MALNAD COLLEGE OF ENGINEERING, HASSAN

(An Autonomous Institution Affiliated to VTU, Belagavi)

Autonomous Programmes

Bachelor of Engineering

DEPARTMENT OF

COMPUTER SCIENCE AND ENGINEERING

SYLLABUS

III Semester & IV Semester

(SECOND YEAR)

Academic Year 2023-24

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

- Impart world class engineering education to produce technically competent engineers.
- Provide facilities and expertise in advanced computer technology to promote research.
- Enhance Industry readiness and entrepreneurial abilities through innovative skills.
- 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 belifelong 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, andan 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 and design 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

Scheme & Syllabus for II Year

THIRD SEMESTER					
Course Category	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Contact Hours**
BSC	22MACS301	Mathematics for Computer Science	2-2-0	3	4
PCC	22CS302	Digital Design and Computer Organization	3-0-2	4	5
PCC	22CS303	Operating Systems	3-0-0	3	3
PCC	22CS304	Data Structures and its Applications	3-0-0	3	3
PCC	22CS305	Data Structures Laboratory	0-0-2	1	2
PCC	22CS306	Unix and Shell Programming Laboratory	0-0-2	1	2
(ESC/ETC/ PLC)	22CS307X	Engineering Science Course (ESC/ETC/PLC)	2-0-2	3	4
UHV	22SCR	Social Connect and Responsibility	0-2-0	1	2
AEC	22CS308X	Ability Enhancement Course	0-0-2	1	2
BSC	22BCM301	Bridge Course Mathematics -I (Mandate Non-CreditCourse)	3(A)-0-0	AUDIT	3
			Total	**20**	**29**

	Engineering Science Course (ESC/ETC/PLC)	
ESC/ETC/PLC	22CS307A	OOP with Java
ESC/ETC/PLC	22CS307B	OOP with C++

Ability Enhancement Course		
AEC	22CS308A	R Programming
AEC	22CS308B	Data Analytics with Excel
AEC	22CS308C	Data Visualization with Python
AEC	22CS308D	Version Controller with GiT

FOURTH SEMESTER					
Course Category	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Contact Hours**
BSC	22MA401	Statistics and Probability	2-2-0	3	4
PCC	22CS402	Design and Analysis of Algorithms	3-0-0	3	3
PCC	22CS403	Microcontroller and Embedded Systems	3-0-2	4	5
PCC	22CS404	Database Management Systems	3-0-2	4	5
PCC	22CS405	Algorithms Laboratory	0-0-2	1	2
ESC/ETC /PLC	22CS406X	Engineering Science Course (ESC/ETC/PLC)	2-0-2	3	4
AEC	22CS407X	Ability Enhancement Course	0-0-2	1	2
BSC	22CS408	Biology for Engineers	2-0-0	2	2
UHV	22CS409	Universal Human Values	1-0-0	1	1
BSM	22BCM401	Bridge Course Mathematics - II (Mandate Non-Credit Course)	3(A)-0-0	AUDIT	3
			Total	**22**	**31**

Engineering Science Course (ESC/ETC/PLC)		
ESC/ETC/PLC	22CS406A	Optimization Techniques
ESC/ETC/PLC	22CS406B	Discrete Mathematical Structures
ESC/ETC/PLC	22CS406C	Graph Theory and Combinatorics

Ability Enhancement Course		
AEC	22CS407A	Computer Assembly and Networking
AEC	22CS407B	UI/UX Laboratory
AEC	22CS407C	Technical writing using Latex

Course Title	MATHEMATICS FOR COMPUTER SCIENCE		
Course Code	**22MACS301**	**L-T-P-C**	**(2-2-0)3**
Exam Hrs.	**3**	**Hours / Week**	**4**
SEE	**50 Marks**	**Total Hours**	**40**

Course Objective: To introduce linear algebra and transform calculus which may be employed as tools in solving engineering application problems.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Utilize the concept of consistency of system of equations to solve the engineering application problems and compute the number of linearly independent vectors.	1, 2	-
2.	Examine for the existence of diagonalization of matrix, find the suitable matrix of transformations so as to get the required image and analyze the system of equations to compute the number of linearly independent Eigen vectors.	1, 2	-
3.	Apply Laplace transform on simple functions and compute Fourier series of periodic functions.	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	-

Course Contents:

MODULE – 1	10 Hrs

Linear Algebra: Importance of Matrices in engineering. Rank of a matrix. Consistency of nonhomogeneous and homogeneous system of equations, Solution of the system of linear equations by Gauss elimination method and Gauss – Seidel iterative method.

Special matrices-matrix of rotation, reflection, translation. To find the matrix of transformation when the 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 – 2	10 Hrs

Linear Algebra: Eigen values and Eigen vectors, properties, Illustrative examples, applications-Stretching of an elastic membrane, to determine the growth of a population model. Role of eigenvalues, eigenvectors in determining natural frequency, mode shapes of equations of motions (Spring mass system). Diagonalization and powers of 3X3 matrices when Eigen values are already given.

***Self Study**-- Stability analysis of differential equations which governs the dynamical systems using the concept of eigen value, eigen vectors.*

MODULE – 3	10 Hrs

Fourier Series: Periodic functions and their graphical representation, 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.*

MODULE – 4	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, heat conduction.*	
Note - Theorems and properties without proof. Applicable to all the Modules.	
Text Book : 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.	
Activities: 1. To represent Sawtooth 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 eigenvalues, eigenvectors in determining natural frequency, mode shapes of equations of motions (Spring mass system).	

Course Title	DIGITAL DESIGN AND COMPUTER ORGANIZATION		
Course Code	22CS302	L-T-P-C	(3-0-2)4
Exam Hrs.	3	Hours / Week	5
SEE	50 Marks	Total Hours	40

Course Objective: To quantitatively evaluate different designs and organizations of a computer system.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain system architecture and functioning of a digital computer, interrupts, bus structures, memory organization, arithmetic unit operations	1	-
2.	Apply arithmetic operations and cache mapping methods on a given problem	1,2	-
3.	Apply various techniques to design combinational logic circuits	1	
4.	Analyze a given logic circuit	1,2	-
5.	Design combinational and sequential logic circuits	1,2,3	-

Course Contents:

MODULE – 1	10 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 – 2	10 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: Floating-Point Numbers & Operations: IEEE Standard for Floating-Point Numbers, Arithmetic Operations on Floating-Point Numbers.

MODULE – 3	10 Hrs

Combinational Logic Circuits: Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, andOctets, Karnaugh Simplifications - Overlapping, Eliminating Redundant Groups.

Data-Processing Circuits: Multiplexers, Decoders

Flip-Flops: RS flip flop, Gated Flip Flop, Edge triggered flipflop, D FLIP-FLOP, Edge-triggered D FLIP-FLOP, Edge-triggered FLIP-FLOP, JK Master-slave FLIP-FLOP.

MODULE – 4	10 Hrs

Flip-Flops (continued): Various Representation of FLIP-FLOPs. Analysis of sequential Circuits, Conversionof flipflops.

Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, ParallelIn - Parallel Out, Applications of Shift Registers.

Counters: Asynchronous Counters, Synchronous Counters, Counter Design as a Synthesis problem.

Design of Synchronous Sequential Circuits: Model Selection, State Transition Diagram, State Synthesis Table, Design equation and circuit diagram.

Text Book :

1. Carl Hamacher, Z. Vranesic & S. Zaky, Computer Organization , 5th Edition, McGraw Hill, 2012

2. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition,Tata McGraw Hill, 2015.

Reference Books:

1. David A. Patterson and John L. Hennessey, Computer Organization and Design, Morgan Kaufmann,Elsevier, Fifth edition, 2014.
2. William Stallings, Computer Organization and Architecture, 9th Edition, Pearson India, 2013
3. Kai Hwang: Advanced Computer Architecture Parallelism, Scalability, Programmability, 2nd Edition, TataMcGraw Hill, 2011.
4. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL,2nd Edition, TataMcGraw Hill, 2014.
5. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss: Digital Systems Principles and Applications, 10thEdition, Pearson Education, 2013.
6. M Morris Mano: Digital Logic and Computer Design, 1st Edition, Pearson, 2013.

MOOC:

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

Course Title	OPERATING SYSTEMS			
Course Code	: 22CS303		Course Code	(3-0-0)3
Exam. Hours	: 3		Hours / Week	3
SEE	: 50 Marks		Total hours	40

Course Objective : Students should recognize critical resources of operating system and schedule the resources appropriately.

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

COs	Statement	Mapping to POs	Mappingto PSOs
1.	Identify fundamental concepts in designing the operating system	1	-
2.	Apply resource management strategies in designing operating system	1, 3	-
3.	Compare various resource scheduling techniques	2, 3	-
4.	Analyse synchronization and deadlock handling mechanisms	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; Operating System structure; Virtual machines.

MODULE – 2	10 Hrs

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

MODULE – 3	10 Hrs

Deadlocks: Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. **Memory Management**: Main Memory: Background; Swapping; Contiguous memory allocation; Paging; Segmentation. Virtual Memory Management: Background; Demand paging; Page replacement

MODULE – 4	10 Hrs

File System Interface: File System: File concept; Access methods; Directory and Disk structure; Mass-Storage Structures: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management, Protection and Security: Access matrix implementation.

Text Books:

1. 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, 2nd Edition, Tata McGraw- Hill, 2002. 2. P.C.P. Bhatt: Operating Systems, 2nd Edition, PHI, 2006. 3. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 1990.	
MOOCs	
1.	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 Title	DATA STRUCTURES AND ITS APPLICATIONS		
Course Code	22CS304	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: To be able to use the 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 basic concept of linear and non-linear data structures.	1	-
2.	Identify the data structures required to solve a given problem.	1	-
3.	Implement operations of linear and non-linear data structures.	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:

1. 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

Course Title	DATA STRUCTURES LABORATORY		
Course Code	22CS305	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	28

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.	Develop, design and document C programs to implement structures and pointers.	1,2,3	-
2.	Illustrate the concepts of data structures: stack, queue, linked list and trees in C using static or dynamic memory allocation and document them.	1,2,3	2
3.	Demonstrate the concept of recursion by developing recursive C programs and document them.	1,2,3	2

Course Contents:

	Practice Programs
1.	Write a C program to find the maximum and minimum element in an array of n integers. Use only pointers 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 defined functions 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 to store 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, yellow and Green. All these glows 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 Title	UNIX AND SHELL PROGRAMMING LABORATORY		
Course Code	22CS306	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	24

Course Objective: To provide the skills needed to develop and customize Unix shell programs and to make effective use of a wide range of UNIX commands.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Execute and document the commands related to Shell basics, vi editor and regular expression.	1,5,9,10	-
2.	Design the solutions for a given problem using the concepts of shell concepts and document.	1,5,9,10	-

Course Contents:

Practice Programs

Execute basic UNIX commands, VI editor commands. 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 Title	OBJECT ORIENTED PROGRAMMING WITH JAVA		
Course Code	22CS307A	L-T-P-C	(2-0-2)3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	40

Course Objective: Design and 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.	Apply Java constructs for the development of object oriented programs.	1	2
2.	Analyze the given java program to make suitable changes.	2	-
3.	Design a java program for the given problem.	3	2
4.	Conduct practical experiments for demonstrating object oriented concepts through java using IDE.	1, 2, 5	1

Course Contents:

MODULE – 1	10 Hrs

Java Programming Fundamentals – The Java Language, The key attributes of Object-Oriented programming, Java Development Kit (JDK), JVM, A first Simple program,
Introducing Data Types and Operators: Java's Primitive Types, A Closer Look at Variables, The Scope and Lifetime of Variables, operators, Type conversion in Assignments, Using Cast. Program Control Statements: Input characters from the Keyboard, if statement, Nested ifs, if-else-if Ladder, Switch statements, for Loop, While Loop, do-while Loop, Use break, Use continue.
Introducing Classes, Objects and Methods: Class Fundamentals, How Objects are Created, Reference Variables and Assignment, Methods, Returning from a Method, Returning Value, Using Parameters, Constructors, Parameterized Constructors, The new operator Revisited, Garbage Collection. The this Keyword. More Data Types and Operators: Arrays, Multidimensional Arrays, Alternative Array Declaration Syntax, Assigning Array References, Using the Length Member, The For-each Style for Loop, Strings.

MODULE – 2	10 Hrs

A Closer Look at Methods and Classes: Controlling Access to Class Members, Pass Objects to Methods, How Arguments are passed, Method Overloading, Overloading Constructors, Recursion, Understanding Static, Introducing Nested and Inner Classes, Varargs: Variable- Length Arguments. **Inheritance:** Inheritance Basics, Member Access and Inheritance, Constructors and inheritance, Using super to call 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, Using Abstract Classes, Using final, The object class.

MODULE – 3	10 Hrs

Interfaces: Interface Fundamentals, Creating an Interface, Implementing an Interface, Using Interface References, Implementing Multiple Interfaces, Constants in Interfaces, Interfaces can be extended, Nested Interfaces. Packages: Package Fundamentals, Packages and Member Access, Importing Packages, Static import. **Exception Handling:** The Exception Hierarchy, Exception Handling Fundamentals, The Consequences of an Uncaught Exception, using Multiple catch clauses, catching subclass Exceptions, try blocks can be nested, Throwing an Exception, A Closer look at Throwable, using finally, using throws, Java's Built-in Exceptions.

MODULE – 4	10 Hrs

Multithreaded Programming: Multithreading fundamentals, The Thread Class and Runnable Interface, Creating Thread,Creating Multiple Threads, Determining When a Thread Ends, Thread Priorities, Synchronization, using Synchronization Methods, The Synchronized Statement, Thread Communication using notify(), wait() and notify All(), suspending, Resuming and stopping Threads.

Exploring java.io – The I/O Classes and Interfaces, File, Auto closeable, Closeable and Flushable Interfaces, The Stream Classes, The Byte Streams, The Character Streams, The Console Class.

Text Books :

1. Java Fundamentals, A comprehensive Introduction by Herbert Schildt, Dale Skrien.Tata McGrawHill 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

Activity:

Write and execute the following programs in java

1. Design Java application to model Employee of an "ABC" organization. Consider types of employees as : a) Manager b) Sales Person Perform the following:
    - Implement simple inheritance where Employee (employee ID, First Name, Last Name, Current salary) is super class, consider Manager (number of stock options) and SalesPerson (number of sales, commission rate) as subclasses.
    - Define parameterized constructors in class hierarchy.
    - Define methods to display status of employee (override toString()) and increase current payment (salary) as giving bonus by a small amount.

2. Create class Employee with name, Id, cellNum, designation, department, salary permanent (boolean) as members. Also create separate class for member name as EmpName, department as Department and salary as Salary. Members of EmpName are firstName, midName, lastName . Members of Salary are BASIC, DA percent, HRA , PF, insurance. Members of Department are deptName, deptCode. Create an instance of Employee and initialize all its members from user input console. Access the same instance by more than one reference of Employee. Count the number of references and objects being created. [class, reference, objects].

3. Create a super class Bind {x,y} and subclass Bind3d {z} include
    - Parameterized constructor in class Bind to initialize object.
    - Include a method in class Bind to Print data members of object. Override the same method in sub¬class and reuse the inherited method in it.
    - Create final static member printArr (Bind[ ]) which print array of objects. In this method use above method to print member of individual objects of array.
    - Write test class to create to array of Bind3d type. Use the above method to print all theobjects of array.
4. A bank maintains two kinds of accounts – Savings account and Current account. The savings account provides simple interest, deposit and withdrawal facilities. The current account only

provides deposit and withdrawal facilities. Current account holders should also maintain minimum balance. If balance falls below minimum level a service charge is imposed. Create an abstract class Account that stores customer name, account number type of account and abstract methods. From this derive the classes Curr_Account (double balance, double min_bal, double service Charge / penalty) and Sav_Account (double balance).

Include the necessary methods in order to achieve the following:

Define parameterized constructor in a class hierarchy.

- Allow deposit and update the balance.
- Display the balance.
- Compute interest and add to balance.
- Permit withdrawal and update the balance (check for minimum balance).
- Apply polymorphism if required for methods in class hierarchy.
- Create an array of super class / object and populate with subclass objects and call the overridden /object methods.
- Write a test program to demonstrate the above said implementations.

5. Define an interface EMP Interface (void displayEMP(), void giveBonus (double amount)). Define an abstract class Employee(empID, fName, lName, salary). Define a concrete class Manager (noOfStockOptions), subclass of Employee and define interface methods.

Perform the following:

- Define appropriate constructors in a class hierarchy.
- Ensure the bonus amount should not be negative and zero using exception handling mechanism (use throws and throw clauses of exception handling)
- Create array of interface reference variables and populate with manager objects.

Write a test program to implement the above said requirements of interface implementation and exception handling.

Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	40

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

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

#	Course outcomes	Mapping to POs
1.	Explain the object – oriented programming concepts.	1, 2, 3
2.	Achieve code reusability and extensibility by means of Inheritance and Polymorphism.	1, 2, 3
3.	Develop programs with code reusability and handle exceptions inprogramming.	1, 2, 3
4.	Design the solution to a real world problem using Object – Oriented programming concepts.	1, 2, 3

Course Contents:

MODULE – 1	10 Hrs.

Introduction to Object Oriented Programming: Computer programming background- C++ overview. First C++ Program -Basic C++ syntax, Object Oriented Programming: What is an object, Classes, methods and messages, abstraction and encapsulation, inheritance, abstract classes, polymorphism

Textbook 1: Chapter 1(1.1 to 1.8)

MODULE – 2	10 Hrs.

Functions in C++: Tokens – Keywords – Identifiers and constants – Operators in C++ – Scope resolution operator – Expressions and their types – Special assignment expressions – Function prototyping – Call by reference – Return by reference – Inline functions -Default arguments – Function overloading, I/O Streams - cin, cout objects.

Textbook 2: Chapter 3(3.2,3.3,3.4,3.13,3.14,3.19, 3.20) , chapter 4(4.3,4.4,4.5,4.6,4.7,4.9) Chapter 12(12.5)

MODULE – 3	10 Hrs.

Inheritance & Polymorphism: Derived class Constructors, destructors-Types of Inheritance- Defining Derived classes, Single Inheritance, Multiple, Hierarchical Inheritance, Hybrid Inheritance.

Textbook 2: Chapter 6 (6.2,6.11) chapter 8 (8.1 to,8.8)

MODULE – 4	10 Hrs.

Exception Handling: Introduction to Exception - Benefits of Exception handling- Try and catch blockThrow statement- Pre-defined exceptions in C++

Textbook 2: Chapter 13 (13.2 to13.6)

Text Books:

1. Bhushan Trivedi, "Programming with ANSI C++", Oxford Press, Second Edition, 2012.
2. Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill Education Pvt.Ltd , Fourth Edition 2010.

Course Title	SOCIAL CONNECT AND RESPONSIBILITY

Course Code	**22SCR**	**L-T-P**	**(0-2-0)1**
Exam	**3 Hrs.**	**Hours/Week**	**2**
CIE	**50 Marks**	**Total Hours**	**15**

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.	6	-
2	Communicate and connect with their surroundings.	7,12	-

MODULE – 1

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 describingthe plant's origin, its usage in daily life, and its appearance in folklore and literature.

MODULE – 2

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, photoblog and documentary on evolution and practice of various craft forms.

MODULE -3

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

MODULE -4

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 14-20 hrs 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.

Course Title	**R Programming**		
Course Code	**22CS308A**	**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 R Programming.
Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	To understand the fundamental syntax of R and demonstration through readings and writing R code	1, 2	-
2.	To apply critical programming language concepts such as data types, iteration, control structures and functions by writing R programs and through examples	2, 3,4,5	-
3.	To import a variety of data formats into R using R-Studio	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. Write a program to check a year (integer) entered by the user is a leap year or not.
2. A shop keeper requires performing simple calculations like addition, subtraction, multiplication and modulo division for his daily business. Develop R program to perform these operation using switch cases and functions.
3. Write a program to perform searching within a list (1 to 5). If the number is found in the list, print that the search is successful otherwise print that the number is not in the list.
4. As a data analyst, you are tasked to analyze the three CIE conducted for 40 students. Find the total marks, average, maximum marks and minimum marks of six subjects.
5. As a data scientist, you are tasked with handling various matrices for a research project. Develop an R program to create three different matrices and populate them with data. For 5x4 and 3x3 matrix, fill the data by rows, and for the 2x2 matrix, fill the data by columns.

   Example:

   Matrix 1: 2x2 matrix with labels

   The matrix represents data gathered from two different subjects (rows) and two measurements (columns).

   Each row corresponds to a subject, and each column represents a different measurement (e.g., heart rate, blood pressure).
6. As a data analyst, you are responsible for merging data from two different departments within your organization. Each department has collected data in the form of matrices with the same number of columns but different numbers of rows. Develop an R program to concatenate these two matrices while preserving the column structure.
7. In your role as a data analyst at the healthcare organization, you have been tasked with organizing patient data into a structured format. You have collected four sets of data, each stored as a

separate vector, which includes patient details such as patient ID, name, age, and medical condition. Write an R program to create data frame from these four vectors. After creating the data frame, you must save the data frame into a file to ensure data preservation and future access.

8. As a programmer at the digital security company, you have been assigned a critical task related to number encryption. Your task is to create an R program that calculates the sum of the digits of a given number using various looping techniques.
9. Create employee .CSV file having attributes such as Eid, name, salary, start_date and department. Perform various operation such as Reading, writing and analyzing (no. of rows and columns, max salary with and without person, specific department, joined on or before specific date)
10. As a teacher at a high school, you recently conducted a quiz for your students on five different subjects: Mathematics, English, Science, History, and Geography. Write an R program to create a simple bar plot for these five subjects to present the performance of your students.

Course Code	22CS308B	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 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.	To understand the mathematical calculations performed in Excel	1, 2	-
2.	To apply sorting, Filtering and condition format for the various problems.	2, 3, 5	-

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.

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 10 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 20 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 power view 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.

Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	15

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.	Understand the importance of data visualization in extracting insights and communicating information effectively.	1	-
2.	Utilize Python libraries such as Matplotlib, Seaborn, and Plotly for creating various types of visualizations.	5	-

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.

Course Title	VERSION CONTROLLER WITH GiT		
Course Code	22CS308D	L-T-P-C	(0-0-2)1

Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	15

Course Objective: To use GitLab and 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.	Understand the fundamental concepts of version control systems and their importance in software development	1	-
2.	Demonstrate proficiency in using basic Git commands for initializing repositories, tracking changes, and committing code	5	-

Course Contents:

MODULE – 1	7 Hrs

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.

Course Title	BRIDGE COURSE MATHEMATICS - I		
Course Code	22BCM301	L-T-P-C	(3(A)-0-0)0

Exam Hrs.	3	Hours/Week	3
CIE	100 Marks	Total Hours	40

Course Objective: To introduce simple concepts of calculus and numerical methods.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
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/ McLaurin's series.	1	-

Course Contents:

MODULE-1	10 Hrs

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 McLaurin'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 $sin^n x$, $cos^n x$(without proof), Simple problems, Double & triple integration, simple problems with standard limits.

MODULE-4	10 Hrs

Numerical Methods: Numerical Solution of algebraic & transcendental equations by Bisection method, Newton Raphson method, Regular Falsi method.

Numerical Interpolation: Definition of forward, backward differences, Newton's forward and backward interpolation formulae, Lagrange's interpolation formula, central difference formulas-Bessel and Stirling formulas, illustrative examples.

Note - Theorems and properties without proof. Applicable to all the units.

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, 8th edition (2007).
3. Calculus by Thomas Finney, 9th edition, Pearson education, 2002.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

Course Title	STATISTICS AND PROBABILITY

Course Code	22MA401	L-T-P-C	(2-2-0)3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	40

Course Objective: To introduce the concept of probability distribution functions, hypothesis testing, complex analysis so as to apply in engineering application problems.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Fit a suitable curve/regression line for the given experimental data, 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	-

Course Contents:

MODULE – 1	10 Hrs

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 regression analysis. (When the experimental output depends on two inputs).
Probability: Discrete Random Variables: Definitions of PDF & CDF: Expectation and Variance: Binominal pdf- Illustrative examples.
Self-study/Applications: *Poisson probability distribution function- Illustrative examples.*

MODULE – 2	10 Hrs

Continuous Random Variables: Definition of PDF and CDF, Expectation and Variance, illustrative examples. Shaft conforms, Detection of signal.
Probability distribution: Exponential pdf, Normal/Gaussian pdf. Discussion on the choice of PDF. Illustrative examples from engineering field.
Self-study/Applications: *Uniform pdf, Digital transmission channel.*

MODULE – 3	10 Hrs

Confidence intervals & Hypothesis analysis: Introduction, Testing a hypothesis, central limit theorem-statement, Level of significance, Simple sampling of attributes, confidence intervals, Test of significance for large samples, Comparison of large samples, Student's t-distribution, Chi-square distribution.
Self-study/Applications: *Current measurement problems, Propellant burning rate, process-capacity problem, drying time problem, Two catalyst effect on chemical reaction.*

MODULE – 4	10 Hrs

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. Application of Markov chain to determine the voting tendencies.
Self-study/Applications: *Estimating the population distribution of a city due to migration.*

Note - Theorems and properties without proof. Applicable to all the modules.

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, DonaldG. 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 line series, 2nd edition.

Activities:

1. Negative binomial distribution: Failure of server's problems,
2. Negative binomial 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.

Course Title	DESIGN AND ANALYSIS OF ALGORITHMS		
Course Code	22CS402	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: To design algorithms using suitable algorithm design method and mathematically 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 basic knowledge of algorithm analysis, algorithm design strategies, various algorithms, NP problems.	1	-
2.	Apply algorithms to solve a given computational problem.	1	2
3.	Analyze algorithms with respect to time & space 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.

Self Study: *Exhaustive Search.*

MODULE – 2	10 Hrs

Divide-and-Conquer: Merge sort, Quick sort, Binary Search.

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

MODULE – 3	10 Hrs

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

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

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

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, Branch-and-Bound.

Text Books :

1. Anany Levitin, Introduction to The Design and Analysis of Algorithms, 3rd Edition, Pearson Education, 2012
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 Title	MICROCONTROLLER AND EMBEDDED SYSTEMS		
Course Code	22CS403	L-T-P-C	(3-0-2)4
Exam Hrs.	3	Hours/Week	5
SEE	50 Marks	Total Hours	40

Course Objective: To make familiar with programming in 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 ARM embedded system and its components.	2	-
2.	Design ARM based Assembly Language Programs to solve problems.	1,2,5	2
3.	Illustrate different Hardware interfacing.	1,3,5	2
4.	Develop embedded programs using IDE.	1,2	2

Course Contents:

MODULE – 1	10 Hrs

ARM Embedded Systems: Microprocessors, Microcontrollers, Microprocessors v/s Microcontrollers, RISC v/s CISC, Harvard v/s Von-Neumann processor, Big-endian v/s Little-endian processors, The ARM Design Philosophy, Embedded System Hardware, and Embedded System Software. What is an Embedded system?, Embedded Vs General computing system, Classification of Embedded systems, Major applications of ES.

MODULE – 2	10 Hrs

ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions-cache and tightly coupled memory. Memory-ROM, RAM.
Introduction to the ARM Instruction Set: Data Processing Instructions-move, barrel shifter, arithmetic, logical, comparison, multiply.

MODULE – 3	10 Hrs

(Continued) Branch Instructions, Load-store instructions-single register transfer, single register load-store addressing modes, multiple register transfer, stack operations, and swap instruction. Program StatusRegister Instructions, Loading Constants, and conditional execution.

MODULE – 4	10 Hrs

Interfacing: Sensors**,** Actuators, LED interfacing, 7 segment LED display interfacing, stepper motor interfacing, LCD interfacing, Keyboard interfacing, 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 (Excluding 3.5.1, 3.5.2), 3.8)
2. Hardware interfacing Manual – Module 4 (Author Shashidhara H V, Malnad College of Engineering, Hassan)
3. Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008

Reference Books:

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

MOOC:

1. https://onlinecourses.nptel.ac.in/noc18_ec03/preview

Course Title	DATABASE MANAGEMENT SYSTEMS		
Course Code	22CS404	L-T-P-C	(3-0-2)4
Exam Hrs.	3	Hours / Week	5
SEE	50 Marks	Total Hours	52

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	Apply knowledge of database concepts in designing database	1	-
2	Analyze a problem, in identifying appropriate computing requirements to get a solution	2	-
3	Formulate SQL queries to perform database operations	3,12	-
4	Design a database for a given scenario using appropriate techniques	3	-

Course Contents:

MODULE – 1	10 Hrs

Introduction: Introduction; An example; Characteristics of Database approach; Actors on the screen; Advantages of using DBMS approach. Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems. **Entity-Relationship Model:** Using High-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	10 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. **SQL:** SQL Data Definition and Data Types; Specifying basic constraints in SQL; Basic Retrieval queries in SQL;

MODULE – 3	10 Hrs

Continued: Insert,Delete and Update statements in SQL; Additional features of SQL, More complex SQL Retrieval Queries; Views; Schema Change Statements in SQL.

Database Design-1: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys-1NF,2NF,3NF.

MODULE – 4	10 Hrs

Database Design-2: Transaction management: The ACID Properties- Consistency and Isolation, Atomicity and Durability; Transactions and Schedules; Concurrent Execution of Transactions- revalorization for Concurrent Execution , Serializability , Anomalies Due to Interleaved Execution , Schedules Involving Aborted Transactions; Concurrency control- 2PL, Serializability, and Recoverability , View Serializability; Introduction to Lock Management - Implementing Lock and Unlock Requests

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, Korth and Sudharshan, Database System Concepts, 5th Edition, Mc-Graw Hill, 2006.
2. C.J. Date, A. Kannan, S. Swamynatham, An Introduction to Database Systems, Pearson education, 8th Edition, 2006.

MOOCs:

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

Course Title	ALGORITHMS LABORATORY		
Course Code	22CS405	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	28

Course Objective: To demonstrate various algorithmic design techniques.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Implement various algorithms	1, 3, 9	2
2.	Document the executed algorithms	10	-

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 Title	OPTIMIZATION TECHNIQUES		
Course Code	22CS406A	L-T-P-C	(2-0-2)3
Exam Hrs.	3	Hours / Week	4
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	-
3.	Solve prediction and estimation problems.	1, 2	-
4.	Expose to the significance of various scientific tools.	5	-

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 Mathematical Model; Deriving Solutions from the Model; Testing the Model; Preparing to Apply the Model; Implementation

Linear Programming – 1 : Prototype example; The Linear Programming (LP) Model, Assumptions of 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 Methods : 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 essence of sensitivity analysis; Applying sensitivity analysis, The dual simplex method ; Parametric linear programming; The upper bound technique.

MODULE – 4	10 Hrs

Transportation Model :

Definition of the Transportation Model, Nontraditional Transportation Models, The Transportation Algorithm. **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 McGrawHill, 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:

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

Course Title	DISCRETE MATHEMATICAL STRUCTURES		
Course Code	22CS406B	L-T-P-C	(2-0-2)3
Exam Hrs.	3	Hours/Week	4
CIE	100 Marks	Total Hours	40

Course Objective: Prepare student to use discrete mathematics as a tool in developing a consistent program in Computer Science & Information Technology.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply logic and counting principles to model and analyze problems of computer science & engineering	3,2	-
2.	Apply the concepts of logic to identify methods of mathematical proofs.	3,2	-
3.	Use concepts of functions in analyzing problems on algorithms and programs.	3,2	-
4.	Model and analyze programming problems related to Graph theory and coding theory.	3,2	-
	Derive mathematical model for real life problems related to Information science and Engineering.		

MODULE-1	10 Hrs

Principles of Counting: The rule of sum and product, permutation principle, combination principle, rule of generalized Permutations and Combinations, counting technique in chess board.

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.

Relations-definition and elementary properties , Partially ordered sets, Hasse diagram, Lattice .

Self-study: Quantifiers, Relations, Partially ordered sets, Hasse diagram.

MODULE-3	10 Hrs

Functions: Ceiling function, Floor function, Characteristic function, and Application of Stirling numbers of second kind. Application of functions in vending machine. Application to algorithm testing using computational complexity.

Self-study: one to one and onto functions, Composition of functions

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:

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

Reference Books:

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

Activities List

1. Application of switching network
2. Application to algorithm testing using computational complexity.
3. Application of graph theory to study ecosystem
4. Application of graph theory in sociology and psychology
5. Computation of number of different ways n rooks can be arranged on an n x n chess board so that no two rooks can attack each other for all positive integers n.
6. Discuss ways in which the current telephone numbering plan can be extended to accommodate the rapid demand for more telephone numbers.
7. Application of functions in vending machine.
8. **Graph Theory:** Basic terminologies of a graph. Discussion of connected and disconnected graphs, Euler and Hamilton graphs, planar graphs, discuss ways in which the current telephone numbering plan can be extended to accommodate the rapid demand for more telephone numbers.
9. **Trees:** Definition, properties of a tree. Weighed trees, prefix codes. Modelling of real-life problems using graphical approach and their analysis.

Course Title	GRAPH THEORY AND COMBINATORICS		
Course Code	22CS406C	L-T-P-C	(2-0-2)3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	40

Course Objective: To design and perform abstract concepts of graph theory in modeling and solvingnon-trivial problems.

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 solvingreal time applications.	1, 2	-
3.	Analyze various concepts of graph and counting techniques applied in solving real time applications.	1, 2	-
4.	Design solutions for real time problems adopting the concepts ofgraph and counting ideas.	1, 2,3	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, Planar Graphs: Planar graphs, Hamilton paths and cycles.

MODULE – 2	10 Hrs

An Introduction to Graph theory (conti..): Graph coloring, chromatic number, and chromatic polynomials.

Optimization and Matching: Transport Networks: The Max-Flow Min-Cut Theorem, Matching Theory.

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, Pearson Education. 2004. Chapters 8, 9,10,11,12.
2. Dr. D.S. Chandrashekar: Graph Theory and Combinatorics, 4th Edition, Prism,2012(Chapter 4)

Reference Books:

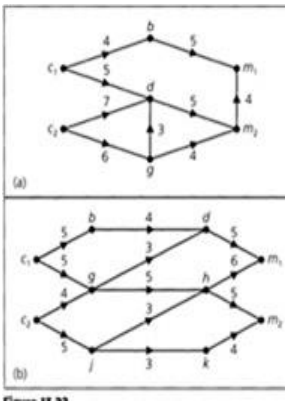
1. Narsing Deo, Graph Theory with applications to Engineering and Computer Science, PHI Publications.
2. V Balakrishnan, Combinatorics, Schaum Series, Tata-McGraw Hill Publications

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) of Fig. 13.22, 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 Title	COMPUTER ASSEMBLY AND NETWORKING		
Course Code	22CS407A	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	15

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	Experience on 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 OPNET simulator software to virtually implement networks and analyze their performances under various traffic models	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 is 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 Cisco Aironet 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) pass-phrase 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 pass-phrase.

Lab 7: Router configuration	**02 Hrs**

This lab introduces the concepts of IP forwarding and routing between IP networks. The lab exercise show how to set up a Windows PC and a Cisco router as an IP router and reveals the similarities of IP forwarding and routing tables on a Widows PC and a Cisco router. Students learn how to interpret and manually 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 OPNET. The goal of the lab is to configure and analyze the performance of the Routing Information Protocol (RIP) model. Here students study how RIP provide 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.

Text Book:

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. RossPearson 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 Title	UI/UX LABORATORY		
Course Code	22CS407B	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	15

Course Objective: To gain a solid understanding of fundamental UI/UX principles, including visual design, user-centered design, usability, and user experience.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply design principles and guidelines to create visually appealing and user-friendly interfaces for websites and mobile applications.	2	-
2.	Develop wireframes and interactive prototypes using design tools to visualize and communicate interface concepts and user flows.	5	-

Course Contents:

1. Designing a Login Form: Design a user-friendly login form for a mobile app. Consider the layout, input fields, button design, and error handling to create an intuitive and visually appealing login experience.
2. Creating a Navigation Menu: Design a navigation menu for a website that includes dropdown menus and a responsive design. Ensure the menu is easy to navigate and visually consistent across different screen sizes.
3. Redesigning a Landing Page: Redesign a landing page for a product or service. Improve the visual hierarchy, use compelling imagery, and optimize the layout to encourage user engagement and conversions.
4. Creating a Contact Form: Design a contact form for a website that captures essential user information. Consider input validation, error messages, and a confirmation message to enhance the user experience.
5. Designing a Product Card: Create a visually appealing product card for an e-commerce website. Include product images, title, price, and call-to-action buttons to entice users to learn more and make a purchase.
6. Improving Form Usability: Evaluate an existing form on a website for usability issues and propose improvements. Focus on optimizing the form's layout, labeling, and input validation to enhance user comprehension and completion rates.
7. Enhancing Mobile App Onboarding: Design an onboarding experience for a mobile app. Create a series of screens that introduce users to the app's features and guide them through the setup process in a clear and engaging manner.
8. Redesigning a Checkout Process: Redesign the checkout process for an e-commerce website. Simplify the steps, provide clear instructions, and optimize the layout and form inputs to streamline the purchasing experience.
9. Designing an Error Page: Design a visually appealing and helpful error page for a website. Consider the tone of the message, provide relevant information or suggestions, and include navigational elements to guide users back on track.
10. Creating an Interactive Prototype: Use a prototyping tool to create an interactive prototype for a mobile app or website. Design key screens and transitions to showcase the user flow and interactions within the interface.

Course Title	TECHNICAL WRITING USING LATEX		
Course Code	22CS407C	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	15

Course Objective: Understand the various sections and files associated with LaTeX document processor.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Understood introduction of Latex tools and its installation or working with online source	1, 2	-
2	Demonstrate various packages, content formatting, inserting figures, equations and references.	1,2	-
3	Build the conference paper, journal-manuscript and thesis in LaTeX.	3, 5	1
4	Design a presentation slides using Beamer template in LaTeX.	3,5,10	1

Course Contents:

MODULE – 1	03 Hrs

Introduction to LATEX: How to prepare a LATEX input file? How to compile a LATEX input file?

LATEX syntax, Commands, Environments, Packages, Keyboard characters in LATEX.

Fonts Selection: Text-mode fonts, Math-mode fonts, Colored fonts. **Texts Formatting :**Sectional units, Labeling and referring numbered items, Quoted texts, New lines and paragraphs, Creating and filling blank space, Producing dashes within texts, Foot notes.

MODULE – 2	04 Hrs

Listing Texts: Numbered listing through enumerate environment, Unnumbered listing through itemize environment, Listing with user-defined labels through description environment, Nesting different listing environments.

Table Preparation: Table through tabular environment, Table through tabular environment, Vertical positioning of tables, Merging rows and columns of tables, Tables in multi-column documents, Tables at the end of a document.

MODULE – 3	04 Hrs

Figure Insertion: Commands and environment for inserting figures, Inserting simple figures, Sub-numbering a group of figures, Figures in multi-column documents, Figures at the end of a document.

Equation Writing: Basic notations and delimiters, Mathematical operators, Mathematical expressions in text-mode, Simple equations, Array of equations.

Bibliography with BIBTEX: Preparation of BIBTEX compatible reference database, Standard bibliographic styles of LATEX, Compiling BIBTEX based LATEX input file.

MODULE – 4	04 Hrs

Article Preparation: List of authors, Title and abstract on separate pages, Articles in multiple columns

Thesis preparation: Template of a thesis, Compilation of thesis.

Slide Preparation: Frames in presentation, Sectional units in presentation, Presentation structure, Title page, Appearance of a presentation (BEAMER themes).

Text Book:

1. LATEX Beginner's Guide, Stefan Kottwitz.

MOOC:

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

Course Title	BIOLOGY FOR ENGINEERS		
Course Code	22CS408	L-T-P-C	(2-0-0)2
Exam Hrs.	3	Hours/Week	2
CIE	100 Marks	Total Hours	14

Course Objective: Realization of relation between natural engineering and man-made engineering.
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 Behavior.	
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

Course Title	UNIVERSAL HUMAN VALUES		
Course Code	22CS409	L-T-P-C	(1-0-0)1
Exam Hrs.	3	Hours / Week	1
SEE	50 Marks	Total Hours	14

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 PSOs
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 Oneself 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 Books:

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 Manual Teachers' Manual 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. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, 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 – PanditSunderlal.
9. Rediscovering India - by Dharampal
10. Hind Swaraj or 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)

Course Title	BRIDGE COURSE MATHEMATICS - II		
Course Code	22BCM401	L-T-P-C	(3(A)-0-0)0
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: To introduce simple concepts of differential equations, vector calculus and numerical integration.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Identify suitable methods to solve the differential equations analytically.	1	-
2.	Solve first order first degree D E, integration problems and simple PDE problems using numerical methods.	1	-
3.	Solve problems on Gradient, Divergence, and Curl of a vector valued function.	1	-

Course Contents:

MODULE – 1 **10 Hrs**

Differential Equations: Solution of first order first degree differential equations- Variable separable methods, Homogeneous Equations, Exact differential equations, illustrative examples from engineering field. Linear& Bernoulli's differential equations, Illustrative examples from engineering field.

MODULE – 2 **10 Hrs**

Differential Equations: Solution of second and higher order equations with constant coefficient by inverse differential operator method$f(D)y = e^{ax}$,f(D)y $= \cos(ax + b)/\sin(ax + b)$, $f(D) = ax^2 + bx + cf(D)y = e^{ax}cos(bx + c)/e^{ax}\sin(bx + c, f(D)y = xcos(ax + b)/x\sin(ax + b)$(Simple problems). Illustrative examples from engineering field.

Numerical solution of first order first degree ordinary differential equations: Taylor series method, Runge-Kutta method of fourth order, Milne's Predictor corrector methods.

MODULE – 3 **10 Hrs**

Solution of Partial Differential Equations: Solving PDE by variable separable method, to find all possible solutions of one-dimensional wave equation, one dimensional Heat flow equation and two-dimensional Laplace's equation by the method of separation of variables, numerical solution of Laplace equation by finite difference approximation method using standard five point formula and diagonal five point formula. Numerical solution of poison equation by finite difference approximation method using standard five-point formula and iterative formulas.

MODULE – 4 **10 Hrs**

Numerical Integration: Computation of line integral by trapezoidal rule, Simpsons 1/3rd rule, Weddle's rule, Simpsons 3/8th rule, Illustrative examples from engineering field.

Vector Algebra: vector addition, Multiplication (Dot and Cross product), Triple products, vector differentiation, velocity, acceleration of a vector point function, Gradient, divergence, curl.

Note - Theorems and properties without proof. Applicable to all the units.

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, 8th edition (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.