructions-move, barrel shifter, arithmetic, logical, comparison, multiply.

MODULE – 3 **12 Hrs**

Introduction to the ARM Instruction Set (Continued) Branch Instructions**,** Load-store instructions-single register transfer, single register load- store addressing modes, multiple register transfer, stack operations, and swap instruction ,Program Status Register Instructions, Loading Constants, and conditional execution.

MODULE – 4 **12 Hrs**

Introduction to ARM7 LPC2148 Microcontroller: Introduction, Features of the LPC 214X Family, Internal Block Diagram of LPC 2148, LPC 2148 GPIO.

Interfacing: LED interfacing, 7 segment LED display interfacing, stepper motorinterfacing, LCD interfacing, Keyboard interfacing and DAC interfacing.

Text Books:

1. ARM system developers guide, Andrew N Sloss, Dominic Symes and Chris Wright, Elsevier, Morgan Kaufman publishers, 2008. (1.1 to 1.4, 2.1 to 2.5.1, 3.1 to 3.3, 3.5 to 3.6 (Excluding3.5.1, 3.5.2), 3.8)

2. Embedded Systems, Raj Kamal ,Tata McGraw-Hill Publishers, 2nd Edition, 2008(1.1,1.2,1.4,1.5,1.11,1.12)
3. Hardware interfacing Manual, Shashidhara H V, Malnad College of Engineering,Hassan

Reference Books:

1. The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd.,1st edition, 2005
2. ARM System-on-Chip Architecture, Steve Furber ,Second Edition, Pearson, 2015

Laboratory Component

	PART- A (Software)
1.	In a class of strength 10 students, I need to find the tallest guy in the class to reach the projector of the classroom. Help me to identify the tallest guy.
2.	To illustrate the working of lookup table in ARM processor, find the square of a number (1 to 10) stored in a look-up table.
3.	Write a procedure FACT to find the factorial of a given number. Use this procedure to compute Binomial coefficient for given two numbers.
4.	Write an ALP to add an array of 16 bit numbers and store the 32-bit result in memory.
5.	Write an ALP to count the number of ones and zeros in N words stored in consecutive memory locations.
6.	Write an ALP to search for a given number in a set of 32-bit numbers, using linear search algorithm.
	PART- B (Hardware Interface)
7.	In the retail shop, the owner wants to know how many customers have been using the service of the shop. A device is used to keep count of incoming customers in the shop. Program the device to carry out the counting. Also the device should reset back to ZERO by down counting. Implement the above using Logic Controller Interface.
8.	In a petrol bunk, if a fire occurs accidently you need to display messages FIRE and HELP alternately on a 7-segment display interface to alarm the people. Implement the above scenario.
9.	A toy car uses a Stepper Motor interface to rotate the motor in specified direction. Program the toy to rotate (Clockwise or Counter-Clockwise) by N steps. Introduce suitable delay between successive steps. (Any arbitrary value for the delay may be assumed by the student).
10.	Generate Sine Wave using DAC interface (The output of the DAC is to be displayed on the CRO).
11.	Write a program to display the text message "COPUTER SCIENCE" on a LCD display.
12.	Scan a 4X4 keypad for a key pressed and display the key pressed on LCD screen

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	3	2	-	2	-	-	-	-	-	-	-	-	2

Course Title	DATABASE MANAGEMENT SYSTEMS		
Course Code	23CS404	L-T-P-C	(3-0-2)4
Exam Hrs.	3	Hours/ Week	5
SEE	50 Marks	Total Hours	48L+10P

Course Objective: Design a database and write SQL queries.

Course Outcomes(COs): Upon completion of the course, students shall be able to

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain the concepts of DBMS.	1	-
2.	Formulate and execute SQL queries for a given problem	3, 5,12	1, 2
3.	Apply normalization techniques to enhance the quality of database schema	2	-
4.	Design and create database for a given scenario.	3, 5	1, 2

Course Contents:

MODULE–1	12 Hrs

Introduction: Introduction;Anexample;CharacteristicsofDatabaseapproach;Actorsonthescreen; Advantages of using DBMS approach.Data models, schemas andinstances;Three-schemaarchitectureanddataindependence;Databaselanguagesandinterfaces;Thedatabasesystemenvironment;Centralizedandclient-serverarchitectures; Classification of Database Management systems.
Entity-Relationship Model: UsingHigh-Level Conceptual Data Models for Database Design; An sample Database Application; Entity Types, Entity Sets, Attributes and Keys. Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; ER Diagrams, Naming Conventions and Design Issues.

MODULE–2	12 Hrs

Relational Model and Relational Algebra: Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN-variations of JOIN, OUTER JOIN operations.

MODULE–3	12 Hrs

SQL: SQL Data Definition and Data Types; Specifying basic constraints in SQL; Basic Retrieval queries in SQL;Insert,Delete and Update statements in SQL; Additional features of SQL, More complex SQL Retrieval Queries; Views; Schema Change Statements in SQL.

MODULE–4	12 Hrs

Database Design:
Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys-1NF, 2NF, 3NF, Boyce-Codd Normal Form. Multi-valued Dependencies and Fourth Normal Form; Concurrency control techniques: Two- Phase Locking Techniques for Concurrency control; Concurrency Control Based on Timestamp Ordering

Text Books:

1. Elmasri and Navathe, Fundamentals of Database Systems, Addison-Wesley, 7th Edition, 2015.
2. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill, 3rd Edition, 2007.

Reference Books:

1. Silberschatz, Korthand Sudharshan, Database System Concepts, 5th Edition, Mc-GrawHill, 2006.
2. C.J.Date, A.Kannan, S.Swamynatham, An Introduction to Database Systems, Pearson education, 8thEdition, 2006.

MOOCs:

1. http://nptel.ac.in/courses/106106093
2. https://www.edx.org/course/database-systems-concepts-design-gtx-cs6400x

Laboratory Component

1. Design an Employee database and answer following queries:
   a) List all the employees who are above 40 years of age
   b) List the employees who work in a particular department
   c) List the female employees who are 30 years of age and drawing salary >8000
   d) List the employee number, employee name and his department name of all employees

2. Design a video parlor database and solve the following queries as outlined below using SQL.
   a) List only videos in the Children category with a daily rental rate of less than 100 and sorted according to video title.
   b) List the catalogNo, title and category of the Video table, ordered by video title
   c) List all videos with a certification of "U" or "B" in the Video table.

3. Consider the Insurance database. Create the tables by properly specifying the primary keys and the foreign keys, Enter at least five tuples for each relation.
   a) Demonstrate how you
      i. Update the damage amount for the car with a specific regno in accident with report number 12 to 25000
      ii. Add a new accident to the database \
   b) Find the total number of people who owned cars that were involved in accidents in 2006.
   c) Find the number of accidents in which cars belonging to a specific model were involved.

4. Consider the database of student enrollment in courses and books adopted for each course.
   a) Demonstrate how you add a new text book to the database and make this book be adopted by some department.
   b) Produce a list of text books(include course # ,book_isbn, book-title) in the alphabetical order for courses offered by the cs department that use more than 2 books.
   c) List the department that has adopted books published by specific publisher.

5. Consider an order processing database application in a company. Create the tables by properly specifying the primary keys and the foreign keys. Enter at least five tuples for each relation.
   a) Produce a listing: CUSTNAME, NO_OF_ORDERS, and AVG_ORDER_AMT, where the middle column is the total number of orders by the customer and the last column is the average order amount for that customer.
   b) List the Order# for the orders that were shipped from all the warehouses that the company has in a specific city.
   c) Demonstrate how you delete a customer from the CUSTOMER table and make that field *null* in the ORDER table.

6. Design a relational database for a real estate agency. It should store information about houses for sale, seller information, Buyer information, agents information (who can act on behalf of either the buyer or the seller), and the sale of houses. Answer the following queries in SQL.
   a) What are the ids, addresses, asking_price, and selling_price of all houses that sold for less than

the asking price?

b) What are names of all of (prospective) buyers who have not bought a house? Each name should appear only once.

c) Find the addresses and asking prices of all houses that have at least 3 bedrooms and two bathrooms that have not sold. Each address, asking price pair should appear only once.

7. Consider the details maintained by a book dealer. Create the tables by properly specifying the primary keys and the foreign keys. Enter at least five tuples for each relation.

a) Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog and the year of publication is after 2000 .

b) Find the author of the book which has maximum sales.

c) Demonstrate how you increase the price of books published by a specific publisher by 10%.

8. Consider the following schema:

Suppliers(sid: integer, sname: string, address: string)
Parts(pid: integer, pname: string, color: string)
Catalog(sid: integer, pid: integer, cost: real)

Design a database to the satisfy the above requirements and answer the following queries

a. Find the names of parts for which there is some supplier.
b. Find the names of suppliers who supply every part.
c. Find the id's of suppliers who supply red parts.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	3	-	2	-	-	-	-	-	-	2	2	2
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	2	-	-	-	-	-	-	-	2	2

Course Title	ALGORITHMS LABORATORY		
Course Code	23CS405	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	14P

Course Objective: To demonstrate various algorithmic design techniques.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping toPOs	Mapping to PSOs
1.	Implement various algorithms	3, 5	1, 2
2.	Document the executed algorithms	10	1, 2

Course Contents:

Practice Programs

1. Sort a given set of elements using Insertion sort method.
2. Obtain the topological ordering of vertices in a given digraph.
3. Write a program using Transform and Conquer technique for checking whether the digits of mobilenumber of a person are unique.
4. Find the Binomial Co-efficient using Dynamic Programming
5. Implement computing a mode using pre-sorting method.
6. Implement 0/1 Knapsack problem using dynamic programming.

Exercise Programs

1. Employees in an organization need to be grouped for a tournament based on their ages. Sort the agesusing Merge sort and find the time required to perform the sorting.
2. Students in a department need to be selected for a high jump competition based on their height (integervalues only). Sort the heights of students using Quick sort and find the time required for the Sorting.
3. Print all the nodes reachable from a given starting node in a digraph using BFS and DFS method.
4. Sort a given set of elements using the Heap sort method.
5. Implement Horspool algorithm for String Matching.
6. Consider N cities. The shortest path between every pair of cities needs to be determined. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem. Also find transitive closure by implementing Warshall's algorithm
7. There are N different routes from hostel to college. Each route incurs some cost. Find the minimum cost route to reach the college from hostel using Prim's algorithm.
8. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
9. Consider the distance between Hassan and N different cities. Every city can be reached from Hassan directly or by using intermediate cities whichever costs less. Find the shortest distance from Hassan to other cities using Dijkstra's algorithm.
10. Consider a scenario where you need to send a secret message across a network. To ensure the confidentiality of the message, encode it using Huffman coding and transmit the encoded message.
11. Consider the problem having weights and profits are:
    Weights: {3, 4, 6, 5}
    Profits: {2, 3, 1, 4}
    The weight of the knapsack is 8 kg.
    Find the optimal set of items to include in the knapsack using dynamic programming.

12. Implement N-Queens problem using back tracking.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	3	-	3	-	-	-	-	-	-	-	3	3
CO2	-	-	-	-	-	-	-	-	-	3	-	-	3	3

Course Title	OPTIMIZATION TECHNIQUES		
Course Code	23CS406A	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: Solve optimization problems using various methods

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Develop mathematical model for a given problem.	1	-
2.	Apply techniques of Operations Research.	2	1, 2
3.	Solve prediction and estimation problems.	1, 2	1, 2
4.	Use scientific tools for solving optimization problems.	3, 5	1

Course Contents:

MODULE – 1 **10 Hrs**

Introduction : Introduction: The origin, nature and impact of OR; Overview of the Operations Research Modeling Approach: Defining the Problem and Gathering Data; Formulating a MathematicalModel; Deriving Solutions from the Model; Testing the Model; Preparing to Apply the Model; Implementation
Linear Programming – 1 : Prototype example; The Linear Programming (LP) Model, Assumptionsof LP, Additional Examples

MODULE – 2 **10 Hrs**

Simplex Method - 1 : The Essence of the Simplex Method; Setting up the Simplex Method; The **Algebra** of the Simplex Method; The Simplex Method in Tabular Form; Tie Breaking in the Simplex Method
Simplex Method – 2 : Adapting to other Model Forms; Post Optimality Analysis, Computer implementation

MODULE – 3 **10 Hrs**

Revised Simplex Method: Foundations of the Simplex Method, The revised simplex method, A Fundamental Insight
Duality Theory: The Essence of Duality Theory; Economic Interpretation of Duality. Primal-Dual **Relationships**, Adapting to other primal forms, The role of duality in sensitive analysis; The essenceof sensitivity analysis; Applying sensitivity analysis, The dual simplex method ; Parametric linear programming; The upper bound technique.

MODULE – 4 **10 Hrs**

Transportation Model: D e f i n i t i o n of the Transportation Model, Nontraditional Transportation Models, The TransportationAlgorithm.
Assignment Model and Network Models : The Assignment Model, CPM and PERT

Text Books :

1. Frederick S. Hillier and Gerald J. Lieberman, “Introduction to Operations Research”, Tata McGraw Hill, 9th Edition, 2012. (Chapters: 1.1 to 1.3, 2, 3.1 to 3.3, 4.1 to 4.7, 5, 6.1 to 6.7, 7.1)
2. Hamdy A Taha, “Operations Research: An Introduction”, Prentice Hall India, 8th Edition, 2005. (Chapters: 5, 6.4)

Reference Book:

Wayne L. Winston, "Operations Research Applications and Algorithms", Thomson Course Technology, 4th Edition 2003

Activity:

1. Problems on Formulating a Mathematical model and deriving solution.
2. Problems on Linear Programming (LP) Model.
3. Problems on Essence of the Simplex Method.
4. Problems on Simplex Method in Tabular Form.
5. Problems on Post Optimality Analysis.
6. Problems on Revised Simplex Method.
7. Problems on Duality Theory.
8. Problems on Relationships.
9. Problems on Transportation Model.
10. Problems on Assignment Model and Network Models.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	-	-	-	-	-	-	-	-	-	-	1	3
CO4	-	-	3	-	3	-	-	-	-	-	-	-	3	-

Course Title	DISCRETE MATHEMATICAL STRUCTURES		
Course Code	23CS406B	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours/Week	3
SEE	50 Marks	Total Hours	40

Course Objective: To introduce concepts of mathematical logic for analyzing propositions and proving theorems.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply logic, mathematical proof and counting principles to given problem.	2 , 3	-
2.	Use concepts of functions in analyzing problems on algorithms.	2	-
3.	Analyze programming problems related to Group theory and Coding theory.	2	-

MODULE-1	10 Hrs

Principles of Counting: The rule of sum and product, permutation principle, combination principle, Combination with repetition

Fundamentals of Logic: Basic logic connectives and truth tables. Logical equivalence and Tautologies. Statement of laws of logic

Self-study: Set theory – set operations, Venn diagram, Inclusion Exclusion principle.

MODULE-2	10 Hrs

Fundamentals of Logic (contd...): Logic implication - Rules of inference theory. Application of switching network.

Relation: Cartesian Product of Sets, Relations, Zero-one Matrix, Directed graph, Properties of Relation, Equivalence Relation, Partially ordered sets, Hasse diagram, Lattice.

Self-study: Quantifiers

MODULE-3	10 Hrs

Functions: Ceiling function, Floor function**,** Functions, Types of Functions, Properties of Functions, Composition of Functions, and Inverse Functions, Application of Stirling numbers of second kind. The Pigeon hole principle.

Self-study: Application of functions in vending machine, Application to algorithm testing using computational complexity.

MODULE-4	10 Hrs

Group theory: Examples and elementary properties

Coding theory: Elements of coding theory, the humming matric**,** the parity – check and Generator matrices, **Group codes**: Decoding with coset leaders. Hamming matrices.

Self-study: sub-groups, cosets, Matrix row operations.

Textbooks:

Discrete and Combinatorial Mathematics, R C Grimaldi, Pearson's publications, 5th edition, 2007.

Reference Books:

Discrete Mathematical Structures, by D. S. Malik & M. K. Sen, Thomson's Publications, First edition, 2006.

Activity:

1. Problems on permutation and combination.
2. Problems on logic connectives and Logical equivalence
3. Problems on laws of logic
4. Problems on Logic implication
5. Problems on Relation
6. Problems on Hasse diagram and Lattice
7. Problems on Functions:
8. Problems on Group theory
9. Problems on Coding theory
10. Problems on Group codes

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-

Course Title	GRAPH THEORY AND COMBINATORICS		
Course Code	23CS406C	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: Understand the fundamentals of graph theory and combinatory.
Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe the concepts of graphs and counting principles.	1	-
2.	Apply the concepts of graphs and counting principles in solving problems	2	-
3.	Analyze various concepts of graph and counting techniques	2	-
4.	Solve a given problem adopting the concepts of graph and counting principles	3 , 5	2

Course Contents:

MODULE – 1	10 Hrs

An Introduction to Graph theory: Definitions and examples, Sub graphs, Complements and Graph isomorphism, Vertex degree, Euler Trails and Circuits, Hamilton paths and cycles,

MODULE – 2	10 Hrs

An Introduction to Graph theory (conti..): Planar graphs, Graph coloring, chromatic number, and chromatic polynomials.
Optimization and Matching: Transport Networks: The Max-Flow Min-Cut Theorem, MatchingTheory.

MODULE – 3	10 Hrs

The Principles of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, generalizations of the principle, dearrangements, Rook Polynomials, Arrangements with forbidden Positions. **Generating function:** Introductory examples, Definition and examples; Partitions of Integers.

MODULE – 4	10 Hrs

Generating function (conti..): The exponential generating function, the Summation Operator.
Recurrence relations: First-order and second order linear recurrence relations, with constant coefficients, The non- homogeneous recurrence relation, The Method of Generating Functions.

Text Books :

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, PearsonEducation. 2004. Chapters 8, 9,10,11,12.
2. Dr. D.S. Chandrashekar: Graph Theory and Combinatorics, 4th Edition, Prism,2012(Chapter 4)

Reference Books:

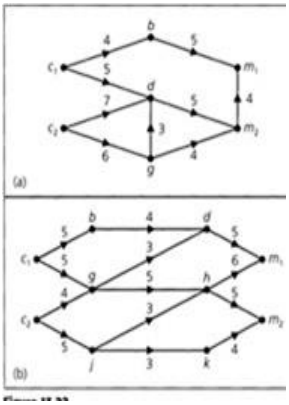
1. Narsing Deo, Graph Theory with applications to Engineering and Computer Science, PHI Publications.
2. V Balakrishnan, Combinatorics, Schaum Series, Tata-McGraw Hill Publications

MOOCs:

1. http://nptel.ac.in/courses/111106050/
2. http://nptel.ac.in/courses/106108051/

Activity:

1. Two cases of soft drinks, 24 bottles of one type and 24 of another are distributed among five surveyors who are conducting taste tests. In how many ways can the 48 bottles be distributed so that each surveyors gets (a) at least two bottles of each type? (b) At least two bottles of one particular type and at least three of the other?
2. How can Mary split up 12 hamburgers and 16 hot dogs among her sons Richard, Peter Christopher, and James in such a way that James gets at least one hamburger and three hot dogs, and each of his brothers gets at least two hamburgers but at most five hot dogs?
3. Sergeant bueti must distribute 40bullets (20 for rifkes and 20 for handguns) among four officersso that each officer gets at least two, but no more than seven, bullets of each type. In how manyways can he do this
4. Nineteen students in a nursery school play a game each day where they hold to hands to form a circle. For how many days can they do this with no students holding hands with the same playmate twice?
5. In each of the following "transport networks" two companies c1 and c2, produce a certain product that is used by two manufactures, m1 and m2. For the network shown in part(a) ofFig. 13.23, company c1 can produce 8 units and company c2 can produce 7 units; manufacturer m1 requires 7 units and manufacturerm2 needs 6 units. In the network shown in Fig 13.22 (b), each company can produce 7 units and each manufacturer needs 6 units. In which situation(s) can the producers meet the manufactures demands?



6. Fritz is in charge of assigning students to part-time jobs at the college where he works. He has25 student applications, and there are 25 different part-time jobs available on the campus. Each applicant is qualified for at least four of the jobs, but each job can be performed by at most four of the applicants. Can Fritz assign all the students to jobs for which they are qualified? Explain. Characterize the type of graph in which an Euler trail (circuit) is also a Hamilton path (cycle).

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-		3	-	2	-	-	-	-	-	-	-	-	3

Course Title	COMPUTER ASSEMBLY AND NETWORKING		
Course Code	23CS407A	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	14P

Course Objective: Acquire hands on experience on computer assembly and disassembly, trouble shooting and computer networking

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Demonstrate computer assembly and disassembly and troubleshooting of computer systems hardware, software and other peripheral equipment.	1	-
2	Familiar with wired and wireless communication and computer networks instruments.	2,3	-
3	Gain practical experiences in networking hardware, device configuration, testing and troubleshooting.	4	-
4	Demonstrate network simulation using virtual network simulator software and analyze their performances.	5	1

Course Contents:

Lab 1: Computer assembly and disassembly — **02 Hrs**

Computer Assembly: Open the case, Install the power supply, Attach the components to the motherboard and install the motherboard, install internal drives, connect all internal cables, install motherboard power connections, connect external cables to the computer, Boot the computer for the first time. Computer Disassembly: Unplugging, Open the case, disconnect all the connectors, Remove the fan, Remove the power supply, Removing HDD and optical drive, Remove RAM (random access memory), modules, remove expansion cards, remove motherboard, Reassemble the components.

Lab 2: Troubleshooting — **02 Hrs**

Diagnose and troubleshooting of microcomputer/computer systems hardware and software and other peripheral equipment: Approaches to solve a PC problem, troubleshooting a failed boot before the OS is loaded, different approaches to installing and supporting I/O device, managing faulty components. Troubleshooting printer and scanner problems, troubleshooting hard drive problems.

Lab 3: Network cables assembling and testing — **01 Hrs**

This lab introduces three types of cabling, i.e. twisted pairs, coaxial cable, and fiber optic. Students assemble connectors to a twisted pair cable using crimping tool, and then they test the cable to ensure properly wired connections. This is important because many of the network installation problems are related to cabling errors.

Lab 4: Network cards installation and test — **01 Hrs**

This lab shows how to install and configure the network card into a PC expansion slot of a client computer. Connect the client computer to the network. Install the cable and document all network connections on a classroom LAN network.

Lab 5: LAN configuration — **02 Hrs**

Once the network operating system and the physical hardware are installed and configured, shares must be set up on the workstations. The lab introduces how to locate the network configuration screen used with Windows XP and configure a workstation with a unique computer name and configure a hub with an IP address. Each workstation becomes a client for Microsoft Networks, and File and Print Sharing is enabled. The basic elements will be in place to share files between workstations on

the LAN. In this procedure students examine the user-level access control, that is, access is granted based upon access privileges granted to a single user or a group of users. Another lab activity is the configuration of a client computer for print sharing.

Lab 6: Wireless Networks **02 Hrs**

In this lab students will install and configure the TP-Link Wireless Access point, which allows laptops and other mobile computer systems wireless access to a network and perform a link test to assess the performance of the RF link. Also, students learn how to implement a strong network security by changing the Service Set Identifier (SSID), and establish a strong Wi-Fi Protected Access (WPA) passphrase on the router or access point. Then configure all the wireless computers and devices on the network to associate with the SSID of WPA-enabled router or access point using the same WPA passphrase.

Lab 7: Router configuration **02 Hrs**

This lab introduces the concepts of IP forwarding and routing between IP networks. The lab exercise shows how to set up a Windows PC and a TP-Link router as an IP router and reveals the similarities of IP forwarding and routing tables on a Widows PC and a TP-Link router. Students learn how to interpret and edit routing-table entries in a network with multiple IP networks and IP routers.

Lab 8: Client-Server Network Configuration **02 Hrs**

Students are introduced to the installation of Window Server tools on a Windows Professional workstation and set up a user account on the Windows server. Also create and manage networked groups and manage the security policies of users and the network.

Lab 9: Routing Information Protocol **01 Hrs**

The lab explores a routing protocol based on the distance-vector algorithm using network simulator. The goal of the lab is to configure and analyze the performance of the Routing Information Protocol (RIP) model. Here students study how RIP provides a distributed, dynamic way to solve the problem of finding the lowest-cost path in the presence of link and node failures and changing edge costs. A lab exercise with the routing protocol RIP explores the analysis of the routing tables generated in the routers based on distance-vector algorithm, and how RIP is affected by link failures.

Textbook:

1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill,Indian Edition.
2. Computer-Networks- Andrew S. Tanenbaum and David J. Wetherall, Pearson Education, 5th-Edition. (www.pearsonhighered.com/tanenbaum).
3. Computer Networking a Top-Down Approach -James F. Kurose and Keith W. Ross Pearson Education 7th Edition.

Reference Books:

1. E. Aboelela, Network Simulation Experiments Manual, Third Edition, Morgan Kaufmann 2003.
2. J. Liebeherr, M. El Zarki, “Mastering Networks, An Internet Lab Manual”, Pearson Education, 2004.
3. J. S. Beasley, Networking, Pearson Education, 2004.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	2	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	3	-	-	-	-	-	-	-	3	-

Course Title	INTRODUCTION TO POWER BI		
Course Code	23CS407B	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	15

Course Objective: To learn and Practice Programming techniques using Microsoft Power BI.
Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Prepare the dataset in suitable format with required preprocessing using Power Query Editor.	1, 2	-
2.	Apply suitable visualization techniques to generate report for the various problem.	3, 5, 9	-
3.	Implement, document and present the data visualization projects for the chosen problems.	3, 5, 9, 10	-

Course Contents:

Practice Programs:

1. Installation of Power BI
2. Building Blocks and Components of Power BI
3. Overview of GU
4. Introduction to Power Query Editor

Guided Laboratory Experiments

1. You have a dataset in an Excel file named SalesData.xlsx with the following columns: Date, Product, Quantity, and Price. You want to:
   a) Import the data.
   b) Filter out rows where the Quantity is less than 10.
   c) Remove duplicate rows.
   d) Add a new column TotalSales which is the product of Quantity and Price.
2. ABC Retailers deals with various data sources and formats, leading to inconsistencies and errors in the data. To derive meaningful insights, the data must be transformed and prepared using Power BI. This includes establishing appropriate data types, replacing erroneous values, handling nulls and errors, performing pivoting and un-pivoting operations, merging and appending queries, and importing data from folders.
3. ABC Retailers needs to perform advanced data transformations to derive more meaningful insights from their data. This involves creating custom columns, conditional columns, summarizing data with group by, managing queries, and optimizing report performance by enabling/disabling load and report refresh options.
4. ABC Corporation has a diverse dataset comprising sales transactions, product details, customer information, and category classifications. The company seeks to utilize Power BI to establish and manage relationships between these datasets to facilitate comprehensive data analysis and reporting.
5. XYZ Corporation is leveraging Power BI to analyze their sales and customer data. They need to understand how to configure cross-filter directions and effectively manage relationships between their datasets to enhance data analysis capabilities.
6. ABC Corporation is looking to enhance its data analysis capabilities using Power BI. Employee's need comprehensive training on understanding various visualization types, utilizing the Format tab effectively, and mastering the creation of tables and bar charts for insightful reporting.

7. XYZ Corporation aims to enhance its data analysis capabilities by leveraging Power BI for insightful data visualization. Employees need training on creating and customizing Clustered Column Charts, Matrix Visuals, Pie Charts, and Donut Charts to effectively present data and derive actionable insights.
8. XYZ Corporation is leveraging Power BI to analyze sales and operational data. Employees need training on creating Clustered Column charts, applying Conditional Formatting, and understanding various types of Filters in Power BI to enhance data visualization and analysis capabilities.
9. ABC Corporation is enhancing its data analytics capabilities using Power BI. Employees require training on utilizing Slicers, managing Edit Interactions, creating Bookmarks, and implementing Drill Down and Drill Through features to optimize data exploration and reporting.
10. XYZ Corporation is adopting Power BI for enhanced data visualization and analytics. Employees need training on using Tooltips, creating interactive Buttons, incorporating KPI Cards, generating Waterfall Charts, and integrating Custom Visuals to develop compelling and actionable reports.

Text books:

1. Introducing Microsoft Power BI by Alberto Ferrari and Marco Russo, Microsoft Press, 2016
2. Mastering Microsoft Power BI by Brett Powell, Packt Publishing, 2018

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	3	-	-	-	2	-	-	-	-	-
CO3	-	-	2	-	3	-	-	-	3	2	-	-	-	-

Course Title	TECHNICAL WRITING USING LATEX		
Course Code	23CS407C	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	14P

Course Objective: To prepare a LaTeX document.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mappingto POs	Mapping to PSOs
1.	Design a document layout using a given problem.	3	1
2.	Prepare the document using mathematical equations, tables and figures.	1, 5	1, 2
3.	Demonstrate and document the work carried out.	5, 9, 10	1

Course Contents:

1. Design an Introduction chapter with two sections, each containing a subsection with the relevant information, and include a header [title of document] and a footer [institute name, page number].
2. Create a document that displays the sample Abstract and Summary consists of relevant information.
3. Develop a LaTeX script to create a simple title page of the MCE project Report [Use suitable Logos and text formatting].
4. Develop a LaTeX script to create the Certificate Page of the Report [Use suitable commands to leave the blank spaces for user entry]
5. Develop a LaTeX script to create a document that contains the following table with proper labels.

Sl No.	USN	Student Name	Marks		
			Subject 1	Subject 2	Subject 3
1	4MC23xx001	Name 1	70	80	85
2	4MC23xx002	Name 2	80	84	90
3	4MC23xx003	Name 3	88	98	50

6. Develop a LaTeX script to include the side-by-side graphics/pictures/figures in the document by using the subgraph concept
7. Develop a LaTeX script to create a document that consists of the following two mathematical equations

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$$= \frac{-2 \pm \sqrt{2^2-4\bullet(1)\bullet(-8)}}{2\bullet 1}$$

$$= \frac{-2 \pm \sqrt{4+32}}{2}$$

$$\varphi_\sigma^\lambda A_t = \sum_{\pi \in C_t} \operatorname{sgn}(\pi)\varphi_\sigma^\lambda \varphi_\pi^\lambda$$

$$= \sum_{\tau \in C_{\sigma t}} \operatorname{sgn}(\sigma^{-1}\tau\sigma)\varphi_\sigma^\lambda \varphi_{\sigma^{-1}\tau\sigma}^\lambda$$

$$= A_{\sigma t}\varphi_\sigma^\lambda$$

8. Develop a LaTeX script to demonstrate the presentation of Numbered theorems, definitions, corollaries, and lemmas in the document
9. Develop a LaTeX script to create a document that consists of two paragraphs with a minimum of 10 citations in it and display the reference in the section

10. Develop a LaTeX script to design a simple tree diagram or hierarchical structure in the document with appropriate labels using the Tikz library
11. Develop a LaTeX script to present an algorithm in the document using algorithm/algorithmic/algorithm2e library
12. Develop a LaTeX script to create a simple report and article by using suitable commands and formats of user choice.

Text Book:

LATEX Beginner's Guide, Stefan Kottwitz.

MOOC:

https://www.my-mooc.com/en/mooc/latex-for-students-engineers-and-scientists

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	3	-	-	-	-	-	-	-	-	-	2	
CO2	2	-	-	-	3	-	-	-	-	-	-	-	2	3
CO3	-	-	-	-	3	-	-	-	3	3	-	-	3	-

Course Title	BIOLOGY FOR ENGINEERS		
Course Code	23CS408	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours/Week	2
CIE	100 Marks	Total Hours	14

Course Objective:

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	To familiarize engineering students with basic biological concepts	1	
2.	To involve students in an interdisciplinary vision of biology and engineering	2	
3.	To gain an appreciation for how biological systems can be designed and engineered to substitute natural system	2	
4.	To develop biological models using AI tools	3	

MODULE-1 **3 Hrs**

Introduction to Human Anatomy: Overview of human anatomy, Structural organization of the human body - cardiovascular system, endocrine system, digestive system, respiratory system, excretory system, lymphaticsystem, nervous system, muscular system and skeletal system.

MODULE-2 **4 Hrs**

Bioinspired Engineering based on human physiology: Circulatory system (artificial heart, pacemaker,stents), Nervous system (Artificial neural network).

MODULE-3 **4 Hrs**

Bioinspired Algorithms and Applications: Genetic algorithm, Gene expression modelling. Parallel Genetic Programming: Methodology, History, and Application to Real-Life Problems. Dynamic Updating DNA Computing Algorithms. Beehive: New Ideas for Developing Routing Algorithms Inspired by Honey Bee Behaviour.

MODULE-4 **3 Hrs**

Artificial Intelligence and Biology: Applications of AI in medical imaging, neural engineering, systems biology,microbiome and data mining.

Text Books:

1. Jenkins, C.H. Bioinspired Engineering, NY: Momentum press, 2012 ISBN: 97816066502259
2. A Practical Guide to Bio-inspired Design, Hashemi Farzaneh, Helena, Lindemann, Udo, Springer 2019, ISBN978-3-662-57683-0

Evaluation :

Continuous Internal Evaluation (CIE)

Two CIEs will be conducted for 20 marks each.

For the activity component students should form a team of 3 to 4 members each. A group activity should be assigned to each team based on the modules covered in the course. Students should show the progress in this activity as a preliminary phase for SEE.

CIE	Schedule	Assessment Method	Marks	Duration (Min.)
CIE I	At the end of 8 weeks	Objective Questions	20	60

CIE II	At the end of 11 weeks	Objective Questions	20	60
Activity	After CIE 2	Presentation/Role Play/Prototype development	10	-

Semester End Examination

SEE will be conducted for 50 marks in practical mode based on the assigned activity which may be a presentation/ prototype development/any other activity.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Course Title	UNIVERSAL HUMAN VALUES		
Course Code	23UHV	L-T-P	(0-0-2)1
CIE	50 marks	Hours/Week	2
SEE	50 marks	Total Hours	28

Course Objective: The course aims at the development of the value education by the right understanding through the process of self-exploration (about themselves), family, society and nature/existence. Strengthening of self-reflection by development of commitment and courage to act are presented as the prime focus throughout the course towards qualitative transformation in the life of the student.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to POs
1.	Start exploring themselves, get comfortable with each other and with the teacher and they start appreciating the need and relevance for the course. Also they are able to note that the natural acceptance (intention) is always for living in harmony.	6, 7, 8, 9, 12	-
2.	Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them and need to take appropriate steps to ensure right participation (in terms of nurturing, protection and right utilization) in the nature.	6, 7, 8, 9, 12	-
3.	Present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them.	6, 7, 8, 9, 12	-

Course Contents

MODULE - 1	8 Hrs
Introduction to Value Education : Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.	
MODULE – 2	**6 Hrs**
Harmony in the Human Being : Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self Lecture, Understanding Harmony in the Self Tutorial, Harmony of the Self with the Body to ensure self-regulation and Health.	
MODULE-3	**8 Hrs**
Harmony in the Family, Nature and Existence: Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order. Whole existence as Coexistence: Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.	
MODULE-4	**6 Hrs**

Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models, Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

Self-Learning Activities-

1. Sharing about One self and Exploring Natural Acceptance
2. Exploring Harmony of Self with the Body
3. Exploring the Feeling of Respect
4. Exploring the Four Orders of Nature Lecture and Exploring Co-existence in Existence
5. Exploring Humanistic Models in Education, Exploring Steps of Transition towards Universal Human Order

Text Book and Teachers Manual-

1. The Textbook: A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. The Teacher's for a Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books-

1. Jeevan Vidya:EkParichaya, ANagaraj, Jeevan Vidya Prakashan, Amarkantak,1999.
2. HumanValues, A.N.Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi
5. Small is Beautiful-E.F Schumacher.
6. Slow is Beautiful-Cecile Andrews
7. Economy of Permanence-J C Kumarappa
8. Bharat Mein Angreji Raj–Pandit Sunderlal.
9. Redis covering India-by Dharampal
10. Hind Swarajor Indian Home Rule-by Mohandas K. Gandhi.
11. India Wins Freedom-Maulana Abdul Kalam Azad
12. Vivekananda-Romain Rolland(English)
13. Gandhi-Romain Rolland(English)

Evaluation :

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Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO2	-	-	-	-	-	2	1	3	2	-	-	1	-	-
CO3	-	-	-	-	-	2	1	3	2	-	-	1	-	-