NUTAN MAHARASHTRA VIDYA PRASARAK MANDAL'S

NUTAN MAHARASHTRA INSTITUTE OF ENGINEERING AND TECHNOLOGY

AN AUTONOMOUS INSTITUTE | UNDER ADMINISTRATIVE SUPPORT OF PCET

Curriculum Structure and Syllabus of Second Year B.Tech. Computer Science and Engineering (2025 Pattern)

Nutan Maharashtra Vidya Prasarak Mandal's (NMVPM's)

NUTAN MAHARASHTRA INSTITUTE OF ENGINEERING AND TECHNOLOGY (NMIET)

An Autonomous Institute from 2025-26

Under Administrative Support - Pimpri Chinchwad Education Trust (PCET)

Course Approval Summary – Board of Studies Computer Science and Engineering

Sl. No.	Approved By	Signature and Stamp of Authority
1	Chairman, Board of Studies, Computer Science and Engineering	HEAD OF THE DEPARTMENT Computer Science & Engineering Nutan Maharashtra Inst of Engg & Tech Talegaon Dabhade, Pune - 410507
2	Secretary, Academic Council, NMIET, Pune	
3	Chairman , Academic Council, NMIET, Pune	Director Nutan Maharashtra Institute of Engineering & Technology Talegaon Dabhade - 410507

VISION OF THE INSTITUTE

To be a notable institution for providing quality technical education and ensuring ethical, moral and holistic development of students.

MISSION OF THE INSTITUTE

To nurture engineering graduates with state of the art competence, professionalism and problem solving skills to serve needs of industry as well as society.

VISION OF COMPUTER SCIENCE and ENGINEERING

To be a premier place of education in Computer Science and Engineering, preparing graduates with commendable knowledge, excellent skills and commitment to build a flourishing nation & world.

MISSION OF COMPUTER SCIENCE and ENGINEERING

- To inculcate experiential learning with contemporary software skills.
- To prepare students to satisfy industry, R&D demands and solves real life problems.
- To imbibe sense of societal and ethical responsibilities amongst leaners.

INDEX

COURSE-WISE CREDIT DISTRIBUTION

Sr. No.	Type of Course	No. of Courses	Total Credits	
			No.	%
1.	Basic Science Course (BSC)	8	14	8.14
2.	Engineering Core Course (ECC)	10	15	8.72
3.	Programme Core Course (PCC)	28	54	31.40
4.	Programme Elective Course (PEC)	9	20	11.63
5.	Multidisciplinary Minor (MDM)	7	13	7.56
6.	Open Elective Course (OEC)	3	8	4.65
7.	Vocational and Skill Enhancement Course (VSEC)	4	8	4.65
8.	Ability Enhancement Course (AEC)	2	4	2.33
9.	Entrepreneurship / Management Course(EMC)	2	4	2.33
10.	Value Education Course (VEC)	2	4	2.33
11.	Experiential Learning Courses	8	22	12.79
12.	Indian Knowledge System	1	2	1.16
13.	Co-curricular Courses	2	4	2.33
Total		**86**	**172**	**100**

SEMESTER-WISE COURSE DISTRIBUTION

COURSE DISTRIBUTION: SEMESTER WISE										
SR NO.	TYPE OF COURSE	NO. OF COURSES / SEMESTER								Total
		1	2	3	4	5	6	7	8	
1.	Basic Science Course (BSC)	4	4	-	-	-	-	-	-	8
2.	Engineering Science Course (ESC)	6	4	-	-	-	-	-	-	10
3.	Programme Core Course (PCC)	-	2	5	5	5	5	4	2	28
4.	Programme Elective Course (PEC)	-	2	-	-	2	3	2	2	11
5.	Multidisciplinary Minor (MDM)	-	-	1	1	2	1	-	2	7
6.	Open Elective Course (OEC)	-	-	1	1	1	-	-	-	3
7.	Vocational and Skill Enhancement Course (VSEC)	1	1	1	1	-	-	-	-	4
8.	Ability Enhancement Course (AEC)	1	1	-	1	-	-	-	-	3
9.	Entrepreneurship / Management Course(EMC)	-	-	1	1	-	-	-	-	2
10.	Value Education Course (VEC)	-	-	1	1	-	-	-	-	2
11.	Experiential Learning Courses	-	-	-	1	1	1	1	1	5
12.	Indian Knowledge System	-	1	-	-	-	-	-	-	1
13.	Co-curricular Courses	1	1	-	-	-	-	-	-	2
Total		**13**	**16**	**10**	**12**	**11**	**10**	**07**	**07**	**86**

SEMESTER-WISE CREDIT DISTRIBUTION

COURSE DISTRIBUTION: SEMESTER WISE										
1 Lecture hour = 1 Credit, 2 Lab Hours = 1 Credit, 1 Tutorial Hour = 1 Credit										
SR NO.	**TYPE OF COURSE**	**NO. OF COURSES / SEMESTER**								**Total**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
1.	Basic Science Course (BSC)	7	7	-	-	-	-	-	-	14
2.	Engineering Science Course (ESC)	9	6	-	-	-	-	-	-	15
3.	Programme Core Course (PCC)	-	3	10	10	10	8	8	4	53
4.	Programme Elective Course (PEC)	-	-	-	-	4	8	4	4	20
5.	Multidisciplinary Minor (MDM)	-	-	2	2	4	2	-	4	14
6.	Open Elective Course (OEC)	-	-	4	2	2	-	-	-	8
7.	Vocational and Skill Enhancement Course (VSEC)	2	2	2	2	-	2	-	-	10
8.	Ability Enhancement Course (AEC)	2	-	-	2	-	-	-	-	4
9.	Entrepreneurship / Management Course(EMC)	-	-	2	2	-	-	-	-	4
10.	Value Education Course (VEC)	-	-	2	-	-	-	-	-	2
11.	Experiential Learning Courses	-	-	-	2	2	2	8	8	22
12.	Indian Knowledge System	-	2	-	-	-	-	-	-	2
13.	Co-curricular Courses	2	2	-	-	-	-	-	-	4
Total		**22**	**22**	**22**	**22**	**22**	**22**	**20**	**20**	**172**

CURRICULUM STRUCTURE

Second Year B.Tech. Computer Science and Engineering

Semester – III

Level 5.0																
Second Year B. Tech Computer Science and Engineering																
Semester III																
Sr. No.	**Course Code**	**Course Type**	**Course Name**	**Credit Scheme**			**Teaching Scheme (Hours/Week)**			**Examination Scheme and Marks**						
										CCE		**ESE**	**PR**	**OR**	**TW**	**TOTAL**
				TH	**TUT**	**PR**	**L**	**TUT**	**PR**	**UT**	**FA**	**SA**				
										25	**25**	**50**				
1	CSE25PCC-201	Programme Core Course	Operating System	2			2			25	25	50				100
2	CSE25PCC-202	Programme Core Course	Foundation of Data Structures	2			2			25	25	50				100
3	CSE25PCCL-203	Programme Core Course	Foundation of Data Structures Laboratory			2			4				50		25	75
4	CSE25PCC-204	Programme Core Course	Object Oriented Programming	2			2			25	25	50				100
5	CSE25PCCL-205	Programme Core Course	Object Oriented Programming Laboratory			2			4				50		25	75
6	CSE25MDM-206	Multi-disciplinary Minor Course	Computer Organization and Architecture	2			2			25	25	50				100
7	--	Open Elective Course	Open Elective Course -I	3	1		3	1		25	25	50				100
8	--	Value Education Course	Value Education Course - I		1	1		1	2						25	25
9	CSE25VSEC-209	Vocational & Skill Enhancement Course	Vocational & Skill Enhancement Course - I			2			4					25	25	50
10	IL25EMC-210	Entrepreneurship / Management Course	Principles of Management and Entrepreneurship		1	1		1	2						25	25
TOTAL				11	3	8	11	3	16	125	125	250	100	25	125	750
				22			30									

CCE- Comprehensive Continuous Evaluation**, ESE**- End Semester Evaluation, **TW**-Term Work, **OR**-Oral, **PR**-Practical, **TH**- Theory**, L**-Lecture, **TUT**-Tutorial, **UT**- Unit Test, **FA**–Formative Assessment, **SA** – Summative Assessment

Semester – III

Basket: List of Courses – Open Elective Course -I

Course Code	Course Name	
CE25OEC-207	Computational Mathematics	Choose Any One
CAI25OEC-207	Probability Theory and Statistical Methods	
AIDS25OEC-207	Probability and Statistics	
IT25OEC-207	Numerical Statistical Analysis	
ETC25OEC-207	Vector and Transformation	
ME25OEC-207	Applied Mathematics	

Basket: List of Courses – Value Education Course -I

Course Code	Course Name	
CSE25VEC-208	Universal Human Values	Choose Any One
ETC25VEC-208A	Professional Ethics for Engineers	
ETC25VEC-208B	Social Connect and Responsibility	

Basket: List of Courses – Vocational and Skill Enhancement Course -I

Course Code	Course Name	
CSE25VSEC-209A	Scientific Computing with Python	Choose Any One
CSE25 VSEC -209B	Mobile Application Development	
CSE25 VSEC -209C	R Programming	

CURRICULUM STRUCTURE

Second Year B.Tech. Computer Science and Engineering

Semester – IV

Level 5.0																	
Second Year B. Tech Computer Science and Engineering																	
Semester IV																	
Sr. No.	**Course Code**	**Course Type**	**Course Name**	**Credit Scheme**			**Teaching Scheme (Hours/Week)**			**Examination Scheme and Marks**							
										CCE		**ESE**	**PR**	**OR**	**TW**	**TOTAL**
				TH	**TUT**	**PR**	**L**	**T**	**P**	**UT**	**FA**	**SA**				
										25	**25**	**50**				
1	CSE25PCC-251	Programme Core Course	Software Engineering	2			2			25	25	50				100
2	CSE25PCC-252	Programme Core Course	Database Management System	2			2			25	25	50				100
3	CSE25PCCL-253	Programme Core Course	Database Management System Laboratory			2			4				50		25	75
4	CSE25PCC-254	Programme Core Course	Advanced Data Structures	2			2			25	25	50				100
5	CSE25PCCL-255	Programme Core Course	Advanced Data Structures Laboratory			2			4				25		25	50
6	CSE25MDM-256	Multi-disciplinary Minor Course	Microprocessors and Microcontrollers	2			2			25	25	50				100
7	--	Open Elective Course	Open Elective Course - II	2			2			25	25	50				100
8	--	Value Education Course	Value Education Course -II	1	1		1	1							25	25
9	CSE25ELC-259	Experiential Learning Course	Community Engagement Project			2			4					50		50
10	IL25EMC-260	Entrepreneurship / Management Course	Entrepreneurship Skills Development		1	1		1	2						25	25
11	IL25AEC-261	Ability Enhancement Course	Modern Indian Languages (Marathi)	1		1	1		2						25	25
TOTAL				12	2	8	12	2	16	125	125	250	75	50	125	750
				22			30									

CCE- Comprehensive Continuous Evaluation**, ESE**- End Semester Evaluation, **TW**-Term Work, **OR**-Oral, **PR**-Practical, **TH**- Theory**, L**-Lecture, **TUT**-Tutorial, **UT**- Unit Test, **FA**–Formative Assessment, **SA** – Summative Assessment

Semester – IV

Basket: List of Courses – Open Elective Course –II

Course Code	Course Name	
CE25OEC-257	Digital Marketing	Choose Any One
ETC25OEC-257	Engineering Economics	
ME25OEC-257	Digital Finance	

Basket: List of Courses – Value Education Course -II

Course Code	Course Name	
CE25VEC-258	Indian Constitute	Choose Any One
AIDS25VEC-258	Environmental Science	

Course Syllabus

Semester-III

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : III			
Course	Operating System			Code		CSE25PCC-201	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Basic Computer Knowledge

Course Objectives: The course aims to:

1. To introduce basic concepts and functions of operating systems.
2. To implement the concept of Process, Thread and Resource Management.
3. To understand the concepts of Process Synchronization and Deadlock.
4. To explore various Memory, I/O and File management techniques.

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Understand role of Operating System in terms of process, memory, file and I/O management.

CO2: Evaluate performance of Process, Thread, Scheduling Algorithms and IPC.

CO3: Analyse the concept of Synchronization and Deadlock.

CO4: Apply the concepts of Memory Management Techniques, File and I/O management.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction Operating System** The Evolution of Operating Systems, Developments Leading to Modern Operating Systems, OS structure: Layered Approach, Monolithic, Microkernel Operating Systems, System components, Operating System services, Virtual Machines	7
II	**Process Concept and Scheduling** **Process:** Concept of a Process, Process States, Process Description, Process Control Block, Operations on Processes. Threads: Definition and Types, Concept of Multithreading, Multicore processors and threads. **Scheduling:** Uniprocessor Scheduling - Types of Scheduling: Preemptive and, Non-preemptive, Scheduling Algorithms: FCFS, SJF, SRTN, Priority based, Round Robin, Multilevel Queue scheduling.	7
III	**Synchronization and Deadlocks** **Concurrency:** Principles of Concurrency, Inter-Process Communication, Process/Thread Synchronization. Mutual Exclusion: Requirements, Hardware Support, Operating System Support (Semaphores and Mutex), Programming Language Support (Monitors), Classical synchronization problems: Readers/Writers Problem, Producer and Consumer problem. **Principles of Deadlock:** Conditions and Resource Allocation Graphs, Deadlock Prevention, Deadlock Avoidance: Banker's Algorithm for Single; Multiple Resources, Deadlock Detection and Recovery. Dining Philosophers Problem.	8

IV	**Memory Management & I/O Management** **Memory Management:** Memory Management Requirements, Memory Partitioning: Fixed, Partitioning, Dynamic Partitioning, Memory Allocation Strategies: Best-Fit, First Fit, Worst Fit, Next Fit, Buddy System, Relocation. Paging, Segmentation. Virtual Memory: Hardware and Control Structures, Demand Paging, Structure of Page Tables, Copy on Write, Page Replacement Strategies: FIFO, Optimal, LRU, LFU, Approximation, Counting Based. Allocation of frames, Thrashing. **File Management:** Overview, File Organization and Access, File Directories, File Sharing, Secondary Storage Management, Linux Virtual File System. I/O Management and Disk Scheduling: I/O Devices, Organization of the I/O Function, Operating System Design Issues, I/O Buffering, Disk Scheduling algorithm: FCFS, SSTF, SCAN, CSCAN, LOOK, CLOOK	**8**
	Total	**30**

Text Books:

1. William Stallings, Operating System: Internals & Design Principles, Prentice Hall, 9th Edition, 2014, ISBN-10: 0133805913 ISBN-13: 9780133805918 .
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons , Inc., 10th Edition, 2016, ISBN 978-81-265-5427-0
3. Andrew Tannenbaum, Operating System Design and Implementation, Pearson, 3rd Edition
4. D.M Dhamdhere, Operating Systems: A Concept Based Approach, 3rd Edition,Mc-Graw Hill

Reference Books:

1. Maurice J. Bach, "Design of UNIX Operating System", PHI 1986 (US Edition).
2. Achyut Godbole and Atul Kahate, Operating Systems, Mc Graw Hill Education, 3rd Edition
3. The Linux Kernel Book, Remy Card, Eric Dumas, Frank Mevel, Wiley Publications.

E-Books: Modern Operating Systems , Andrew S. Tanenbaum (and Herbert Bos, recent edition)
Link- https://freecomputerbooks.com/Modern-Operating-Systems-by-Andrew-Tanenbaum.html?utm_source=chatgpt.com

MOOC / NPTEL/YouTube Links:
Introduction to Operating Systems - Course
Link-https://onlinecourses.nptel.ac.in/noc25_cs94/preview?utm_
Youtube Link- https://youtu.be/vBURTt97EkA

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : III			
Course	Foundation of Data Structures			Code		CSE25PCC-202	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Basic knowledge of Programming in C, Functions, Structures and Pointers

Course Objectives: The course aims to:

1. To introduce fundamental concepts of data structures for problem solving.
2. To enable students to understand and apply sequential data structures such as arrays, strings, and records.
3. To develop the ability to implement and analyze stack and queue operations for efficient memory management.
4. To introduce linked lists and their variations for dynamic data storage and manipulation.

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Understand the fundamental concepts of data structures and algorithm analysis.

CO2: Apply sequential data structures such as arrays and strings to solve computational problems.

CO3: Implement stack and queue operations for real-time application scenarios.

CO4: Develop and apply singly, doubly, and circular linked lists for dynamic data operations.

Course Contents

Unit	Description	Duration [Hrs]
I	**Fundamentals of Data Structures and Algorithm** **Algorithms-**Introduction to Algorithms, Characteristics of Algorithms, Algorithm Design Tools: Pseudo code and Flowchart. **Complexity of algorithms**- Space complexity, Time complexity, Asymptotic notation- Big-O, Theta and Omega, Standard Measures of Efficiency. **Data Structures-** Introduction, Abstract Data Types (ADT), Concept of Linear and Non-linear, Static and Dynamic, Persistent and Ephemeral Data Structures, and relationship among Data, Data Structure, and Algorithm. **Algorithmic Strategies-** Introduction to Algorithm Design Strategies- Divide and Conquer, and Greedy Strategy. **Recurrence relation -** Recurrence Relation, Linear Recurrence Relations, With constant Coefficients, Homogeneous Solutions. Solving Recurrence Relations	7
II	**Array- Data Structures, Searching and Sorting Techniques** **Overview of Array,** Array as an Abstract Data Type, Operations on Array, Storage and address Representation, Multidimensional Arrays[2D, nD], Sparse matrix representation using 2D,Basic operations on Arrays. **Searching Techniques**: Search/Linear Search, Binary Search, Fibonacci Search, and Indexed Sequential Search. **Sorting Techniques:** Concepts- Stability, Efficiency, and Number of Passes, Internal and External Sorting, Bubble sort, Insertion Sort, Selection Sort, Quick Sort, Merge sort.	7

III	**Implementation and Applications of Stacks and Queues** **Stacks**: Stack Primitive operations, Stack Abstract Data Type, Representation of Stacks Using Sequential Organization, Multiple Stacks, Applications of Stack- Expression Evaluation and Conversion, Polish notation and expression conversion, Need for prefix and postfix expressions, Postfix expression evaluation, Linked Stack and Operations. **Queues:** Queue as ADT, Realization of Queues Using Arrays, Types of Queues, Operations on Queues, Operations on Circular Queues, its advantages and applications	**8**
IV	**Linked List** Introduction of Linked Lists, Primitive Operations on Linked List- Create, Traverse, Search, Insert, Delete, Sort, and Concatenate. Types of Linked List: Singly Linked List, Linear and Circular Linked Lists, Doubly Linked List.	**8**
	Total	**30**

Text Books:

1. Horowitz, Sahni, Anderson - Freed: Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2008.

Reference Books:

1. Narasimha Karumanchi: Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles, Career monk Publications, 5th Edition, 2016
2. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003.
3. Data Structures, Seynour Lipschutz and GAV Pai, Schaum's Outlines, McGraw Hill, 2008. 1st Edition.
4. Richard F. Gilberg and Behrouz A. Forouzan: Data Structures- A Pseudocode Approach with C, Cengage Learning, 2005. Revised 1st Edition.
5. R. Gillberg, B. Forouzn, ―Data Structures: A Pseudo code approach with C, 2nd Edition, Cenage Learning, ISBN 9788131503140.

E-Sources: Programming, Data Structures and Algorithms using Python, Prof. Madhavan Mukund, Chennai Mathematical Institute
Link- https://archive.nptel.ac.in/courses/106/106/106106145/

MOOC / NPTEL/YouTube Links:

1. https://nptel.ac.in/courses/106102064
2. https://onlinecourses.swayam2.ac.in/cec19_cs04/preview

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : III			
Course	Foundation of Data Structures Laboratory			Code		CSE25PCCL-203	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	50	-	25	75

Pre-requisites: Understanding of Programming and Problem Solving concepts

Course Objectives: The course aims to:

1. To understand the fundamental concepts of Data Structures and their applications in problem-solving using C++ programming.
2. To apply Searching, Sorting, and Expression Conversion Techniques using appropriate Data Structures.
3. To implement various Linear and Non-Linear data structures such as Arrays, Stacks, Queues, and Linked Lists.
4. To develop the ability to Design, Simulate, and Analyze Real-time Applications based on Stack, Queue, and Linked List operations.

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Construct and manipulate different data structures including Arrays, Stacks, Queues, and Linked Lists using C++ programs.

CO2: Apply Searching and Sorting Algorithms effectively to solve computational problems.

CO3: Demonstrate the implementation of stack and queue operations in real-life scenarios such as Undo/Redo and Patient Queue Management.

CO4: Convert expressions and perform advanced linked list operations such as merging, Dynamic Insertion, Deletion, and Traversal.

Suggested List of Experiments/Assignments

The instructor is expected to conduct TWO assignments from each group (A,B,C,D,E).The instructor may set multiple sets of assignments and distribute them among batches of students. Encourage students for appropriate use of Hungarian notation, proper indentation and comments. Use of open source software is to be encouraged. In addition to these, instructors may assign one real life application in the form of a mini-project based on the concepts learned.

Sl. No.	Group A: Arrays and Searching Sorting Algorithms
I	Write CPP program to implement the following operations on array (1) Creation of Dynamic Array list (2) Append element into the list (3) Remove element from the list (4) Insert element in the list
2	Write a CPP program to implement following searching algorithms, (1)Based on Linear Search: Program to Search an Item in an Array and Display its Position Using Linear Search (2) Based on Binary: Write a CPP to accept the n number of students, input the roll numbers in sorted order, and search for a specified roll number. If the roll number is found, display its position; otherwise, display an appropriate message.

3	Write a CPP program to implement following sorting algorithms. (1)Based on Bubble Sort: Write a CPP program to sort a list of integers in ascending order using the Bubble Sort technique. Display the list before and after sorting. (2) Based on Selection: Write a CPP program to arrange the marks of students in a class in ascending order using the Selection Sort technique. The program should accept the total number of students, input their marks, and display the list of marks before and after sorting.
Group B: Stacks and Queues	
4	Write a program to implement following STACK operations. (1) PUSH (2) POP (3) PEEK (4) UPDATE (5) DISPLAY
5	Write a program to implement following QUEUE operations. (1) INSERT (2) DELETE (3) DISPLAY
6	Write a CPP to implement an Undo and Redo feature for a Simple Text Editor using Stacks. The program should allow the user to enter text, undo the last change, and redo the undone change using Stack operations.
7	Write a CPP to manage the queue of patients waiting for consultation in a hospital. Add a patient to the queue when they arrive and remove a patient when they are called for treatment. Display the updated queue after each operation.
Group C: Stack Applications	
8	Write a CPP to convert (A+B)*C-D an infix expression into a postfix expression using stack operations and display the equivalent postfix expression.
9	Write a CPP to convert an infix expression into a postfix expression using stack operations. The program should accept a valid infix expression, apply operator precedence and associativity rules, and display the equivalent postfix expression.
Group D: Linked List	
10	Write a CPP to create at least three nodes of a singly linked list, link them together, and display the data stored in each node.
11	Write a CPP to create a shopping list using a linked list. Each item entered should be stored as a node. Display the list of items to buy.
12	Write a CPP to create two singly linked lists and merge them into a single list. Display the result after merging.

Text Books:

1. Reema Thareja - Computer fundamentals and programming in C, Oxford University, 2nd Edition, 2017
2. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003.

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : III			
Course	Object Oriented Programming			Code:		CSE25PCC-204	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Programming and Problem Solving, C Programming Basics

Course Objectives: The course aims to:

1. To introduce the fundamental principles of Object-Oriented Programming (OOP) such as Encapsulation, Abstraction, Classes, Objects, Constructors, and their role in solving real-world problems using C++.
2. To develop the ability to implement modular and reusable software components through the application of Inheritance, Polymorphism, Operator overloading, and effective use of Pointers.
3. To equip learners with skills in robust program development through File handling, Stream Operations, Memory Management, and Exception-Handling mechanisms in C++.
4. To enable students to design generic and efficient solutions using templates, the Standard Template Library (STL), including containers, iterators, and algorithms.

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Apply fundamental Object-Oriented Programming concepts such as Classes, Objects, Encapsulation, Abstraction, Constructors, and Destructors to develop basic modular C++ Programs.

CO2: Implement Inheritance, Static and Dynamic Polymorphism, Operator Overloading, and Pointer- based interactions to build reusable and extensible software components.

CO3: Apply C++ memory management features, File Streams, and Exception Handling to design programs that handle data persistence and runtime errors robustly.

CO4: Develop generic and efficient solutions using function and class templates, and apply STL containers, iterators, and algorithms to solve moderately complex computational problems.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Object-Oriented Programming** Overview of object-oriented programming, fundamentals of OOP. C++ as an Object-Oriented Programming Language: C++ programming basics, data types, structures, enumerations. **Encapsulation:** Concept and need for encapsulation, class structure, data members and member functions, access specifies (private, public, protected), data hiding, and simple ADT-based class examples. **Abstraction:** Meaning of abstraction, separation of interface from implementation, abstracting operations using classes, and the role of header files. **Constructors and destructors,** types of constructors, constructor overloading, and destructor basics with invocation order	7
II	**Inheritance, Polymorphism and Pointers** **Inheritance-** Base Class and derived Class, Types of Inheritance, Ambiguity in Multiple Inheritance, Virtual	8

	Base Class, Abstract class. **Polymorphism-** Introduction to Polymorphism, **Types of Polymorphism:** Compile Time Polymorphism: function overloading, operator overloading (unary and binary), early binding, **Run Time Polymorphism**: Base class pointer to derived class object, virtual functions, pure virtual functions, abstract base class, virtual destructor, virtual table (vtable). **Pointers:** declaring and initializing pointers, indirection operators, memory management using new and delete, pointers to objects, this pointer, pointers vs. arrays, accessing arrays using pointers, arrays of pointers, function pointers, null pointer, and void pointer.	
III	**Files , Streams and Exception Handling** **Data hierarchy**, Stream and files, Stream Classes, Stream Errors, Disk File I/O with Streams, File Pointers, and Error Handling in File I/O, File I/O with Member Functions. **Exception Handling:** fundamentals of exception handling, try–catch–throw mechanism, simple exception handling (divide-by-zero), multiple catch blocks, re-throwing exceptions, user-defined exceptions.	**7**
IV	**Templates & Standard Template Library** **Templates:** Introduction to the power of templates, function templates, class templates, templates with multiple parameters, templates and friends, generic programming functions, use of the type name and class keywords, significance of the export keyword **Standard Template Library (STL):** Introduction to STL, STL components, sequence containers and associative containers, container adapters, applications of container classes such as vector and list**.** **STL Algorithms:** Basic searching and sorting algorithms find() and sort(), min–max algorithms using min_element() and max_element(), set operations set_union() and set intersection(). Iterators: Input iterator, output iterator, forward iterator, bidirectional iterator, random access iterator.	**8**
	Total	**30**

Text Books:

1. Object-Oriented Programming with C++ (8th Edition) Author: E. Balagurusamy Publisher: McGraw-Hill Education**,** 2017 ISBN-13: 978-9353162344 ISBN-10**:** 9353162349
2. Robert Lafore, "Object-Oriented Programming in C++||", 4th Edition, Sams Publishing, ISBN:0672323087 (ISBN 13: 9780672323089

Reference Books:

1. Herbert Schildt, "C++-The complete reference"||, 8th Edition, McGraw Hill Professional, 2011, ISBN:978-00-72226805
2. Matt Weisfeld, "The Object-Oriented Thought Process", 3rd Edition Pearson ISBN-13:075-2063330166
3. Deitel,"C++ How to Program", 11th Edition, Pearson Education, ISBN:81-297-0276-

E-Books: McGraw-Hill Official Page

Link- https://www.mheducation.co.in/object-oriented-programming-with-c-9789353162344-ind-english

MOOC / NPTEL/YouTube Links:

Object Oriented Programming using C++ – IIT Kharagpur

Link- https://nptel.ac.in/courses/106105151

Youtube- Gate Smashers – OOP in C++ (Exam oriented)

Link- https://www.youtube.com/playlist?list=PLxCzCOWd7aiGmXg4J24H4iN4C3Q8-GR4h

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : III			
Course	Object Oriented Programming Laboratory			Code		CSE25PCCL-205	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	50	-	25	75

Pre-requisites: Understanding of Programming and Problem Solving concepts

Course Objectives: The course aims to:

1. To apply fundamental object-oriented programming constructs such as Classes, objects, encapsulation, and abstraction to solve real-world problems using C++.
2. To implement Inheritance, Polymorphism, Operator Overloading, and Pointers in C++ programs to develop modular and reusable software components.
3. To handle Files, Streams, and Exceptions effectively in C++ programs for robust data management and error handling.
4. To utilize templates and STL (Standard Template Library) to develop generic and efficient solutions for programming tasks.
5. To enhance programming skills, debugging, documentation, and teamwork, preparing students for real-world software development practices.

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Apply basic C++ programming constructs and OOP fundamentals to develop console-based applications

CO2: Implement object-oriented concepts such as classes, objects, constructors, encapsulation, and function overloading for modular program design

CO3: Develop C++ applications using inheritance, polymorphism, pointers, and virtual functions to solve problems involving hierarchical relationships

CO4: Utilize file handling, stream operations, and exception handling to perform data processing tasks and ensure program reliability

CO5: Design generic and reusable code using function templates, STL components, and iterators, while demonstrating effective coding practices and teamwork

Suggested List of Experiments/Assignments

Sl. No.	Program
I	Develop a C++ program to track student activity participation using basic OOP concepts. Represent student details (name, roll number, division, activity score) using appropriate data types, and store activity information using a *struct Activity*. Use an *enum ParticipationStatus* to indicate whether a student has NotParticipated, Participated, or Completed an activity. Accept all inputs using suitable control structures and display a formatted summary of student details, activity details, and participation status. Implement the solution using a Student class with relevant data members and member functions.
2	Develop a C++ program to implement a BankAccount class that demonstrates encapsulation by securely managing account data using private members and controlled access through public functions. Use multiple constructors (default, parameterized, and

	copy) to initialize account objects under different scenarios and perform basic account operations.
3	Write a C++ program to demonstrate the Diamond Problem in multiple inheritance and implement its resolution using virtual base classes. A / \ B C \ / D
4	Pointer to derived class in single inheritance Pointer to derived class in multilevel inheritance
5	Inline function for arithmetic operations (+, –, *, /) Write a C++ program to read two float numbers. Perform arithmetic operations like +, -, *, / on these numbers using Inline Function. (Use manipulators)
6	Marksheet class: accept marks, calculate total, percentage, grade, display (user-defined manipulator) Create a C++ class Marksheet with data members Seat_No., Student_Name, Class, Subject_Name, Int_Marks, Ext_Marks, Total, Grand_Total, Percentage, Grade. Write member function to accept Student information for 4 subjects. Calculate Total, Grand_Total, Percentage, Grade and display Marksheet. (Use user defined manipulator)
7	Date class with operator overloading (>>, <<) and date validation Create a class Date with members as dd, mm, yyyy. Write a C++ program for overloading operators >> and <<to accept and display aDate. Validate the date while accepting it (check correct month, correct number of days in the month, and leap year rule for February).
8	File creation, writing, closing, reading Write a C++ program that creates an output file, writes information to it, closes the file and open it again as an input file and read the information from the file.
9	Function template to swap integers and floats Write a C++ program to swap two integer values and two float values by using function template
10	STL for Searching and Sorting user record using vector container Write C++ program using STL for sorting and searching user defined records such as Item records (Item code, name, cost, quantity etc) using vector container.
11	Write a C++ program to demonstrate the use of the map associative container. Store state names as keys and their populations as values. Prompt the user to enter a state name, and display the corresponding population using the map container.

Text Books:

1. Object-Oriented Programming with C++ (8th Edition) Author: E. Balagurusamy Publisher: McGraw-Hill Education, 2017 ISBN-13: 978-9353162344 ISBN-10: 9353162349
2. Robert Lafore, "Object-Oriented Programming in C++‖", 4th edition, Sams Publishing, ISBN:0672323087 (ISBN 13: 9780672323089

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : III			
Course	Computer Organization and Architecture			Code		CSE25MDM-206	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Computer System

Course Objectives: The course aims to:

1. To understand the basic organization of computer systems and their functional units.
2. To learn the data representation, instruction formats, and addressing modes.
3. To Study the architecture, functioning, and programming of microprocessors.
4. To Analyze memory organization, I/O interfacing, and system performance.

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Explain the structure and organization of computer systems and distinguish between Computer Architecture and Organization.

CO2: Analyze data representation methods, describe CPU organization, instruction formats, addressing modes, and apply error detection and correction techniques in Microprocessors.

CO3: Design and simulate assembly programs for given microprocessor tasks.

CO4: Evaluate system performance and interpret design trade-offs in memory and I/O Subsystems.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Computer Architecture** A Brief History of computers, block diagram of a computer, computer organization vs architecture, Von Neumann vs Harvard architecture, Design for performance, evolution of Intel architectures, A Top- Level View of Computer Function and Interconnection: Computer Components, Computer Function, Interconnection Structures, Bus Interconnection Computer Arithmetic: Scalar Data Types, Fixed and Floating point numbers, IEEE 488 Number representation, Signed numbers, Integer Arithmetic, 2's Complement method for multiplication, Booths Algorithm	7
II	**Instruction Sets** Machine Instruction Characteristics: Elements of a Machine Instruction, Instruction Representation, Instruction Types, Number of Addresses, Instruction Set Design, Types of Operands: Numbers, Characters, Logical Data, Types of Operations: Data Transfer, Arithmetic, Logical, Conversion, Input/Output, System Control, Transfer of Control, Addressing Modes, Instruction Formats,	7
III	**Central Processing Unit (CPU) Design** Processor structure and function, Processor organization, Register organization, Instruction cycle, Instruction pipelining, RISC vs CISC,	8

	Control unit design, Micro-operations, Control of the processor, Hardwired and Micro-programmed control.	
IV	**Memory and Input-Output System** Characteristics of Memory Systems, The Memory Hierarchy, Internal Memory: Semiconductor Main Memory, Error Correction, DDR DRAM, eDRAM, Flash Memory, Cache Memory: Cache Memory Principles, Elements of Cache Design, External Memory: Magnetic Disk, RAID, Solid State Drives, Optical Memory, Magnetic Tape Input/Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access	**8**
	Total	**30**

Text Books:

1. Computer System Architecture by M. Morris Mano 3rd Revised Edition.
2. Computer Organization and Architecture by William Stallings. 11th Edition.
3. Advanced Microprocessors and Peripherals by K. M. Bhurchandi; A. K. Ray. 3rd Edition

Reference Books:

1. Computer Architecture: A Quantitative Approach – John L. Hennessy; David A. Patterson, Morgan Kaufmann. 7th Edition.
2. Advanced Computer Architecture: Parallelism, Scalability, Programmability – Kai Hwang, McGraw Hill. 2003, Ist Edition
3. A.Ray, K.Bhurchandi, "Advanced Microprocessors and peripherals: Arch, Programming & Interfacing", Tata McGraw Hill,2006 ISBN 0-07-463841-6 3rd Edition
4. Computer Architecture and Organization – John P. Hayes, McGraw Hill. 3rd Edition
5. Computer Organization and Design: The Hardware/Software Interface – Patterson; Hennessy, Elsevier. 4th Edition

E-Sources: NPTEL – Computer Architecture
Link- https://nptel.ac.in/courses/106102209

E-Books:

1.Computer System Architecture – M. Morris Mano
Link- https://www.pearson.com/en-us/subject-catalog/p/computer-system-architecture/P200000006364/9780131755635
2. Computer Organization and Architecture – William Stallings
Link- https://williamstallings.com/ComputerOrganization/

MOOC / NPTEL/YouTube Links:

NPTEL- Computer Organization & Architecture – IIT Kharagpur
Link- https://nptel.ac.in/courses/106105163
MOOC- Coursera – Computer Architecture *(*University of Washington*)*
Link- https://www.coursera.org/learn/comparch.
YOUTUBE- Gate Smashers – COA (full course)
Link- https://www.youtube.com/playlist?list=PLxCzCOWd7aiGFBD2-5iC4B0eY0G0T8j6N

Program	S. Y. B. Tech. (Open Elective Course-I)			Semester: III			
Course	Computational Mathematics			Code:	CE25OEC-207		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Basic knowledge of algebra, trigonometry, and calculus from First-Year Engineering Mathematics.

Course Objectives: The course aims to:

1. To develop foundational knowledge of logic, sets, functions, relations, and combinatory.
2. To model and analyze computational problems using discrete mathematical structures.
3. To understand conceptual clarity and knowledge of Statistical methods and probability.
4. To understand Numerical techniques to approximate solutions for interpolation, integration, and ordinary differential equations.
5. To understand different transform methods like Fourier/Z transforms.

Course Outcomes: After completion of the course, the students will be able to:

CO1: Apply propositional/predicate logic and proof techniques for problem solving.

CO2: Solve counting problems using combinatory and recurrence relations.

CO3: Apply correlation and regression methods to analyze experimental data in reliability, probability, testing, and quality control

CO4: Apply numerical methods for interpolation, differentiation, integration, and solving differential equations using single-step and multi-step methods.

CO5: Apply transforms to engineering systems related to signals, circuits, and control applications.

Course Contents

Unit	Description	Duration [Hrs]
I	**Logic, Proof Techniques & Sets** Propositional logic, truth tables, Predicate logic, quantifiers Logical implications, inference rules Proof techniques: direct, contradiction, contrapositive, Mathematical induction Sets: set operations, algebra of sets Functions: injective, surjective, bijective	9
II	**Relations, Recurrence & Combinatory** Recurrence relations (basic introduction) Relations: definition, properties, equivalence relations, partial orders Combinatory: Permutations & combinations, Pigeonhole principle Inclusion–exclusion principle	9
III	**Statistics & Probability** Introduction to Data Science, Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation: Karl Pearson's correlation, Spearman's rank correlation, Regression analysis, and Reliability of regression estimates. Probability, Probability density function, and Central limit theorem, Probability distributions: Binomial, Poisson, Normal, and Test of	9

	hypothesis: Chi-square test	
IV	**Numerical Methods** Interpolation: Finite Differences, Newton's and Lagrange's interpolation formulae, Numerical differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error. Solution of ordinary differential equations: Euler's method, Modified Euler's method, Runge-Kutta 4th order method, introduction to Predictor-Corrector methods.	**9**
V	**Fourier and Z-Transforms** **Fourier Transform:** Introduction to time-domain and frequency-domain representation of signals. Complex exponential form of Fourier series. Fourier integral representation. Fourier Transform and inverse Fourier Transform. Properties of Fourier Transform such as linearity, time shifting, frequency shifting, and scaling. Fourier sine and cosine transforms with inverses. **Z-Transform:** Discrete-time signals and systems. Definition of Z-transform and region of convergence (ROC). Z-transform of basic sequences. Properties of Z-transform. Inverse Z-transform using standard pairs and partial fraction method. **Applications of Z-Transform:** Application of Z-transform in solving linear difference equations, analysis of discrete-time systems, stability analysis, and modeling of simple digital filters., Fourier sine and cosine transforms and their inverses.	**9**
	Total	**45**

Text Books:

1. Rosen, K. H., Discrete Mathematics and Its Applications, 8th Edition, McGraw-Hill Education, 2019. ISBN: 978-1-259-67651-2.
2. Kolman, B., Busby, R. C., & Ross, S., Discrete Mathematical Structures, 6th Edition, Pearson/Prentice Hall, 2009/2010. ISBN: 978-0-13-229751-6.
3. Lipschutz, S., & Lipson, M., Schaum's Outline of Discrete Mathematics, Revised 3rd Edition, McGraw-Hill Education, 2009. ISBN: 978-0-07-161586-0.
4. Grimaldi, R. P., Discrete and Combinatorial Mathematics: An Applied Introduction, 5th Edition, Pearson/Addison-Wesley, 2004 (reprints 2013). ISBN: 978-0-321-21103-3.
5. Ramana, B. V., Higher Engineering Mathematics, 1st Edition, Tata McGraw-Hill, 2006. ISBN: 978-0-07-063419-0.

Reference Books:

1. Kenney, J. F. and Rosen, K. H., Discrete Mathematics, 1st Edition, McGraw-Hill Education, 2012. ISBN: 978-0-07-338309-5
2. Biggs, N. L., Discrete Mathematics, 2nd Edition, Oxford University Press, 2003.ISBN: 978-0-19-850717-8
3. Graham, R. L., Knuth, D. E. and Patashnik, O., Concrete Mathematics: A Foundation for

Computer Science, 2nd Edition, Addison-Wesley, 1994. ISBN: 978-0-201-55802-9
4. Deo, N., Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall of India, 1974. ISBN: 978-0-13-363473-0
5. Epp, S. S., Discrete Mathematics with Applications, 4th Edition, Cengage Learning, 2011. ISBN: 978-0-495-39132-6
6. Kreyszig, E., Advanced Engineering Mathematics, Wiley Eastern Ltd., New Delhi (Indian Edition), 1999 (Reprinted). ISBN: 978-81-224-0883-6
7. Jain, M. K., Iyengar, S. R. K. and Jain, R. K., Numerical Methods for Scientific and Engineering Computation, 7th Edition, Khanna Publishers, 2013. ISBN: 978-81-7409-205-9

E-Sources:

MOOC / NPTEL/YouTube Links:

1. NPTEL / SWAYAM Course: Discrete Mathematics by IIT Ropar
   https://onlinecourses.nptel.ac.in/noc20_cs82/preview
2. NPTEL / SWAYAM Course: Discrete Mathematics for CS by IIT Kanpur
   https://onlinecourses.nptel.ac.in/noc25_cs27/preview

Program	S. Y. B. Tech (Open Elective Course-I)			Semester: III			
Course	Probability Theory and Statistical Methods			Code:		CAI25OEC-207	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Prior knowledge of basic understanding of algebra and arithmetic operations is essential.

Course Objectives:

1. To introduce the fundamental concepts of probability, random variables, and distributions required to model real-world uncertainty.
2. To develop the ability to analyze discrete and continuous probability models and interpret their applications.
3. To provide understanding of statistical measures, sampling techniques, and the behaviour of sample data.
4. To explain estimation methods, hypothesis testing, and inference techniques used for data-driven decision making.
5. To enable students to apply probability and statistical tools for solving practical engineering and computational problems.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain random variables, probability distributions and their properties.
CO2: Apply standard discrete and continuous distributions to solve problems.
CO3: Analyze statistical measures and perform hypothesis testing for decision-making.
CO4: Apply point estimates, interval estimates, and MLE for parameter estimation.
CO5: Evaluate stochastic processes and Markov chain behaviors in AI-related scenarios.

Course Contents

Unit	Description	Duration [Hrs]
I	**Fundamentals of Probability & Random Variables** Sets, events, sample space, mutually exclusive events, independent events, conditional probability, Bayes' theorem, random variables (discrete and continuous), PMF, PDF, CDF, expectation, variance, moments, joint distributions, marginal distributions, conditional distributions, independence of random variables, Markov's inequality, Chebyshev's inequality, Chernoff bounds, Weak Law of Large Numbers, Strong Law of Large Numbers, Central Limit Theorem. **Case Studies (Select any one):** Spam classification using Bayes' theorem, weather prediction using conditional probability, joint probability in manufacturing defect analysis, network traffic modelling using Central Limit Theorem.	10
II	**Probability Distributions**	08

	Bernoulli distribution, Binomial distribution, Geometric distribution, Poisson distribution, Poisson process, Uniform distribution, Exponential distribution, Normal distribution, mean and variance of distributions, Introduction of moment generation, applications in AI/ML and queuing systems. **Case Studies (Select any one):** Call center arrival modelling using Poisson distribution, defect detection in manufacturing using binomial distribution, waiting time analysis using exponential distribution, sensor reading variations modeled using normal distribution.	
III	**Hypothesis Testing** Parameter and statistic, null hypothesis, alternative hypothesis, Type I error, Type II error, significance level, p-value, power of a test, large sample tests (mean, difference of means, proportion, difference of proportions), small sample tests (t-test for mean, t-test for difference of means), chi-square test, F-test for variances, hypothesis testing for real-world decision making. **Case Studies (Select any one):** A/B testing for e-commerce click-through rate improvement, medical data testing for treatment effectiveness, comparison of accuracy between two ML models, evaluating impact of teaching method using student score data.	**10**
IV	**Estimation – Point, Interval & MLE** Point estimation, interval estimation, confidence intervals for mean, confidence intervals for proportion, confidence intervals for binomial, Poisson and normal parameters, properties of estimators (unbiasedness, consistency, efficiency), Maximum Likelihood Estimation, MLE for binomial parameters, MLE for Poisson parameters, MLE for exponential distribution, MLE for normal distribution parameters. **Case Studies (Select any one):** MLE-based click-through rate estimation, estimation of failure rate of electronic components using exponential distribution, estimation of customer arrival rate in retail using Poisson distribution, confidence interval estimation for OTT movie rating averages.	**09**
V	**Stochastic Processes & Markov Chains** Introduction to stochastic processes, branching processes, Markov chains, transition probability matrix, state classification, recurrent states, transient states, absorbing states, stationary distributions, applications of Markov chains in AI, introduction to martingales and stopping times. **Case Studies (Select any one):** Google PageRank using Markov chains, customer loyalty state transition modelling, weather forecasting using Markov model, reinforcement learning grid-world transition modelling.	**08**
	Total	**45**

Text Books:

1. R. A. Johnson, Miller and Freund's "Probability and Statistics for Engineers", Pearson Publishers, 9 th Edition, 2017.
2. John E. Freund, Benjamin M. Perles, "Modern Elementary Statistics", 12th Edition, Pearson, 2013. 3. Hamdy A. Taha, "Operations Research: An Introduction", Pearson, 2017, Tenth Edition.
3. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", 12th Edition, S.Chand &

Co, 2020.
4. Kantiswarup, P.K.Gupta and Manmohan Singh, "Operations Research", Sultan Chand & Sons, 2014.

Reference Books*:*

1. Sheldon M. Ross : Introduction to Probability and Statistics for Engineers and Scientists Academic Press.
2. A. Papoulis & S. U. Pillai : Probability, Random Variables, and Stochastic Processes McGraw-Hill
3. J. S. Milton & J. C. Arnold : Probability and Statistics in the Engineering and Computer Sciences McGraw-Hill

E-sources:

1. NPTEL – Stochastic Processes (IIT Bombay)
   https://nptel.ac.in/courses/111102014
2. University of Cambridge – Stochastic Processes Notes
   https://www.statslab.cam.ac.uk/~rrw1/markov/M.pdf

Program	S. Y. B. Tech. (Open Elective Course-I)			Semester :III			
Course	Probability & Statistics			Code: AIDS25OEC-207			
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Basic knowledge of algebra, trigonometry, and calculus from First-Year Engineering Mathematics.

Course Objectives: The course aims to:

1. To introduce the basic concepts of random variables and probability distributions.
2. To develop the ability to apply standard discrete and continuous distributions to real-world problems.
3. To analyze fundamental statistical measures and distribution properties.
4. To provide knowledge of hypothesis testing methods for decision-making.
5. To enable students to analyze real-life situations using statistical reasoning and case studies

Course Outcomes: After completion of the course, the students will be able to:

CO1: Demonstrate understanding of Set Theory concepts and their relevance to probability.

CO2: Interpret random variables, probability distribution functions, and basic probability concepts.

CO3: Apply standard discrete and continuous probability distributions (Binomial, Poisson,Uniform, Exponential, and Normal) to solve simple engineering problems.

CO4: Analyze statistical measures such as mean, quantiles, and inequalities (Markov and Chebyshev) to study distribution properties.

CO5: Evaluate hypotheses for population parameters and interpret results using real-life case studies.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Set Theory** Basics of set Theory: Introduction to sets and algebra of sets, Random Experiment, Sample Space, Events, Complementary Events, Union and Intersection of Two Events, Difference Events, Exhaustive Events, Mutually Exclusive Events, Equally Likely Events, Independent Events.	7
II	**Introduction to Probability** Probability Theory: Mathematical & Statistical definition of Probability, Need of probability theory in Data science, Axiomatic definition of probability, Addition Theorem, Multiplication Theorem, Theorems of Probability, Conditional Probability, Inverse Probability, Joint Probability, Total Probability and Bayes Theorem. Case Study: Use of probability in real-life situations, like weather forecasting, sports betting, sales forecasting etc	8
III	**Introduction to Statistics:** Introduction, Origin and Development and scope of Statistics, Population and Sample, Sampling –Introduction, Types of Sampling, Purposive Sampling, Random Sampling, Simple Sampling, Stratified Sampling, Parameter and Statistic, Sampling Distribution 54 Sampling With and	10

	Without Replacement, Population Parameters, Sample Statistics. Introduction, Arithmetic Mean, Simple and weighted mean for raw data, Discrete frequency distribution, Continuous frequency distribution, Properties of A.M.,Merits & Demerits of A.M. Median, Mode for raw data, Merits and demerits of Median and Mode. Case Study : Create measures of central tendency for a real-life example dataset, such as the payroll dataset or titanic dataset. Case study of sampling for any real-world problem like exit poll statistics	
IV	**Descriptive Statistics** Measures of Dispersion, Skewness and Kurtosis: Dispersion, Characteristics for an Ideal Measure of Dispersion, Measures of Dispersion, Range, Quartile Deviation, Mean Deviation, Standard Deviation and Root Mean Square Deviation, Coefficient of Dispersion, Coefficient of Variation, Skewness, Kurtosis. Correlation and Regression: Bivariate Distribution, Scatter diagrams, Correlation, Karl Pearson's coefficient of correlation, Rank correlation, Regression, Regression Coefficients, Lines of Regression. Case study: Create measures of dispersion for a real-life example dataset like students dataset, iris detection etc.	**10**
V	**Probability Distributions & Hypothesis Testing** Random Variables: Distribution function, PMF, PDF, basic properties; mean, median, quantiles, Markov and Chebyshev inequalities. Standard Distributions: Bernoulli, Binomial, Poisson, Uniform, Exponential, Normal – definitions and simple applications. Moment concepts (introduction) and basic characteristics of the above distributions. Hypothesis Testing: Statistical hypothesis, null and alternative hypotheses, level of significance, Type I & II errors, tests for mean and proportion. Case studies based on binomial distribution and hypothesis testing for real-life decision problems.	**10**
	Total	**45**

Text Books

1. A. M. Mood, F. A. Graybill, D. C. Boes, Introduction to the Theory of Statistics, McGraw-Hill. 3rd Edition
2. Robert V. Hogg, Joseph McKean, Allen T. Craig, Introduction to Mathematical Statistics, Pearson, 8th Edition
3. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons. 11th Edition

Reference Books

1. Sheldon Ross, A First Course in Probability, Pearson, 9th Edition
2. William Mendenhall, Statistics for Engineering and the Sciences, CRC Press, 13th Edition
3. J.E. Freund, Mathematical Statistics, Pearson, 7th Edition

Online Sources:

1. NPTEL Courses (IIT Bombay / IIT Kanpur)
   https://nptel.ac.in/courses/111105090
2. Probability and Statistics for Engineers
   https://nptel.ac.in/courses/111102160

Course	Numerical Statistical Analysis			Code:		IT25OEC-207	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Basic knowledge of Engineering Mathematics, Algebra, Calculus, and Programming Concepts is essential.

Course Objectives:

1. To solve algebraic and transcendental equations using numerical methods.
2. To apply interpolation, curve fitting, numerical differentiation, and numerical integration techniques.
3. To analyze probability theory, random variables, and standard probability distributions.
4. To utilize statistical tools for sampling, correlation, regression, and hypothesis testing.
5. To develop analytical skills for engineering problems using numerical and statistical techniques.

Course Outcomes:

CO1: Apply numerical techniques to solve algebraic and transcendental equations with convergence analysis.

CO2: Use interpolation, curve fitting, numerical differentiation, and numerical integration effectively.

CO3: Apply probability concepts and standard probability distributions to engineering problems

CO4: Perform sampling, regression analysis, correlation and statistical data interpretation.

CO5: Conduct hypothesis testing such as t-test, z-test, chi-square, ANOVA & construct confidence intervals.

Course Contents

Unit	Description	Duration [Hrs]
I	**Numerical Solution of Equations** Types of Errors: Absolute, Relative, Percentage error Roots of algebraic & transcendental equations, Bisection Method, Regula Falsi Method, Newton–Raphson Method, Secant Method, and Convergence of iterative methods.	9
II	**Interpolation & Curve Fitting** Finite differences**,** Interpolation: Newton Forward & Backward Interpolation, Lagrange's Interpolation**,** Newton's Divided Difference Formula, Curve fitting: Least Squares Method, Fitting Straight Line, Parabola, and Exponential Curves.	9
III	**Numerical Differentiation & Integration** Numerical differentiation using Newton's formulas, Maxima & minima using numerical differentiation, Numerical Integration: Trapezoidal Rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule, Error analysis for numerical differentiation & integration.	9
IV	**Probability & Statistical Distributions** Basic Probability Theory, Bayes' Theorem, Random Variables, Discrete & Continuous Probability Distributions: Binomial Distribution, Poisson Distribution, Normal Distribution, Moments, Skewness & Kurtosis.	9
V	**Sampling, Regression & Hypothesis Testing**	9

	Sampling Techniques & Sampling Distribution, Correlation: Karl Pearson coefficient, Regression Analysis: Linear regression & multiple regression, Hypothesis Testing: t-test, z-test, Chi-square test, ANOVA (One-way), Confidence intervals.	
	Total	**45**

Text Books:

1. S.S. Sastry – Introductory Methods of Numerical Analysis, PHI, 5th edition
2. Erwin Kreyszig – Advanced Engineering Mathematics, Wiley, 10th edition
3. Gupta & Kapoor – Fundamentals of Mathematical Statistics, Sultan Chand, , 11th edition

Reference Books:

1. Jain, Iyengar, Jain – Numerical Methods for Scientific and Engineering Computation, New Age, 6th edition
2. William Navidi – Engineering Statistics, McGraw Hill, 2nd edition
3. Richard Johnson – Statistics & Data Analysis, Pearson, 6th edition

E-Sources:

1. NPTEL: Numerical Methods (IIT Bombay / IIT Kharagpur) https://nptel.ac.in/courses/111/102/111102128/

E-Books:

1. https://www.aerostudents.com/courses/applied-numerical analysis/IntroductoryMethodsOfNumericalAnalysis.pdf

Program	S. Y. B. Tech. (Open Elective Course-I)			Semester : III			
Course	Vectors and Transforms			Code	ETC25OEC-207		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Univariate and Multivariate Calculus.

Course Objectives: The course aims to:

1. To develop a strong foundational understanding of transform techniques to analyze and solve engineering and communication-related problems.
2. To provide conceptual clarity in formulating and solving differential equations arising in various engineering applications.
3. To equip students with numerical methods for interpolation, numerical integration, and solving ordinary differential equations with practical computational approaches.
4. To enable students to understand, differentiate, and integrate vector fields, and apply these concepts to engineering and physical systems.

Course Outcomes: After completion of the course, the students will be able to:

CO1: Apply transforms such as Laplace transform, to solve problems related to Signal Processing and control systems.

CO2: Apply Integral transforms such as, Fourier transform to solve problems related to Signal Processing and control systems.

CO3: Apply transforms such as Z-Transform to solve problems related to Signal Processing and Control Systems.

CO4: Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.

CO5: Perform vector differentiation and integration, analyze the vector fields and apply to Electromagnetic fields.

Course Contents

Unit	Description	Duration [Hrs]
I	**Laplace Transform** Definition – conditions for existence; Transforms of elementary functions; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives; Evaluation of integrals by using Laplace transform; Transforms of some special functions- periodic function, Heaviside unit step function, Dirac delta function.	9
II	**Inverse Laplace Transform** Introductory remarks; Inverse transforms of some elementary functions; General methods of finding inverse transforms; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications	9

	to find the solutions of linear differential equations.	
III	**Fourier and Z-Transforms** Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral representation, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms and their inverses. Z-Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses, Solution of difference equations	**9**
IV	**Numerical Methods** Interpolation: Finite Differences, Newton's and Lagrange's interpolation formulae, Numerical differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error. Solution of ordinary differential equations: Euler's method, Modified Euler's method, Runge-Kutta 4th order method, introduction to Predictor-Corrector methods.	**9**
V	**Vector Differential and Integral Calculus** Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities. Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Electro-magnetic fields	**9**
	Total	**45**

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill), 1st Edition.
2. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning), 2nd Edition.

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.), 1st Edition.
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication), 44th Edition.
3. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York, First Edition.
4. Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, 4/e, Tata McGraw Hill Editions, 2002, ISBN 0-07-047437-0
5. Dr. B. S. Garewal, Numerical Methods in Engineering and Science, 7/e, Khanna Publishers, ISBN 81-74009-205-6
6. Thomas' Calculus by George B. Thomas (Addison-Wesley, Pearson), 1st Edition.

E-sources:

1. https://onlinecourses.nptel.ac.in/noc23_ma54/
2. https://nptel.ac.in/courses/111106111

Program	S. Y. B. Tech. (Open Elective Course-I)			Semester : III			
Course	Applied Mathematics			Code			ME25OEC-207
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites:
Univariate Calculus, Multivariate Calculus

Course Objectives: This course aims at enabling students:

1. To develop conceptual understanding of Laplace Transform techniques and their applications in engineering problems.
2. To impart knowledge of Inverse Laplace Transform methods for solving differential equations and system analysis problems.
3. To introduce Fourier Transform techniques for analysis of signals and systems in the frequency domain.
4. To familiarize students with statistical methods and probability theory for modeling and analysis of engineering data.
5. To provide foundations of vector calculus**,** including vector fields and their differentiation and integration**,** for engineering applications.

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Apply transforms such as the Laplace transform to solve problems related to mechanical systems

CO2: Apply transforms such as the Inverse Laplace transform to solve problems related to mechanical systems, such as Differential Equations, mass, and spring systems.

CO3: Apply Integral transforms, such as the Fourier transform, to solve problems related to mechanical systems

CO4: Apply Statistical methods like correlation and regression in analyzing and interpreting experimental data applicable to reliability engineering and probability theory in testing and quality control.

CO5: Perform vector differentiation and integration, analyze the vector fields and apply to magnetic fields

Course Contents

Unit	Description	Duration [Hrs.]
I	**Laplace Transform** Definition – conditions for existence; Transforms of elementary functions; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives; Examination of integrals by using Laplace transform; Transforms of some special functions- periodic function, Heaviside unit step function, Dirac delta function.	09

II	**Inverse Laplace Transform** Introductory remarks; Inverse transforms of some elementary functions; General methods of finding inverse transforms; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find the solutions of linear differential equations.	**09**
III	**Fourier Transforms** Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral representation, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms, and their inverse Fourier transform, inverse Fourier sine transform, inverse Fourier cosine transform	**09**
IV	**Statistics & Probability** Introduction to Data Science, Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation: Karl Pearson's correlation, Spearman's rank correlation, Regression analysis, and Reliability of regression estimates. Probability, Probability density function, and Central limit theorem, Probability distributions: Binomial, Poisson, Normal, and Test of hypothesis: Chi-square test and t- test	**09**
IV	**Vector Differential and Integral Calculus** Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities. Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stokes' theorem. Applications to problems in Electro-magnetic fields	**09**
	Total	**45**

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill),1st Edition.
2. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning), 2nd edition.

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.), 1st Edition.
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication), 1st Edition.
3. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill , New York, 2nd edition.
4. Thomas' Calculus by George B. Thomas (Addison-Wesley, Pearson), 1st Edition.
5. Introduction to Probability and Statistics for Engineers and Scientists, 5e, by Sheldon M. Ross.
6. Jason Brownlee, 'Statistical Methods for Machine Learning', Machine learning Mastery, 1st Edition.

E-sources:

1. https://nptel.ac.in/courses/111107098
2. https://nptel.ac.in/courses/111105041

Program	S. Y. B. Tech. (Value Education Course-I)			Semester : III			
Course	Universal Human Values			Code		CSE25VEC-208	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	-	2	1			25	25

Pre-requisites: Social Values, Communication

Course Objectives: The course aims to:

1. To help the students develop a holistic, humane world-vision, and appreciate the essential complementarity between values and skills to ensure mutual happiness and prosperity
2. To elaborate on 'Self-exploration' as the process for Value Education.
3. To facilitate the understanding of harmony at various levels starting from self and going towards family and society.
4. To elaborate on the salient aspects of harmony in nature and the entire existence.

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Recognize the concept of self-exploration as the process of value education and see they have the potential to explore on their own right.

CO2: Explore the human being as the coexistence of self and body to see their real needs / basic aspirations clearly.

CO3: Explain relationship between one self and the other self as the essential part of relationship and harmony in the family.

CO4: Interpret the interconnectedness, harmony and mutual fulfilment inherent in the nature and the entire existence and draw ethical conclusions in the light of Right understanding

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Value Education** Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity - the Basic Human Aspirations and their Fulfilment, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity - Current Scenario, Method to Fulfil the Basic Human Aspirations	4
II	**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, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to Ensure self-regulation and Health	4
III	**Harmony in the Family and Society** Harmony in the Family - the Basic Unit of Human Interaction "Trust' - the Foundational Value in Relationship, 'Respect' - as the Right Evaluation, Values in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order	4
IV	**Harmony in the Nature (Existence)** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence, Professional Ethics in the light of Right Understanding, Strategies for Transition towards Value-based Life and Profession	3

	Total	**15**

The subject instructor supposed conduct the activities based on the topic covered during the tutorial sessions. The few activities should be individual or in group. The students supposed to submit the properly written documents.

Sl. No.	Suggested List of Experiments/Assignments
1	Introduce yourself in detail. What are your life goals? How do you make goals for your life? How do you distinguish between right and wrong? What are your major accomplishments and faults in life? Observe and study them
2	Man-made issues such as energy and material resource depletion, pollution, global warming, ozone depletion, deforestation, and soil degradation pose a threat to the survival of life on Earth. What is the source of these ailments and what is the solution, in your opinion?
3	There is rapidly growing danger due to nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression, and suicidal attempts. What do you think is the root cause of these threats to human happiness and peace? What is the solution in your opinion?
4	Our "Natural Acceptance" ability allows us to choose what is right or wrong for ourselves. We are not educated to listen to our "Natural Acceptance," which can be confused by perceptual biases and sensory stimuli. Explore the following: (i) What is your natural level of respect for yourself and others? (ii) What is "naturally acceptable" to you: nurturing or exploiting others? Is your lifestyle consistent with your natural acceptance or divergent from it?
5	Share a personal experience when you demonstrated deliberate devotion to values in a challenging scenario
6	Identify any two major problems confronting society now and investigate the underlying causes. Can these be handled based on natural acceptance of human values? If so, how should one move in this approach given the current situation?
7	Having awareness about nature, its four orders and their mutual fulfillment. Activities to be performed- written assignment, chart making.
8	List down all your desires, Observe whether the desire is related to Self (I) or Body. If it appears to be related to both, see which part of it is related to Self (I) and which part is related to Body.
9	Create small groups in the class and in that group initiate dialogue and ask the eight questions related to trust. The eight questions are: 1a. Do I want to make myself happy? 2a. Do I want to make the other happy? 3a. Is the other want to make him happy? 4a. Is the other want to make me happy? Intention (Natural Acceptance) 1b. Am I able to make myself always happy? 2b. Am I able to make the other always happy? 3b. Is the other able to make him always happy? 4b. Is the other able to make me always happy? What is the answer? Competence Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate your intention & competence as well as the others' intention & competence.

10	1. Observe on how many occasions you are respecting your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under-evaluation, over-evaluation or otherwise evaluation. 2. Also observe whether your feeling of respect is based on treating the other as yourself or on differentiations based on body, physical facilities or beliefs.
11	Write a note in the form of story, poem, skit, essay, narration, dialogue to educate a child. Evaluate it in a group. Develop three chapters to introduce social science-its need, scope and content in the primary education of children
12	List down units (things) around you. Classify them in four orders. Observe and explain the mutual fulfilment of each unit with other orders. List what do you take from nature; and what do you give back to nature? Are you a source of harmony in Nature?

Text Books:

1. A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-7-3 (Printed Copy), 978-81- 957703-6-6 (e-book)
2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-5-9 (Printed Copy), 978-81-957703-0-4 (e-Book)

Reference Books:

1. Nagaraj, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak 1999,
2. P. Banerjee, Foundations of Ethics and Management, Excel Books, Ist Edition 2005
3. N. Tripathy, Human Values, New Age International Publishers, 2019, 3rd Edition
4. E. G. Seebauer & Robert L. Berry, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press, 2000,

E-Sources:

1. A Foundation Course in Holistic Human Health - UHV
2. https://uhvparivar.org/publications/otherbooks/Jeevan-Vidya-ek-Parichay.pdf

E-Books: A Foundation Course in Human Values and Professional Ethics
Link- https://uhvparivar.org/publications/uhvbooks/UHV-FCV-3E-Textbook.pdf

MOOC / NPTEL/YouTube Links:

NPTEL: 1. Swayam Course on "Understanding Human Being Nature and Existence Comprehensively" by Dr. Kumar Sambhav

Link

1. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
2. NPTEL Course on "Exploring Human Values: Visions of Happiness and Perfect Society" by Prof. A. K. Sharma IIT Kanpur

Link- https://nptel.ac.in/courses/109104068
YOUTUBE: UHV Lecture Series – Prof. R. R. Gaur
Link- https://www.youtube.com/playlist?list=PLz0n_SjOttT0LlwM1zVfPVTz3wGM5seXm

Program	S.Y. B. Tech. (Value Education Course-I)			Semester : III			
Course	Professional Ethics for Engineers			Code:		ETC25VEC-208 A	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	2	1			25	25

Pre-requisites: Social Values, Basic Communication

Course Objectives: The course aims to:

1. To provide the students an understanding of the meaning of ethics in engineering profession.
2. To introduce an awareness of ethical duties and responsibilities of engineers in the practice of their Careers.
3. To provide a sociological understanding of the social impact of technology and engineering.
4. To examine some of the classical cases as well as contemporary ethical issues in engineering Profession.

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Practice the moral values that ought to guide the Engineering profession.

CO2: Discover of the set of justified moral principles of obligation, ideals that ought to be endorsed by the engineers and apply them to concrete situations.

CO3: Know the definitions of risk and safety also discover different factors that affect the perception of risk.

CO4: Appreciate the Ethical issues and know the code of ethics adopted in various professional bodies and industries.

Course Contents

Unit	Description	Duration [Hrs]
I	**Ethics in Engineering** Understanding basic concepts Ethics- Engineering Ethics- Engineering as Profession – Difference between occupation and professions- Professional Ethics - Codes of Ethics in Engineering profession- Moral dilemmas and moral autonomy in Engineering profession.	3
II	**Engineering as Social Experimentation:** Engineering as experimentation-Engineers as responsible Experimenters-A balanced outlook on Law.	4
III	**Social Impact of Technology and Engineering:** Ethics of science and engineering- Ethical leadership in engineering and society, social responsibility of scientist/ researchers, Intellectual property and society, Cross cultural issues in engineering research.	4
IV	**Major Issues in Engineering Ethics and Environment** Ethics and sustainable engineering- Computer ethics- Analysing ethical problems in research- Ethics in collaborative research- Engineers as expert consultants and advisors- Corporate Social Responsibility (CSR).	4
	Total	15

Sl.No.	Suggested List of Experiments/Assignments (Minimum 8 Experiments/Assignments to be performed)
1	Study of basic ethical concepts including values, morals, rights, duties, and ethical reasoning frameworks relevant to engineering practice.
2	Study of engineering as a profession with emphasis on professional roles, responsibilities, accountability, and distinction between occupation and profession.
3	Study of professional ethics and codes of ethics as prescribed by recognized professional engineering bodies, highlighting ethical conduct and compliance.
4	Study of moral dilemmas in engineering practice through case studies to develop ethical reasoning and decision-making skills.
5	Study of engineering as social experimentation focusing on risk, safety, uncertainty, and the responsibility of engineers as responsible experimenters.
6	Study of law and ethics in engineering practice to understand regulatory compliance and the need for a balanced ethical and legal outlook.
7	Study of social, environmental, and sustainability impacts of technology and engineering in the context of societal well-being..
8	Study of research ethics and intellectual property rights including issues related to plagiarism, authorship, innovation, and societal benefit.
9	Study of computer ethics and ethics in collaborative engineering work covering data privacy, cyber security, and professional integrity.
10	Study of corporate social responsibility (CSR), ethical leadership, and sustainable practices in engineering organizations.

Text Books:

1. Naagarazan, R. S. , “Professional Ethics and Human Values “ New age International, 3rd Edition.
2. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall 4th edition.

Reference Books:

1. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice all of India, New Delhi, 2004, 1st Edition.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics - Concepts and Cases", Wadsworth Thompson Learning, United States, 2000, 2nd Edition.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003, 4th Edition.

E-Sources:

1. https://youtu.be/ag1fHF7aL0A?si=vlNPA0Ea7ZjKAT3S
2. https://youtu.be/ag1fHF7aL0A?si=_T2VV3q_iYG4rj8L

Program	S.Y. B. Tech. (Value Education Course-I)			Semester : III			
Course	Social Connect and Responsibility			Code		ETC25VEC-208B	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	2	1			25	25

Pre-requisites: Social Values, Communication

Course Objectives: The course aims to:

1. To enable the student to do a deep drive into societal challenges being addressed by NGO(s), social enterprises & the government and build solutions to alleviate these complex social problems through immersion, design & technology.
2. To provide a formal platform for students to communicate and connect with their surroundings.
3. To enable to create of a responsible connection with society.

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: **Perform** tree plantation and adoption activities and document Plant characteristics, Relevance, and Cultural significance.

CO2: **Demonstrate** understanding of local heritage and crafts through field visits and Digital Documentation.

CO3: **Explain** principles of organic farming and wet waste management and relate them to sustainable campus practices

CO4: **Analyze** water conservation practices in community settings and prepare Evidence-Based documentation.

CO5: **Explore** and document local culinary heritage, indigenous materials, and food lore through Field-Based interactions.

Course Contents

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large. The course will engage student's interactive sessions, open mic, reading groups, storytelling sessions, and semester-long activities conducted by faculty mentors. In the following a set of activities planned for the course have been listed :

Unit	Description	Duration [Hrs]
I	**Plantation and adoption of a tree** Plantation of a tree that will be adopted for four years by a group of B.Tech. Students. They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature carried out by the project groups.	3
II	**Heritage walk and crafts corner** Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms.	3

III	**Organic farming and waste management** Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus.	**3**
IV	**Water Conservation** Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices.	**3**
V	**Food Walk** City's culinary practices, food lore, and indigenous materials of the region used in cooking	**3**
	Total	**15**

Sl. No.	**Suggested List of Experiments/Assignments**
1	**Tree Plantation & Adoption Activity** Students will plant a sapling on campus or a designated location and adopt it for four years. They must record initial environmental conditions, plant type, and growth indicators.
2	**Documentary/Photo Blog on Adopted Plant** Each group will prepare a short documentary or a photo blog about the adopted tree covering: • Plant origin • Botanical features • Usage in daily life • Cultural, folklore, and literary significance
3	**Heritage Walk Documentation** Students will participate in a heritage walk within the city to study historical sites, traditional architecture, and community spaces. They will document observations with photographs and short descriptions.
4	**Crafts Corner Study & Documentation** Visit a local crafts workshop (e.g., pottery, weaving, metalwork) to interact with craftsmen and understand techniques, tools, and cultural relevance. Prepare a photo blog or documentary on evolution and practice of the craft.
5	**Organic Farming Exposure Visit** Students will visit an organic farm or agricultural field to learn about: • Organic farming techniques • Soil preparation • Bio fertilizers • Crop rotation • Pest control methods A reflective report will be prepared based on observations.
6	**Wet Waste & Compost Management Practical** Study wet waste collection, segregation, and composting processes in nearby villages or campus. Students will carry out small-scale composting using daily biodegradable waste.
7	**Water Conservation Practices Survey** Survey nearby villages/campus to document traditional and modern water conservation practices such as:

	• Rainwater harvesting • Check dams • Greywater reuse • Percolation pits Prepare a photo blog or documentary presenting current practices and recommendations.
8	**Food Walk & Culinary Culture Mapping** Conduct a food walk to explore local dishes, ingredients, indigenous cooking materials, and culinary traditions. Students will document: • History behind specific dishes • Food lore • Traditional preparation methods

Guideline for Assessment Process

Continuous Internal Evaluation (CIE) After completion of, the social connect, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information/Data collected during the social connect Analysis of the information/data and report writing

Textbooks:

1. Agricultural Sustainability: Strategies for Organic, Climate-Smart, and Resource-Conserving Farming, Shravanthi et al., First edition, *2025.*
2. Hydrological Measurements for Watershed Research – Wasi Ullah et al., First Edition.
3. Perspectives in Environmental Studies – Kaushik & Kaushik, First Edition, 2018.

E-Sources:

1. https://www.youtube.com/watch?v=iaQjEDYyWKw
2. https://onlinecourses.nptel.ac.in/noc23_hs155/preview

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : III			
Course	Scientific Computing with Python			Code		CSE25VSEC -209A	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-		25	25	50

Pre-requisites: Basic Programming

Course Objectives: The course aims to:

1. To implement Python programs with conditionals and loops.
2. To use functions for structuring Python programs.
3. To apply compound data using Python lists, tuples, and dictionaries
4. To understand the use of python for data analysis and presentation

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Develop Python programs step-wise by defining functions and calling them

CO2: Apply searching and sorting algorithms effectively to solve computational problems.

CO3: Demonstrate the implementation of stack and queue operations in real-life scenarios such as undo/redo and patient queue management.

CO4: Convert expressions and perform advanced linked list operations such as merging, Dynamic Insertion, Deletion, and Traversal.

Sl. No.	Suggested List of Experiments/Assignments
I	Create a dictionary and apply the following methods 1) Print the dictionary items 2) access items 3) use get() 4)change values 5) use len()
2	Write a python program to print a number is positive/negative using if-else
3	Write a program to create a menu with the following options 1. To Perform Addition 2. To Perform Subtraction 3. To Perform Multiplication 4. To Perform Division Accepts users input and perform the operation accordingly. Use functions with arguments
4	Write a Python function that takes two lists and returns True if they are equal otherwise false
5	Write a program to double a given number and add two numbers using lambda()?
6	Write a python program to calculate numerical integration and differentiation
7	Write python program for Solving Linear Algebra problems (matrix operations, eigenvalues, and decompositions).
8	Write python program for Simple Data Visualization 1. Draw stem Plots, Line Plots, Box Plots, Bar Plots and scatter plots with random data. 2. Plot the histogram of a random data. 3. Create legends in plots.
9	Write python program for Simple Data Analysis with Spreadsheets 1. Display an electrical signal on DSO and export it as a .csv file.

	2. Read this .csv or .xls file as an array and plot it. 3. Compute the mean and standard deviation of the signal. Plot its histogram with an appropriate bin size.
10	Write python program to perform file operations such as open read, write and close on text and numeric data files.
11	Write python program to Plot Spiral Curve, scatter plot. Assume suitable dataset
12	Write python program to implement a loan calculator using Tkinter.

Reference Books:

1. Reema Thareja - Computer fundamentals and programming in C, Oxford University, 2nd edition, 2017
2. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003.

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : III			
Course	Mobile Application Development			Code		CSE25VSEC -209B	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-		25	25	50

Pre-requisites: Basic Programming knowledge,

Course Objectives: The course aims to:

1. To understand how Android applications work, their life cycle, manifest, Intents, and using external resources
2. To design and develop useful Android applications with compelling user interfaces by using, extending, and creating yourown layouts and Views and using Menus.
3. To secure, tune, package, and deploy Android applications
4. To use Android's communication APIs for SMS, telephony, network management, and internet resources (HTTP)

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Display proficiency in coding on a mobile programming platform.

CO2: Understand the limitations and features of developing for mobile devices.

CO3: Creating a complete Mobile app with a significant programming component, involving the Sensors and Hardware features of the phone.

CO4: Practice existing state of mobile app development via researching existing apps, meeting with industry professionals, and formulating new ideas.

Sl. No.	Suggested List of Experiments/Assignments
I	a) Create an android application to display RGMCET Text Message. Create an android application to display RGMCET Text Message with push button
2	b) Create an android application to display dropdown menu items and pick one item by using Spinner Component.
3	Create an android application to display internal storage data using Array Adapter
4	Create an android application to display webpage by using Web view Component.
5	Create an android application to display different webpages in fragments by using Fragments Component.
6	Create an android application to demonstrate concept of SQLite Database Storage method.
7	Create an android application to demonstrate concept of SQLite Database Storage method.
8	a) Write an android program to develop Video view application b) Write an android program to develop Audio Recording application.
9	a) Create an android application to get latitude and longitude value by using Location Service. b) Create an android application to display X, Y Sensor values by using Sensor Service
10	Create an android application to get the System Announcements by using Broadcast Receiver

11	Create an android application to display different Dialog Boxes.
12	Create an android application to display current location on Google maps by using Google-Maps Service

Reference Books:

1. Android Application Development (with Kitkat Support), Black Book by Pradeep Kothari. 2014, 1st Edition
2. Beginning Android 4 Application Development by Wei-Meng Lee. 2012, 1st Edition
3. Android Application Development for Dummies by Michael Burton, 2012 2nd Edition

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : III			
Course	R Programming			Code		CSE25VSEC -209C	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-		25	25	50

Pre-requisites: Basic Programming knowledge

Course Objectives: The course aims to:

1. To develop a strong grasp of R syntax, data types, and structures (vectors, lists, matrices, data frames).
2. To understand the R environment, packages, and workflow for statistical computing and data analysis.
3. To apply efficient data wrangling techniques to prepare data for analysis
4. To build and evaluate statistical models, including regression, classification, and time-series analysis.

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Learn the installation of R Programming Environment.

CO2: Make use of different R Data Structures.

CO3: Develop programming logic using R Packages.

CO4: Analyze the datasets using R programming capabilities

CO5: Apply R programming for reading, cleaning, visualizing and analyzing data.

Sl. No.	Suggested List of Experiments/Assignments
I	Download and install R-Programming environment and install basic packages using install .packages()command in R.
2	Learn all the basics of R-Programming (Data Types, Variables Operators etc.)
3	Implement R-Loops with different examples.
4	Learn the basic of functions in R and implement with examples.
5	Implement data frames in R. Write a program to join columns and rows in a data frame using c bind()and r bind() in R.
6	Implement different String Manipulation functions in R.
7	Implement different data structures in R (Vectors, Lists, Data Frames)
8	Write a program to read a csv file and analyze the data in the file in R
9	Create pie charts and bar charts using R.
10	Create a data set and do statistical analysis on the data using R.
11	Write R program to find Correlation and Covariance
12	Write R program for Regression Modeling
13	Write R program to build classification model using KNN algorithm

14	Write R program to build clustering model using K-mean algorithm

Reference Books:

1. R for Data Science, Hadley Wickham & Garrett Grolemund, O'Reilly
2. The Book of R, Tilman M. Davies
3. Hands-On Programming with R, Garrett Grolemund, O'Reilly

Program	S.Y. B.Tech (Entrepreneurship Management Course)			Semester : III			
Course	Principal of Management and Entrepreneurship			Code		IL25EMC-210	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	1	2			25	25

Pre-requisites: Prior knowledge of Engineering Environment, Communication Skills, Mathematical and Analytical Skills are essential.

Course Objectives: The course aims to:

1. To introduce the fundamental concepts, functions, and principles of management
2. To develop the ability to plan, organize, lead, and control organizational activities
3. To familiarize with the concept of entrepreneurship
4. To develop skills for identifying business opportunities
5. To create awareness about MSME policies, institutional support systems, start-up ecosystem

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Explain fundamental principles, functions of management with the role and responsibilities of manager.

CO2: Design and develop the plan, strategies, organizational structure and HR processes.

CO3: Apply motivational theories for leadership in organizational situations

CO4: Identify entrepreneurial traits and competencies

CO5: Create the opportunities to Utilize government and financial support systems through business plans

Course Contents

Unit	Description	Duration [Hrs]
I	**Theory of Management** Meaning, Nature, Scope and Importance of Management, Functions of Management – Planning, Organizing, Staffing, Directing, Controlling, Levels of Management – Top, Middle and Lower, Roles of a Manager (Mintzberg's Managerial Roles), Evolution of Management Thought: Classical Theory (Fayol, Taylor), Behavioral Approach, Modern Approaches (System, Contingency), Social and Ethical Responsibilities of Managers	3
II	**Planning and Techniques in Management** Planning – Nature, Process, Types of Plans, MBO (Management by Objectives), Decision Making – Types, Steps, Techniques, Organizing – Concept, Types of Organization Structures (Functional, Divisional, Matrix), Span of Control, Delegation of Authority, Centralization vs Decentralization, Staffing – Manpower Planning, Recruitment, Selection and Training	3
III	**Leadership and Control** Leadership – Meaning, Importance, Qualities of a Leader, Leadership Styles – Autocratic, Democratic, Laissez-faire, Transformational, Motivation – Meaning, Importance, Motivation Theories – Maslow, Herzberg, McGregor Theory X & Y, Communication – Process, Types, Barriers, Effective Communication Techniques, Controlling – Concept, Steps, Techniques of	3

	Control, Budgetary and Non-Budgetary Controls.	
IV	**Introduction to Entrepreneurship and Business Plan** Concept and Meaning of Entrepreneurship**,** Characteristics and Competencies of Successful Entrepreneurs**,** Types of Entrepreneurs – Innovative, Imitative, Serial, Social, Women Entrepreneurs**,** Entrepreneurial Process – Idea Generation to Enterprise Launch**,** Creativity and Innovation – Techniques and Tools**,** Barriers to Entrepreneurship – Personal, Social, Situational. Micro, Small & Medium Enterprises (MSMEs) – Definition, Importance, Opportunities, Business Environment – Internal & External Factors, Market Survey, Feasibility Study & Project Identification, Business Plan Preparation & Project Report Components. & External Factors, Market Survey, Feasibility Study & Project Identification, Business Plan Preparation & Project Report Components. Institutional Support for Entrepreneurship: MSME-DI, DIC, NSIC, SIDBI, NABARD, KVIC, NIESBUD, EDII, Start-up India, Make in India, Atal Innovation Mission. Financial Support: Seed Funding, Angel Investors, Venture Capital, Bank Loans	**6**
	Total	**15**

Sl. No.	**Suggested List of Experiments/Assignments**
1	Case Study on Functions of Management in a Real-World Organization
2	Preparation of Vision, Mission, and Objectives for a Startup Idea
3	Case Study on Evolution of Management Thought – Classical to Modern Approaches
4	Case Study on Motivation Strategy Development for Employee Productivity Improvement
5	Business Communication Activity – Drafting Official Letters, Memos, and Emails
6	Decision-Making Exercise Using Decision Tree or SWOT Analysis
7	Preparation of a Basic Business Plan for a Startup
8	Market Survey and Opportunity Identification for New Ventures
9	Preparation of Project Report for an Entrepreneurial Idea
10	Group Activity: Role Play on Leadership and Team Management

Text Books:

1. Stephen Robins, Mary Coulter , David Decenzo. Fundamental of Management, 11th Edition, Pearson, 2020, ISBN 13: 978-0-13-517515-6
2. Richard L. Hughes, Robert C. Ginnett, Gordon J. Curphy. Leadership, 09th Edition, Mc Graw Hill, 2022, ISBN-13. 978-9355320704
3. Bygrave, W.D., Zacharakis, A., & Corbett, A.C. Entrepreneurship, 6th Edition, Wiley, 2025.ISBN: 9781394262809.

Reference Books:

1. Jennifer M. George. Contemporary Management, 1st Edition, Mc Graw Hill, 2024, ISBN13: 9781264948390
2. Ries, Eric. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create
3. Radically Successful Businesses, 1st Edition, Crown Business, 2011. ISBN: 9780307887894.

4. Osterwalder, Alexander & Pigneur, Yves. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, 1st Edition, Wiley, 2010. ISBN: 9780470876411.

E-Sources: Introduction to Entrepreneurship — Katherine & Jonathan Carpenter (public-domain / Creative Commons course book)
Link- https://www.maktaba.org/book/1134/introduction-to-entrepreneurship?utm

E-Books: Entrepreneurship (OpenStax)
Link- https://openstax.org/books/entrepreneurship/pages/2-introduction?utm_source=chatgpt.com

MOOC / NPTEL/YouTube Links:

1. https://www.coursera.org/learn/entrepreneur-guide-beginners
2. Entrepreneurship By Prof. C Bhaktavatsala Rao IIT Madras https://onlinecourses.nptel.ac.in/noc21_mg70/preview
3. Entrepreneurship Essentials By Prof. Manoj Kumar Mondal IIT Kharagpur
4. https://onlinecourses.nptel.ac.in/noc20_ge08/preview

Course Syllabus

Semester - IV

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : IV			
Course	Software Engineering			Code:		CSE25PCC-251	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Basics of software developments

Course Objectives: The course aims to:

1. To learn and understand the principles of Software Engineering
2. To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements.
3. To learn and understand agile Process and agile development models on current use
4. To apply Design and Testing principles to S/W project development.
5. To understand software quality attributes

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Decide on a process model for a developing a software project

CO2: Classify software applications and Identify unique features of various domains

CO3: To Apply agile development process model for developing a software project.

CO4: Use design and modeling for implementation structure of software

CO5: Design test cases of a software system

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction** Professional software development, Software Engineering Principles Software engineering ethics, Process Models (SDLC): A Generic Process Model, Prescriptive Process Models: The Waterfall, Waterfall with feedback, Incremental Process (RAD), Evolutionary Process, Prototyping Process Model, Coping with change, Unified Process, Concurrent.	7
II	**Requirements Engineering** **Requirements Engineering:** User and system requirements, Functional and non-functional requirements. **Software Requirements Specification (SRS):** The software requirements Specification document, the structure of SRS, Ways of writing a SRS. **Requirement Elicitation:** Process, Requirement validation, Elicitation techniques. **Requirement Modeling:** Decision Tables, Event Tables, State Transition Tables, Petri Nets, Class Responsibility Collaborator (CRC) model.	7
III	**Software Modeling** Introduction to the Static Modeling, Introduction to UML **Class Diagram:** Relationships: Association, Aggregation, Composition, Generalization, **Object Diagram:** Objects and their instances, **Use Case Diagram:** Relationships: Include, Extend, Generalization, **Activity Diagrams:** Workflow, Control Flow, Swimlanes. Introduction to the Dynamic Modeling, **Sequence Diagrams:** Object Interactions in Time Sequence, Collaboration **Diagrams:** Interactions and Message Flows, **State Chart Diagrams:** States, Events, Transitions.	8

IV	**Architectural Design** Architectural design decisions, Architectural views, Architectural patterns, Application architecture. **Detail Design:** component, Designing class based components, conducting component-level design, Object-oriented design using UML. User Interface Design: The golden rules, Interface Design steps; Analysis, Design Evaluation **System modeling:** Context models, Interaction models, Structural models, Behavioral models, Model-driven engineering Introduction to Software Testing, Principles of Testing, Development testing, Test-driven development	**8**
	Total	**30**

Text Books:

1. Ian Sommerville, " Software Engineering", Addison and Wesley, ISBN 0-13-703515-2, 9th Edition
2. Roger Pressman, "Software Engineering: A Practitioner's Approach", McGraw Hill, ISBN 0–07–337597–7 2, 9th Edition
3. Ali Behfrooz and Fredeick J. Hudson "Software Engineering Fundamentals" Ist Edition Oxford University Press 1997

Reference Books:

1. Carlo Ghezzi, "Fundamentals of Software Engineering", Prentice Hall India, ISBN-10: 0133056996 Ist edition
2. Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall India, ISBN-13: 978-8120348981, 4th Edition

E-Sources: Software Engineering — IIT Kharagpur (NPTEL, Free e-book + video Lectures)
Link- https://nptel.ac.in/courses/106/105/106105087

E-Books: Handbook of Software Engineering Methods — by Lara Letaw (Open-Textbook, 2024)
Link- https://open.oregonstate.education/setextbook/?utm_source=chatgpt.com

MOOC / NPTEL/YouTube Links:

1. Software Engineering – Prof. R. Mall (IIT Kharagpur)
Link: https://nptel.ac.in/courses/106105087
2. Software Engineering – Prof. Ashish Sureka (IIIT Delhi)
Link: https://nptel.ac.in/courses/106102132

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : IV			
Course	Database Management Systems			Code:		CSE25PCC-252	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Data Structure

Course Objectives: The course aims to:

1. To understand database concepts, design principles, and ER/EER modeling.
2. To develop SQL and PL/SQL skills for efficient database operations and procedural programing.
3. To apply normalization techniques for designing well-structured relational databases.
4. To explore database transactions, concurrency control methods, and recovery mechanisms.
5. To analyze NoSQL database models and their role in managing unstructured data

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Explain the fundamentals of database management systems, including data models, ER Modeling, and database design.

CO2: Develop and execute SQL and PL/SQL programs to manage and manipulate Relational Data.

CO3: Apply normalization techniques to improve database design and ensure data integrity.

CO4: Analyze transaction management concepts and concurrency control techniques for reliable database systems

CO5: Evaluate NoSQL database types and explain their suitability for handling unstructured data.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction** Need for Database Management Systems, Evolution, Database System Concepts, and Architecture. Data Modeling: Entity Relationship (ER) Model, Relational Model, Extended ER Model, converting ER and EER diagram into tables. Database Design: Codd's Rules, Need of Normalization, Functional Dependencies, Functional Dependency Closure, Decomposition Properties, Normal Forms: 1NF, 2NF, 3NF, and BCNF.	7
II	**SQL/PLSQL** Characteristics and Advantages, Data Types and Literals, DDL, DML, Select Queries and clauses, SQL Operators, Functions, Aggregate Functions, Nested queries, Join Queries, Views: Creating, Dropping, Updating, Index and Sequence in SQL, DCL, TCL, PL/SQL: Procedure, Function, Cursors, Trigger.	7

III	**Transaction** Introduction to query processing, basic concepts of a Transaction, ACID Properties, State diagram, Concept of Schedule. Serializability – Conflict and View, Concurrency Control Protocols-Lock based and timestamp-based protocols, Recovery techniques. File organization – various kinds of indexes. Query Processing – Measures of query cost - Selection operation – Projection operation, - Join operation – set operation and aggregate operation	**8**
IV	**Introduction to NoSQL Databases** Types of NoSQL Databases, BASE properties, CAP Theorem, Comparative study of RDBMS and NoSQL, MongoDB (syntax and usage): CRUD Operations, Indexing, Aggregation, MapReduce.	**8**
	Total	**30**

Text Books:

1. Avi Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 2019, Seventh Edition, McGraw-Hill, ISBN 9780078022159.

Reference Books:

1. Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, "MongoDB: The Definitive Guide", 2020, Third Edition, O'Reilly Publications, ISBN- 978-1-449-34468-9.
2. S. K. Singh, "Database Systems: Concepts, Design and Application", 2013, Second Edition, Pearson Education, ISBN- 978-81-317-6092-5.

E-Sources:

1.SQL Notes – w3resource (open access)

Link- https://www.w3resource.com/sql/tutorials.php

2. /~dbbook/openAccess/thirdEdition/

NPTEL Lecture Notes

Link- https://nptel.ac.in/courses/106104135

E-Books: Database Management Systems – Open Textbook

Link- https://pages.cs.wisc.edu

MOOC / NPTEL/YouTube Links:

NPTEL- Lecture Videos by Dr. Arnab Bhattacharya from IIT Kanpur. Fundamentals of Database Systems

Link-http://www.nptelvideos.com/course.php?id=426

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : IV			
Course	Database Management Systems Laboratory			Code		CSE25PCC--253	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	50	-	25	75

Pre-requisites: Data Structure, Basic Databases

Course Objectives: The course aims to:

1. To experiment to handle SQL statements and PL/SQL code in databases.
2. To implement advanced SQL operations, including aggregate functions, joins, subqueries, views, stored procedures, and triggers, for efficient database management.
3. To use to handle NoSQL databases.
4. To demonstrate application development with database connectivity

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Implement the given relational schema, database queries, and PL/SQL programs for 2-tier architecture using MySQL.

CO2: Implement NoSQL queries and aggregate functions for given requirements using MongoDB.

CO3: Develop and execute SQL queries for data manipulation, transaction control, and access man agement using DML, DCL, and TCL commands

CO4: Develop database applications using database connectivity.

Sl. No.	Suggested List of Laboratory Experiments/Assignments
I	Use an open source database tool to implement a structured database system for a Medical Store to manage products, customers and orders. Write SQL queries to perform DDL operations for table creation in the Retail Store database with constraints (Not Null, Primary, Foreign etc) and Modification using Alter command variations, and also perform basic DML operations (Insert, Select, Update, Delete), and executing various Select statement queries with different clauses for given schemas of Medical Store database.
2	NMIET maintains a structured database to manage student enrollments, courses, instructors and departments. Write SQL queries using various JOIN types (Natural, Inner, Equi, Non-Equi, Outer, Left Outer, Right Outer), as well as Subqueries and Views to extract insights from the NMIET database system.
3	A Bank wants to automate its customer credit scoring system based on their financial standing. Let the credit score be computed on a scale of 0 to 5 by a PLSQL function based on the account balance and loan amount of any customer. (hint: if loan_amount is 50% of account balance then, credit_score: 3). Write a stored procedure that uses a cursor and calls the function with each customer name for computing credit scores of all bank customers. i. Customer(Cust_name, AccNo, Balance, city) ii. Loan(Loan_no, branch_name, Amount) iii. Borrower(Cust_name, Loan_no, CreditScore).
4	A Company wants to track employee salary changes, maintain company-wide statistics, and log employment history efficiently using row-level triggers. Implement

	BEFORE and AFTER triggers on EMPLOYEE, COMPANY_INFO, and EMP_LOG tables using INSERT, UPDATE and DELETE operations. i. EMPLOYEE(Emp_Id, First_Name, Last_Name, Email, Phone_No, Hire_Date, Job_Profile, Salary, HRA) ii. COMPANY_INFO(Emp_Count, Total_Salary_Expenses) iii. EMP_LOG(Emp_Id, Old_Salary, New_Salary, Edit_Time, Job_Status)
5	Use an open source database tool to implement a structured database system for a Medical Store to manage products, customers and orders. Write SQL queries to perform DDL operations for table creation in the Retail Store database with constraints (Not Null, Primary, Foreign etc) and Modification using Alter command variations, and also perform basic DML operations (Insert, Select, Update, Delete), and executing various Select statement queries with different clauses for given schemas of Medical Store database.
6	An institute maintains details of all teachers, including name, qualifications, department details, experience, salary structure, date of joining, appointment _nature and area of expertise. Design and implement MongoDB queries to perform CRUD operations on the teacher's collection for various administrative tasks. Create the above collection, insert suitable documents and design updation and retrieval queries requiring comparison and logical operators, save() method, etc.
7	Customers of an online marketplace frequently search for products and their orders, and the search becomes slow as the products and orders grow. Implement all types of indexes on the products and order MongoDB collections
8	The University wants to analyze course enrollments, faculty performance and student achievements using MongoDB aggregation pipelines. The university maintains a "courses" collection, which includes: i. Course details (title, department, credit hours, instructor) ii. Student enrollments (student names, scores, pass/fail status) iii. Faculty details (experience, designation, department) Design and implement aggregation queries to generate various reports using multiple aggregation stages with the given collection in MongoDB.
9	Implement various database operations through suitable programming language.
10	Submit Mini project based on all the basic operations of normalization , SQL and Pl SQL
Instructor should maintain progress report of mini project. throughout the semester from project group. •The practical exam will be based on Assignments 1 through 10 provided above. •Mini Project in this course should facilitate the Project Based Learning among students	

Reference Books:

1. Walter Shields," SQL: QuickStart Guide – The Simplified Beginner's Guide to SQL" 1st Edition 2019
2. Alan Beaulieu," Learning SQL (3rd Edition)" 2020

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : IV			
Course	Advanced Data Structure			Code:		CSE25PCC-254	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Data Structure

Course Objectives: The course aims to:

1. To Introduce advanced tree structures and priority queues for efficient data processing.
2. To develop understanding of graph representations and classical/advanced graph algorithms.
3. To explain hashing techniques, collision handling, and dictionary operations.
4. To provide knowledge of advanced structures like disjoint sets, BIT, external indexing, and file organization.

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Apply advanced tree and heap structures for optimized operations.
CO2: Implement graph algorithms for traversal, shortest path, MST, and max flow.
CO3: Use hashing and skip lists for efficient searching and indexing.
CO4: Apply disjoint sets, BIT, and file organization methods in real applications.

Course Contents

Unit	Description	Duration [Hrs]
I	**Trees** Introduction, representation, sequential and linked organization, converting tree to binary tree, binary tree traversals, Binary Tree Operations. Binary Search Tree (BST) and its operation. Optimal Binary Search Tree (OBST), OBST as an example of Dynamic Programming, **Advanced Trees:** AVL Trees, Height Balanced Tree- AVL tree, B-Trees and B+ Trees, Red-Black Trees, Splay Tree, Segment Trees, Interval Trees, K-dimensional tree, AA tree. **Priority Queues:** Introduction, Min and MAX Heap. **Binary Heaps:** Binary Heap, Heap Operations, Binomial Heap, Fibonacci Heap, Pairing Heap, Applications of Heaps (Dijkstra, Prim).	7
II	**Graphs** Introduction, Storage representation, Adjacency matrix, adjacency list, adjacency multi list, inverse adjacency list. Traversals-depth first and breadth first, Minimum spanning Tree, **Greedy algorithms:** Introduction to greedy Strategy for computing minimum spanning tree- Prims and Kruskal Algorithms. **Advanced Graphs:** Dikjtra's Single source shortest path, Topological ordering, MST.Maximum Flow & Matching.	7
III	**Hash Table** Concepts-hash table, hash function, bucket, collision, probe, synonym, and overflow, open hashing, closed hashing, perfect hash function, load density, full table, load factor, rehashing, issues in hashing.	8

	Hash functions - properties of good hash function, division, multiplication, extraction, mid-square, folding and universal, **Collision resolution strategies-** open addressing and chaining, Hash table overflow- open addressing and chaining, extendible hashing. Dictionary- Dictionary as ADT, ordered dictionaries. **Skip List -** representation, searching and operations- insertion, removal.	
IV	**Disjoint Set Data Structure -** Path Compression & Rank, Skip Lists, Fenwick Tree (Binary Indexed Tree), External Memory Structures (External Sorting, B-Tree Indexing), O Applications (Compression, Search Engine Data Structures, Distributed Hashing). **File Organization:** Sequential file organization- concept and primitive operations, **Direct Access File -** Concepts and Primitive operations, Indexed sequential file organization-concept, types of indices, structure of index sequential file, Linked Organization- multi list files, coral rings, inverted files and cellular partitions.	**8**
	Total	**30**

Text Books:

1. Peter Brass**,** Advanced Data Structures||, Cambridge University Press, ISBN: 978-1-10743982-5, Ist Edition
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C/C++, Pearson., 2nd Edition
3. Thomas H. Cormen et al**.**, Introduction to Algorithms (CLRS), MIT Press., 3rd Edition
4. Ellis Horowitz, Sartaj Sahni, Fundamentals of Data Structures, University Press., Ist Edition
5. Narasimha Karumanchi, Data Structures and Algorithms Made Easy, Career Monk, 5th Edition

Reference Books:

1. A. Aho, J. Hopcroft, J. Ulman**,** ―Data Structures and Algorithms||, Pearson Education, 1998, ISBN-0-201-43578-0. 2. , 1st Edition
2. Michael J Folk**,** ―File Structures an Object Oriented Approach with C++||, Pearson Education, ISBN: 81-7758-373-5. 3. 1st Edition
3. Sartaj Sahani, ― Data Structures, Algorithms and Applications in C++||, Second Edition, University Press, ISBN:81-7371522 X. 4.
4. G A V Pai**,** ― Data Structures and Algorithms||, The McGraw-Hill Companies, ISBN 9780070667266. 1st Edition
5. Goodrich, Tamassia, Goldwasser, ― Data Structures and Algorithms in Java||, Wiley Publication, ISBN: 9788126551903., 6th Edition

E-Sources:
Link- https://www.geeksforgeeks.org/dsa/dsa-tutorial-learn-data-structures-and-algorithms/

E-Books:
Link- https://www.mta.ca/~rrosebru/oldcourse/263114/Dsa.pdf

MOOC / NPTEL/YouTube Links:
Link-

1. https://nptel.ac.in/courses/106102064
2. https://onlinecourses.nptel.ac.in/noc25_cs81
3. https://nptel.ac.in/courses/106105225
4. https://nptel.ac.in/courses/106106145
5. https://www.youtube.com/watch?v=AT14lCXuMKI&list=PLdo5W4Nhv31bbKJzrsKfMpo_grxuLl8LU

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : IV			
Course	Advanced Data Structure Laboratory			Code		CSE25PCC--255	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	25	-	25	50

Pre-requisites: Data Structures and Algorithms,
Fundamentals of C++, Programming,

Course Objectives: The course aims to:

1. To provide hands-on experience in implementing fundamental and advanced data structures such as trees, graphs, hashing, skip lists, and disjoint sets.
2. To develop students' ability to design and analyze algorithms related to searching, sorting, traversal, and optimization using different data structures.
3. To enable students to apply appropriate data structures to real-world problems like route planning, directory management, and library systems.
4. To enhance logical thinking and programming skills by implementing operations such as insertion, deletion, balancing, hashing, and path finding.
5. To help students understand the performance implications (time & space complexity) of different data structures and choose the most efficient one for a task.

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Implement and perform operations on various data structures (BST, AVL, Graphs, Hash Tables, Skip Lists, etc.) using a programming language.

CO2: Apply algorithmic techniques such as traversal, balancing, hashing, BFS, DFS, and TSP to solve computational and real-time problems.

CO3: Apply multithreading techniques to manage memory access. Analyze and compare the efficiency of different data structure operations in terms of time and space complexity.

CO4: Develop mini-projects or problem-based solutions using suitable data structures for applications like delivery optimization, population management, and book indexing.

CO5: Demonstrate the ability to design, test, and debug modular programs using appropriate data structures and justify their choice based on performance.

Sl. No.	Suggested List of Experiments/Assignments
	Group A (All)
I	Implement various operations on a Binary Search Tree, such as insertion, deletion, display, and search.
2	Construct an expression tree from the given prefix expression, e.g., +--a*bc/def, traverse it using post-order traversal (non-recursive), and then delete the entire tree.
3	Implement an AVL Tree to store integer data. Perform: 1. Insert nodes with proper balancing

	2. Perform left/right rotation where necessary 3. Search for an element 4. Display the tree in preorder, inorder, and postorder 5. Find the height and balance factor of each node
Group B (All)	
4	Choose any area in your city and list some well-known places (A, B, C, …). Think of each place as a node in a graph. If there is a direct road between two places, show it as a connection (edge) between those nodes. Now, starting from place A, find the order in which you would visit all the places using: 1. BFS (Breadth First Search) 2. DFS (Depth First Search) Perform: • Use an adjacency matrix to represent the graph for DFS. • Use an adjacency list to represent the graph for BFS.
5	A pizza shop gets many delivery orders from different nearby locations. These locations can be shown as a graph, where the time taken to travel between two places is shown as a connection between nodes. One pizza delivery boy needs to deliver pizzas to all customers in the shortest possible time. Use Travelling Salesman Problem (TSP) and find the best route for delivering all the pizzas quickly.
6	You are given a list of cities along with their population. Store this information using a **Binary Search Tree (BST)** . Your program should be able to: 1. **Add** a new city to the list 2. **Delete** an existing city 3. **Update** the population of any city 4. **Display** all city names in **ascending** or **descending** order 5. Find the **maximum number of comparisons** needed to search for a city in the BST
Group C (Any 2)	
7	Implement a hash table of size 10 and use the division method as a hash function. In case of a collision, use chaining. Implement the following operations: **Perform:** 1. **Insert(key):** Insert key-value pairs into the hash table. 2. **Search(key):** Search for the value associated with a given key. 3. **Delete(key):** Delete a key-value pair from the hash table
8	Design and implement a hash table of fixed size. Use the division method for the hash function and resolve collisions using linear probing. Allow the user to perform the following operations: **Perform:** 1. Insert a key 2. Search for a key 3. Delete a key 4. Display the table
9	Implement a hash table with extendible hashing. The hash table should dynamically expand when the number of keys in a bucket exceeds a certain threshold. Perform the following operations: **Perform:**

	1. **Insert(key):** Insert key-value pairs into the hash table 2. **Search(key):** Search for the value associated with a given key 3. **Delete(key):** Delete a key-value pair from the hash table
Group D (Any 2)	
10	**Designing a High-Performance Data Management System for a Digital Library.** A large digital library system needs to efficiently manage **millions of books, users; categories, search queries, and storage files**. You are appointed to design core backend data structures to ensure: Fast search1. Efficient storage 2. Minimum disk I/O 3. Dynamic file access 4. Scalable indexing. **Disjoint Sets (Union–Find)** The digital library groups books by **themes** (e.g., AI, ML, DS, IoT). Th Implement Disjoint Set with Path Compression + Union by Rank. **Perform:** 1. Implement Disjoint Set with Path Compression + Union by Rank. 2. Given book–theme pairs and merge operations, identify which theme a book belongs to. 3. Demonstrate merging of categories and find operations.
11	Skip List for Fast Search - Implement a Skip List to store book titles. **Perform:** 1. Insertion of new titles 2. Search operations 3. Deletion of outdated titles 4. Compare Skip List performance with a normal Linked List (number of steps per search).
12	Write a CPP to create two singly linked lists and merge them into a single list. Display the result after merging.
Group E	
	City Information Management System using BST
13	1. City Directory using BST 2. Expression Tree Builder 3. AVL Tree Student Record System 4. Smart City Tour Planner using BFS & DFS 5. Pizza Delivery Optimizer using TSP 6. Population Information Manager using BST 7. Student Lookup using Chaining Hash Table 8. Product Inventory using Linear Probing Hash Table 9. Dynamic Extendible Hashing System 10. Digital Library Theme Manager using Union-Find 11. Skip List Book Search Engine

Reference Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education. 2014
2. Malik, D. S.. Data Structures Using C++. India, Course Technology/Cengage Learning India, 2012.
3. Agarwal, Dr. Basant, and Baka, Benjamin. Hands-On Data Structures and Algorithms with Python: Write Complex and Powerful Code Using the Latest Features of Python 3.7, 2nd Edition. Germany, Packt Publishing, 2018.

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : IV			
Course	Microprocessor & Microcontroller			Code:		CSE25MDM-256	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: DELD, COA

Course Objectives: The course aims to:

1. To learn the architecture and programmer's model of advanced processor
2. To understand the system level features and processes of advanced processor
3. To acquaint the learner with application instruction set and logic to build assembly language programs.
4. To understand debugging and testing techniques confined to 80386 DX

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Understand 80386 architecture, multi-tasking and multiuser system.

CO2: Apply the segmentation principals

CO3: Describe the protection and multitasking in 80386

CO4: Explore the microcontroller systems for embedded systems.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to 80386** 80386DX Features and architecture, Programmers Model of 80386, Memory Organization and Segmentation- Global Descriptor Table, Local Descriptor Table, Interrupt Descriptor Table, Data Types, Registers, Instruction Format, Operand Selection, Interrupts and Exceptions.	7
II	**Systems Architecture** Systems Registers, Systems Instructions. Memory Management- Segment Translation, Page Translation, Combining Segment and Page Translation.	7
III	**Protection and Multi-tasking** Protection- Need of Protection, Overview of 80386DX Protection Mechanisms, Segment Level Protection, Page Level Protection, Combining Segment and Page Level Protection. Multitasking- Task State Segment, TSS Descriptor, Task Register, Task Gate Descriptor, Task Switching, Task Linking, Task Address Space. Processor Modes	8
IV	**Introduction to Microcontrollers** Architecture of typical Microcontroller, Difference between Microprocessor and Microcontroller, Characteristics of 8 bit and 16 bit microcontrollers, Applications of Microcontrollers, User Interface Design: The golden rules, Interface Design steps & Analysis, Design Evaluation.	8

	Total	**30**

Text Books:

1. A.Ray, K.Bhurchandi, "Advanced Microprocessors and peripherals: Arch, Programming & Interfacing", Tata McGraw Hill,2004 ISBN 0-07-463841-6 3rd Edition
2. Intel 80386 Programmer's Reference Manual 1986, Intel Corporation, Order no.: 231630-011, December 1995.
3. James Turley, "Advanced 80386 Programming Techniques", McGraw-Hill, ISBN: 10: 0078813425, 13: 978-0078813429., 1st Edition

Reference Books:

1. Walter A. Triebel, —The 80386Dx Microprocessor: Hardware||, Software, and Interfacing, Pearson Education, ISBN: 0137877307, 9780137877300. 1st edition
2. Brey, Barry B, —8086/8088, 80286, 80386 and 80486 Assembly Language Programming||, Prentice Hall, ISBN: 13: 9780023142475, 1993
3. Mohammad Rafiquzzaman, —Microprocessors: Theory and Applications: Intel and Motorola", Prentice Hall, ISBN:-10:0966498011, 13:978:0966498011, 1st Edition

E-Sources: Microprocessors and Interfacing– Lecture Notes
Link- https://www.vssut.ac.in/lecture_notes/lecture1423725540.pdf

E-Books: 1. Intel 80386 Programmer's Reference Manual (Free PDF)
Link- https://css.csail.mit.edu/6.858/2014/readings/i386.pdf
2. Intel 80386 System Architecture Manual
Link- https://pdos.csail.mit.edu/6.828/2005/readings/i386/systems.pdf

MOOC / NPTEL/YouTube Links:

1. NPTEL — Advanced Microprocessors (IIT KGP)
Link- https://nptel.ac.in/courses/106105107
2. NPTEL — Microprocessors & Microcontrollers (IIT Kharagpur)
Link - https://nptel.ac.in/courses/108105102
3. MIT OpenCourseWare — Computer System Engineering (Covers 80386 Internals)
Link- https://ocw.mit.edu/courses/6-033-computer-system-engineering-spring-2018/

Program	S.Y. B. Tech. (Open Elective Course-II)			Semester : IV			
Course	Digital Marketing			Code:	CE25OEC-257		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: General awareness of marketing terms such as target audience, branding, product, pricing, etc.

Course Objectives: The course aims to:

1. To provide the basic Concepts of Digital marketing and the road map for successful Digital marketing strategies.
2. To know the importance of Social Media Platforms importance in Digital Marketing
3. To understand the technological importance of Search Engine Optimization (SEO)
4. To develop skills for creating, managing, and optimizing digital marketing campaigns across various channels.
5. To enable students to analyze digital consumer behavior and create effective online strategies.

Course Outcomes: After completion of the course, the students will be able to:

CO1: Explain the basic Concepts of Digital marketing

CO2: Apply digital marketing tools for suitable applications

CO3: Examine the various social media and design Advertising campaigns

CO4: Apply SEO, SEM, and content creation techniques to improve online visibility.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Digital Marketing:** Fundamentals of Digital marketing & Its Significance, Traditional marketing Vs Digital Marketing, Evolution of Digital Marketing, Digital Marketing Landscape, Key Drivers, The Digital users in India, Digital marketing Strategy- Consumer Decision journey Digital advertising Market in India, Skills in Digital Marketing, Digital marketing Plan. **Case study**: Launching a Tech Startup's Mobile App —"SmartBudget"	7
II	**Digital Marketing Strategy:** **Strategy** used in Digital Marketing, PPC and online marketing through social media, Social Media Marketing, Google web-master and analytics overview, Email Marketing, Mobile Marketing Display adverting, Buying Models, different type of ad tools, Display advertising terminology, types of display ads, different ad formats **Case study: Social Media Marketing** Platforms: Instagram, YouTube Shorts, LinkedIn	8
III	**Social Media Marketing:** Fundamentals of Social Media Marketing& its significance, Necessity of Social media Marketing Facebook Marketing: Facebook for Business, Facebook Insight, Different types of Ad formats, setting up Facebook	8

	Advertising Account, Facebook audience & types, Designing Facebook Advertising campaigns, Facebook Avatar, Apps, Live, Hashtags **Case study**: App Store Optimization (ASO)	
IV	**Search Engine Optimization (SEO):** Introduction to SEO, How Search engine works, SEO Phases, History Of SEO, How SEO Works, Googlebot (Google Crawler), Types of SEO technique, Keyword Planner tools Social media Reach- Video Creation & Submission, Maintenance- SEO tactics, Google search Engine **Case study: Provide REAL outputs like a mini-project** Marketing plan, Keyword research sheet Google Ads mock screenshot FB Ads audience design Social media creative poster 1 reel script	**7**
	Total	**30**

Text Books:

1. Dave Chaffey & Fiona Ellis-Chadwick, "Digital Marketing", 8th Edition, Pearson, 2022, ISBN: 9781292738086.
2. Madan, Supriya. Digital Marketing: The Science and Magic of Digital Marketing Can Help You Become a Successful Marketing Professional. Germany, BPB Publications, 2022.

Reference Books:

1. Klaus Solberg Søilen, "Digital Marketing", Springer, 2024, ISBN: 9783031695186.
2. Dionne Solomons et al., "eMarketing: The Essential Guide to Marketing in a Digital World", 6th Edition, 2020, ISBN: 9780639707808.

MOOC/ NPTEL/YouTube Links:

1. NPTEL Course, By Dr. Tejinderpal Singh, Panjab University Chandigarh https://onlinecourses.swayam2.ac.in/ugc19_hs26/preview

Program	S.Y. B. Tech. (Open Elective Course-II)			Semester : IV			
Course	Engineering Economics			Code:	ETC25OEC-257		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Basic Knowledge of economics & mathematics.

Course Objectives: The course aims to:

1. To enable the students to understand the economic theories which may be applied to maximize return and economic environment in which they have to operate.
2. To introduce fundamental economic principles relevant to engineering analysis and decision-making.
3. To develop the ability to apply time-value-of-money concepts for evaluating engineering alternatives.
4. To learn cost estimation, depreciation, and break-even analysis for effective financial planning in engineering projects.

Course Outcomes: After completion of the course, the students will be able to :

CO1: Identify the core concepts of economics and recognize its potential in addressing modern day socio-economic challenges

CO2: Compare and analyze alternatives based on present, annual, rate of return, benefit over cost analyses, and time value of money in evaluation of investments and projects in real life and the impact of economic factors on feasibility of real life projects.

CO3: Analyze and predict the economic impact of engineering solutions to make financially prudent decisions in everyday life.

CO4: Evaluate the role of economics to give knowledge to the students about various costs for determining the manufacturing of a product.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction** Nature and significance of economics, Goods and Utility, Basic Concept of Demand and Supply, Elasticity of Demand- Price elasticity of Demand, Cross elasticity of Demand, Production - Production Function, Production Process and Factors of Production, Market - Introduction to Monopoly, Perfect Competition, Oligopoly and Monopolistic Competition, Cost Concepts, E-commerce.	7
II	**Money- its evaluation and function, Bank** Commercial Bank and Central Bank and brief idea about function of banking system. Tax and Subsidy, Type of Tax- Direct and Indirect, Monetary and fiscal policy, Inflation and Business cycle, IPR & WTO, International trade, terms of Trade, Gain from International Trade, Free Trade vs. Protection, Dumping, and Balance of Payment	8
III	**Role of Science, Engineering and Technology In economic Development:**	7

	Some of the burning problems of rural and slum areas in India and how engineering and technology may be used to alleviate them, example of Green Revolution and White revolution. Reasons for their success and can we replicate them. Sustainable Development **Case study**: App Store Optimization (ASO)	
IV	**Elementary Economic Analysis; Interest formulas and their Applications:** Calculations of economic equivalence, Bases for Comparison of Alternatives: Present Worth Method, Future worth method, Annual equivalent, Internal Rate of return; Evaluating Production Operations, Business Risk Management.	**8**
	Total	**30**

Text Books:

1. A Textbook of Engineering Economics: The Principles and Applications, D. R. Kiran, BS Publications, 2021, 1st Edition.
2. Engineering Economics Test & Cases, D N Dwivedi, Dr. H L Bhatia & Dr. S N Maheshwari, Vikas Publishing House Pvt. Ltd. Revised / Latest Edition (2024).

Reference Books:

1. Principles of Engineering Economics with Applications, Zahid A. Khan, Arshad N. Siddiquee, Brajesh Kumar, Mustufa H. Abidi, 2nd Edition, Cambridge University.
2. Practical Applications of Engineering Economics, Kal R. Sharma, Momentum Press. Engineering Economics, R. Panneerselvam, PHI Learning Private Ltd, 1st Edition.

E-sources:

1. https://youtu.be/-5q7RB1GWEA

Program	S.Y. B. Tech. (Open Elective Course-II)			Semester: IV			
Course	Digital Finance			Code:		ME25OEC-257	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Basic Finance and Economics**,** Cyber Security & Digital Payments

Course Objectives:

1. To understand the evolution of digital finance and the role of big data in modern financial systems.
2. To gain insight into digital payment ecosystems and ongoing transformations in digital banking.
3. To acquire foundational knowledge of blockchain technology, cryptocurrencies, and decentralized finance.
4. To explore applications of artificial intelligence, machine learning, and data analytics in financial services

Course Outcomes:

On completion of the course, students will be able to –

CO1: Explain the basics of digital finance, big data, and regulatory frameworks.
CO2: Analyze digital payments, FinTech trends, and neo-banking models.
CO3: Illustrate block chain, crypto currencies, and DeFi systems.
CO4: Discuss the role of AI/ML for financial analytics.
CO5: Apply cybersecurity and compliance strategies for digital finance.

Course Contents

Unit	Description	Duration [Hrs]
I	**Digital Finance Fundamentals & Big Data** **Evolution & Fundamentals of Digital Finance:** Evolution of digital finance and the shift from traditional to digital systems. Introduction to FinTech and technological transformations in financial services. Overview of regulatory frameworks and compliance in the digital era. **The Rise of Big Data in Finance:** Role of big data in shaping financial decision-making and risk management. Leveraging data science for personalization and modern financial services Case Study: DBS Bank's Digital Transformation	7
II	**Digital Payment Systems & Digital Banking Transformation** **Digital Payment Ecosystems:** Historical evolution and digitalization of payment systems (ECS, RTGS, NEFT, IMPS, UPI, mobile wallets, contactless payments), Attributes of a well-functioning payment system and the role of banks. **Fintech Innovations & Disruption:** FinTech startups, challenger banks, and peer-to-peer lending models, FinTech applications across banking, NBFCs, insurance, lending, audit, and compliance, Regulatory guidelines (e.g., RBI guidelines) and risks associated with new payment models. The Future of Digital Banking: How traditional banks are adapting and the rise of neo-banks, Digital banking trends and evolving customer expectations	7

	Case Study: Unified Payments Interface (UPI) in India	
III	**Block chain, Crypto currencies & Decentralized Finance** **Block chain Technology:** Fundamentals of block chain and underlying cryptographic techniques, Smart contracts and decentralized finance (DeFi) applications. Crypto currencies & Digital Assets: Overview and evolution of crypto currencies (Bitcoin, Ethereum, etc.), Central Bank Digital Currencies (CBDCs) and other emerging digital assets. **Advanced Applications & Case Studies:** Impact of blockchain on payments, lending, and financial settlements, Real-world case studies and disruptive potential in global finance Case study: The Sand Dollar (Bahamas' CBDC)	**8**
IV	**Artificial Intelligence, Machine Learning in Financial Analytics** **AI & Machine Learning in Finance:** Predictive analytics in stock markets, trading, and algorithmic/high frequency trading, Credit risk analysis and automated decision-making using AI. Data Analytics & Financial Applications: Data sourcing, cleaning, processing, and visualization for financial data, Sentiment analysis and AI-driven portfolio management. **Practical Projects & Case Studies:** Hands-on projects: building stock price prediction models, fraud detection systems, and credit score prediction models, Real-world applications in digital lending and wealth management Case study: Thread programming Using Pthreads, POSIX	**8**
	Total	**30**

Text Books:

1. C. Skinner, Digital Finance: Big Data, Startups, and the Future of Financial Services, 1st edition. Hoboken, NJ, USA: Wiley, 2016.
2. J. H. M. T. Jeffry, Introduction to FinTech, 1st edition. Noida, India: Pearson Publications, 2018
3. D. Tapscott and A. Tapscott, The Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World, 1st edition. New York, NY, USA: Penguin Random House, 2016.
4. M. López de Prado, Machine Learning for Asset Managers, 1st edition . Cambridge, UK: Cambridge University Press, 2020.
5. "FinTech: The Impact and Role of Financial Technology" by Parag K. Patel, Wiley publications, 1st edition

Reference Books:

1. R. Ghose, Future Money: Fintech, AI and Web3. London, UK: Kogan Page, 2024.
2. Y. Hilpisch, Artificial Intelligence in Finance: A Python-Based Guide, 1st edition. Sebastopol, CA, USA: O'Reilly Media, 2020.
3. M. López de Prado, Advances in Financial Machine Learning, 1st edition. Hoboken, NJ, USA: Wiley, 2018.
4. S. Chishti and J. Barberis, The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs, and Visionaries, 1st edition. Hoboken, NJ, USA: Wiley, 2016.
5. D. Drescher, Blockchain Basics: A Non-Technical Introduction in 25 Steps, 1st edition. Berkeley, CA, USA: Apress, 2017.
6. B. Hines, Digital Finance: Security Tokens and Unlocking the Real Potential of Blockchain, 1st edition. Hoboken, NJ, USA: Wiley, 2020

E- Books:

1. P. H. Beaumont, Digital Finance: Big Data, Start-ups, and the Future of Financial Services, 1st edition. London, U.K.: Routledge, 2019.
   Link- https://download.e-bookshelf.de/download/0015/1963/23/L G-0015196323-0047264745.pdf

2. N. Urbach and M. Roglinger, Big Data and Artificial Intelligence in Digital Finance, 1st edition. Cham, Switzerland: Springer, 2022
   Link- https://library.oapen.org/bitstream/id/fefe46c7-4495 49ba-bcab-9cf1851e81e6/978-3-030-94590-9.pdf
3. L. Perlman, An Introduction to Digital Financial Services, 1st edition., 2018.
   Link - https://www.academia.edu

MOOC/NPTEL/YouTube Links:

1. https://www.my-mooc.com/en/mooc/introduction-to-fintech/
2. https://mooc.besideproject.eu/courses/blockchain-use-cases-in-digital-finance/
3. https://www.coursera.org/specializations/digital-transformation-financial-services

Program	S.Y. B.Tech (Value Education Course II)			Semester : IV			
Course	Indian Constitution			Code:		CE25VEC-258	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	TW	Total
2	1	-	1	-	-	25	100

Pre-requisites: Knowledge of and Indian history, civics, and societal structure to comprehend constitutional principles and governance frameworks is essential.

Course Objectives: This course aims at enabling students:

1. To acquaint the students with legacies of constitutional development in India and help those to understand the most diversified legal document of India and philosophy behind it.
2. To make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
3. To channelize students' thinking towards basic understanding of the constitutional principles and statutory institutions.
4. To enable students to critically evaluate constitutional provisions and apply them to contemporary social, political, and administrative contexts.

Course Outcomes: After completion of the course, the students will be able to

CO1: Identify and explore the basic features and modalities about Indian constitution.

CO2: Differentiate and relate the functioning of Indian Parliamentary System at the center and State-level.

CO3: Understand the administrative structure of various branches of government.

CO4: Examine different aspects of Indian Legal System and its related bodies.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Constitution** Meaning & Constitutionalism, Introduction to Constitution: Meaning of the constitution law and constitutionalism, making of constitution, Salient features and characteristics of the Constitution of India, Preamble, Fundamental Rights, Directive Principles of State Policy, Fundamental Duties and its legal status, Citizenship. **Case Study :** The Kesavananda Bharati Case (1973) – Basic Structure & Constitutionalism	4
II	**System of Government- Center & State level and local level** Structure and Function of Central Government, President, Vice President, Prime Minister, Cabinet, Parliament, Supreme Court of India, Judicial Review, Federal structure, and distribution of legislative and financial powers between the Union and the States, local self-government. **Case Study :** S.R. Bommai v. Union of India (1994) – Misuse of President's Rule	4

III	**Government: Union & State** Executive & Legislature, composition, powers and functions, Local Self Governments – Panchayat Raj Institutions & Urban Local Bodies (Municipalities). Statutory Institutions: Elections-Election Commission of India, National Human Rights Commission, National Commission for Women **Case Study:** Indira Gandhi v. Raj Narain (1975) – Executive Accountability(Powers of Election Commission, Executive accountability, Free & fair elections)	**4**
IV	**Constitution Functions** Indian Federal System and its characteristics, Federal structure & distribution of legislative and financial powers between the Union and the States. Centre & State Relations, President's Rule, Constitutional Amendments and powers, Constitutional Functionaries, Emergency Provisions, Assessment of working of the Parliamentary System in India. **Case Study :** GST & Federal Structure (2017–2023)	**3**
	Total	**15**

Text Books:

1. E I Durga Das Basu, —Introduction to the Constitution of India —, Prentice Hall of India, New Delhi,24th edition,2020, ISBN-109388548868
2. Clarendon Press, Subhash C, Kashyap, — Our Constitution: An Introduction to India's Constitution and constitutional Law||, NBT, 5th edition, 2014, ISBN-9781107034624

Reference Books:

1. Maciver and Page, —Society: An Introduction Analysis —, Laxmi Publications, 4th edition, 2007, ISBN-100333916166
2. P. M. Bhakshi, —The constitution of India||, Universal Law Publishing - An imprint of Lexis Nexis, 14th edition,2017, ISBN-108131262375
3. Indian Constitution by Subhash C. Kashyap, National Book Trust, New Delhi.
4. Constitution of India and Professional Ethics, Dr. G. B. Reddy & Mohd. Suhaib, Dreamtech Press.

E-Sources:

E-Books:

1. The full text of the Constitution of India (latest version) — available for download in English (and other Indian languages). Legislative Dashboard+2legislative.gov.in+2
2. Updated 2024 edition (English + Hindi Diglot) — PDF version. S3WaaS
3. Official publication with all amendments (as on May 2022) — PDF version. S3WaaS
4. A simple introductory book: The Constitution of India — An Introduction (by NCERT) — which gives a good basic overview. NCERT

MOOC / NPTEL/YouTube Links:

1. **Constitution Law and Public Administration in India** (NPTEL-NOC, IIT Madras) — comprehensive course covering constitutional law + public administration. NPTEL Online Courses+2NPTEL+2
2. Playlist on YouTube: **"Constitutional Studies" (NPTEL)** — lectures by law professors covering fundamentals, history, structure, rights etc. YouTube+2

Program:	S. Y. B. Tech. (Value Education Course II)			Semester: IV			
Course:	Environmental Science			Code:	AIDS25VEC-258		
Credit	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
02	-	2	1	25	-	-	25

Pre-requisites: Knowledge of Multidisciplinary nature of environmental studies; components of environment — atmosphere, hydrosphere, lithosphere and biosphere.is essential.

Course Objectives: This course aims at enabling students to:

1. To gain an understanding of the Environment where we live
2. To Understanding the importance of water
3. To educate about Air and Noise pollution
4. To explain the concepts of E- waste and Green Computing

Course Outcomes: After completion of course, the students will be able to:

CO1: Analyze the impacts of different types of environmental pollution on ecosystems and physical resources.

CO2: Describe the sources and effects of water, air, and noise pollution on human health and the environment.

CO3: Identify sources and types of e-waste and analyze basic e-waste management practices.

CO4: Apply green computing principles to promote environmental sustainability and reduce ecological impact.

	Detailed Syllabus	
Unit	**Description**	**Duration [Hrs]**
I	Environmental pollution: Environment and its importance, Definition, Types. Effect of environmental pollution on Plants, Non-living things.	3
II	Water Pollution: Definition, Sources of water Pollution, Types of waste water-Domestic and industrial wastewater	4
III	Air pollution: Definition, Sources/causes of air pollution. Atmospheric layers, Effects on human. Noise Pollution: Definition of Noise Pollution, Types of Noise Pollution	4
IV	E-waste management: Definition of E-waste, Sources of E-waste, Types of E-waste Green computing: Definition, Objectives of Green Computing, Necessity, Environmental benefits	4
	Total Hrs	15

Tutorial Conduction and Term work Guidelines (Set of Suggested Activities)	
1	Report/Presentation on the effect of Environmental Pollution on any world famous Structure/ monument.
2	Report/Presentation on importance of different sources of water available nearby them.
3	Report/Presentation based on the data collected from the local authorities on air pollution and noise pollution.
4	Report/Presentation on the E-Waste generated in the campus.
5	Time-series analysis of natural resource consumption of a given country using publicly available data

Text Books:

1. 'Environmental Science: A Global Concern' Cunningham W.P. & Saigo S.W. 5th edition (1 July 1998) WCB, McGraw Hill
2. "The text book of Environmental studies", Dr. P. D. Raut, Shivaji University, 2013.
3. "A Text Book of Environmental Studies", Dr. D. K. Asthana, S. Chand.
4. "Environmental Pollution, monitoring and control", S. M. Khopkar, New Age Publication.

Reference Books

1. E. Bharucha – Textbook of Environmental Studies, 1st Edition, Universities Press, 2005, ISBN-10: 8173715408.
2. Mahua Basu – Environmental Studies, 1st Edition, Cambridge University Press, ISBN: 978-1-107-5317-3.

Online Sources:

https://onlineethics.org/cases/life-and-environmental-science-ethics-case-studies

Program	S.Y. B.Tech (Computer Science and Engineering)			Semester : IV			
Course	Community Engagement Project			Code:		CSE25ELC-259	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	-	50	-	50

Pre-requisites: Social Responsibility, Human Behavior

Course Objectives: The course aims to:

1. To Opportunities to engage with their local community, fostering empathy, teamwork, and problem solving skills while contributing positively to their surroundings.
2. To understanding of the challenges faced by the local community and the role of engineering in addressing those challenges.
3. To ability to apply technical knowledge and skills to design solutions or interventions that create a positive impact on the community.
4. To evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact.

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Identify and Analyze community needs and challenges by engaging with stakeholders and evaluating real-world problems. (Remembering & analyzing)

CO2: Design and Implement practical, creative, and context-specific solutions using Engineering Principles to address community issues. (Creating & applying)

CO3: Reflect and Evaluate the effectiveness of their interventions and articulate lessons learned through reports and presentations. (Evaluating & Understanding)

Course Guidelines

A community engagement project is intended to instill social responsibility and to connect students with local communities to address real-life challenges and promote sustainable development. Students are expected to contribute to the community by sharing their learning outcomes and solve/propose solutions to societal/community problems. The motto of the community engagement project is 'Campus to Community'. Students are expected to identify socially relevant problems/projects under the guidance of teacher and solve or propose solutions. These projects foster collaboration, empathy, and social responsibility.

Projects may include, but not limited to, diverse areas such as health, where students can organize free check-up camps or mental health awareness drives; livelihood, through skill-sharing or micro entrepreneurship support; and education, via digital literacy workshops, mobile libraries, or career guidance camps. Environmentally impactful projects include rainwater harvesting awareness and solar lighting in villages. Moreover, projects like documenting local history or organizing cultural exchange events help preserve and celebrate community identity. Such initiatives not only benefit society but also provide participants with practical experience, leadership skills, and a deeper understanding of civic duties. Through these engagements, communities become active partners in development, creating a more inclusive and resilient society.

A. Group Formation:

- Form a group of 3-4 students that share a similar interest in each batch, Duration: 24 hours

(divided into manageable sessions or shifts).

• The group should be cohesive, sharing and caring, contribute to the task assigned.

• The task carried out need to be maintained in LOG book by each group.

B. Project Scope:

The CEP should focus on addressing a specific community or societal issue. Projects may fall under the following themes:

1. Education and Awareness:

• Conduct workshops or awareness drives on topics like digital literacy, environmental sustainability, mental health, or career planning for local stakeholders.

2. Technology for Social Good:

• Develop a simple prototype or solution that addresses a real-world problem (e.g., a water saving device, simple mobile apps, or tools for community use).

3. Environmental Sustainability:

• Organize clean-up drives, tree plantations, recycling campaigns, or energy conservation initiatives.

4. Health and Wellness:

• Promote health through awareness programs on hygiene, nutrition, and exercise.

5. Skill Development:

• Teach basic computer or technical skills to students, staff, or the community.

C. Step-by-Step Execution Plan:

1. **Planning Phase**:

• Team Formation: Form teams of 3-4 students with a balance of skills and interests.

• Project Selection: Choose a project theme and define a clear objective that aligns with community needs.

• Proposal Submission:

- Submit a one-page project proposal outlining:
- Title of the project.
- Objective and expected outcome.
- Plan of execution (timeline and activities).
- Required resources (if any).
- Get approval from the designated faculty mentor.

2. **Execution Phase:**

• Phase 1 Activities

- Conduct initial outreach and engage with the community or target participants.
- Implement planned activities with close teamwork and documentation.

• Phase Activities

- Continue engagement and collect feedback from the participants.
- Begin summarizing the outcomes of the project.

• Best Practices:

- Maintain a positive attitude and open communication with the community.
- Respect cultural norms and values of the participants.
- Adapt your plan based on real-time needs or challenges.

3. **Reporting Phase:**

• Documentation:

- Create a detailed report containing
- Title, objective, and scope of the project.
- Activities conducted and timeline.
- Outcomes and community feedback.
- Photos/videos of the activities (if permitted).
- Challenges faced and how they were addressed.

• Presentation:

- Each team will present their project to a panel of faculty members or peers, showcasing their

efforts and outcomes.

- Duration of presentation: 5-7 minutes per team.

Text Books:

1. Dostilio, L. D., et al. The Community Engagement Professional's Guidebook: A Companion to The Community Engagement Professional in Higher Education. Stylus Publishing, 2017. A practical guide for community engagement projects, including tools and strategies for effective implementation and assessment.
2. Waterman, A. Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects. Routledge, 1997. Insights into service-learning methodology, planning, and assessment techniques for impactful projects.
3. Beckman, M., and Long, J. F. Community-Based Research: Teaching for Community Impact. Stylus Publishing, 2016. Approaches for conducting research and engagement projects collaboratively with communities

Reference Books:

1. R. Ghose, Future Money: Fintech, AI and Web3. London, UK: Kogan Page, 2024.
2. Y. Hilpisch, Artificial Intelligence in Finance: A Python-Based Guide, 1st ed. Sebastopol, CA, USA: O'Reilly Media, 2020.
3. M. López de Prado, Advances in Financial Machine Learning, 1st ed. Hoboken, NJ, USA: Wiley, 2018.
4. S. Chishti and J. Barberis, The FINTECH Book: The Financial Technology Handbook for In vestors, Entrepreneurs, and Visionaries, 1st ed. Hoboken, NJ, USA: Wiley, 2016.
5. D. Drescher, Blockchain Basics: A Non-Technical Introduction in 25 Steps, 1st ed. Berkeley, CA, USA: Apress, 2017.

Program	S.Y. B.Tech (Entrepreneurship Management Course)			Semester : III			
Course	Entrepreneurship Skills Development			Code		IL25EMC-260	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	2	1		-	25	25

Pre-requisites: Entrepreneurship, Organization Operations, Industry

Course Objectives: The course aims to:

1. Introduce the fundamental principles of entrepreneurship, forms of business organizations, and the start-up ecosystem.
2. Enable students to identify, evaluate, and select viable business opportunities using structured techniques.
3. Familiarize students with business models, financial planning, and market validation strategies.
4. Expose students to key marketing strategies, customer acquisition techniques, and branding essentials for start-ups
5. Develop students' entrepreneurial mind-set and their ability to communicate and pitch business ideas effectively using structured storytelling techniques

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Describe the role of entrepreneurship in economic growth and the start up ecosystem

CO2: Apply creative techniques to viable business ideas based on customer needs

CO3: Develop a basic business model using tools like the Business Model Canvas through market research

CO4: Implement basic marketing strategies for start-ups

CO5: Deliver a concise business pitch using storytelling and effective communication techniques.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Entrepreneurship** Entrepreneurship: Definition and evolution, Role of entrepreneurship in economic development, Role in job creation, GDP, and innovation. Characteristics of an Entrepreneur: Key traits: Risk-taking, innovation, pro-activeness, Leadership, perseverance, and resilience. Types of Entrepreneurships: Startup entrepreneurship, Social entrepreneurship, Entrepreneurship (corporate entrepreneurship), Lifestyle and small business entrepreneurship, Forms of Business Organization – Sole proprietorship, partnership, private limited, public limited. Entrepreneurial Mindset: Growth mindset and adaptability, Creativity and problem-solving, Opportunity recognition and initiative-taking. Overview of the Startup Ecosystem: Key stakeholders: Incubators, accelerators, angel investors, VCs, Government support schemes (Startup India, Atal Innovation Mission, etc.), Global vs. Indian startup ecosystems	3
II	**Idea Generation & Opportunity Recognition** Creativity Techniques for Idea Generation: Definition and importance of creativity in entrepreneur- ship. Brainstorming: Rules of effective	3

	brainstorming. Individual vs. group brainstorming. Mind Mapping: Visual idea structuring using central themes and branches. Tools (manual and digital) for mind mapping. Understanding Customer Needs and Pain Points: Customer pain points and their identification, Problem-solution fit: Linking pain points to possible solutions. Observational techniques, user inter-views, and empathy mapping. Evaluating Opportunities: Difference between an "idea" and an "opportunity." Basic filters: Desir- ability, feasibility, and viability. Tools: SWOT Analysis, Opportunity Matrix, Industry trends, market gaps.	
III	**Business Model Development** Introduction to Business Model Canvas: Definition and purpose of a business model, Overview of the Business Model Canvas by Oster alder, Benefits of using BMC for startups. Key Components of BMC: Value Proposition: Defining what unique value the product/service offers. Addressing customer pain points. Customer Segments: Identifying target customers. Creating customer personas Revenue Models: Direct sales, subscriptions, fermium, licensing, etc. Basic Market Research for Validation: Importance of market research in early-stage business development. Designing effective surveys and customer feedback forms. Conducting basic interviews and analyzing responses. Introduction to MVP (Minimum Viable Product) and feedback loops.	**3**
IV	**Customer Acquisition , Pitching & Funding Sources** Search Engine Optimization (SEO): Basics of how search engines work, Keyword research and content optimization, On-page vs. off-page SEO Importance of Digital Presence – Website essentials, blogs, and analytics tools. Customer Acquisition Strategies: Understanding the Customer Journey – Awareness, interest, decision, action. Early-Stage Customer Acquisition Tactics: Word-of-mouth & referrals, Influencer marketing (micro-influencers), Email marketing basics, building a landing page and collecting lead. Crafting an Elevator Pitch: Definition and purpose, Key elements: Problem, solution, value proposition, target audience, Delivery tips: Clarity, brevity, confidence Overview of Funding Sources: Public & private capital sources, venture capital, debt financing. Bootstrapping: Meaning, benefits, and risks, Angel investors: Role, expectations, approach, Brief on incubators, government schemes, crowd funding.	**6**
	Total	**15**

List of Practical

Sl. No.	Title	Objective	Description

1	Entrepreneurial Mindset Reflection	To encourage students to explore their personal views on entrepreneurship and recognize the key characteristics of an entrepreneurial mindset by studying the journey of a real-world entrepreneur.	**Write a reflective essay** (500–600 words) based on the following: ▪ Explain what entrepreneurship means to you personally. ▪ Identify an entrepreneur (Indian or global) whom you admire and explain the reasons for your admiration. ▪ Highlight specific mindset traits (e.g., risk-taking, resilience, innovation, adaptability) that contributed to this entrepreneur's success. ▪ Reflect on how these traits align with your own strengths or indicate areas you wish to develop.
2	Idea Generation Challenge	To foster creativity, structured brainstorming, and the ability to identify potential business opportunities based on real-world problems.	**Generate 10 Business Ideas** Use any structured brainstorming technique 1. Ideas can be tech-based, social impact, service-based, or product-based 2. Select One Idea- Choose the most promising idea from your list 3. Write a 1-page Concept Summary, include the following: ▪ Problem Identified: Describe the specific problem or pain point your idea addresses. ▪ Solution Overview: Briefly describe your business idea. ▪ Target Audience: Identify the group of people or organizations that would benefit. ▪ Market Potential: Discuss the viability and scalability of the idea.
3	Business Model & Customer Validation	To help students develop a clear, structured business model and test its assumptions through customer conversations. The goal is to learn how to validate ideas through real-world feedback and refine the business concept accordingly.	**Part A: Business Model Canvas** 1. Choose a business idea (from Assignment 2 or a new one). 2. Create a Business Model Canvas with all 9 key blocks: • Customer Segments • Value Propositions • Channels • Customer Relationships • Revenue Streams • Key Resources • Key Activities • Key Partnerships • Cost Structure Present the BMC in visual or tabular format. **Part B: Customer Interviews & Insights** 1. Identify 2–3 potential customers from your target segment. 2. Conduct brief interviews (5–10 minutes each) to gather insights on:

			• Their pain points • Their reaction to your proposed solution • Willingness to pay or use your product/service 3. Summarize findings in a 1–1.5 page report that includes: • Key customer quotes or paraphrased insights • A revised Value Proposition or Customer segment block (if needed) A short reflection: key learnings and potential changes to your idea
4	Business Launch Plan – Marketing & Financial Snapshot	To develop a practical understanding of how marketing strategy and financial planning go hand-in-hand in launching a startup. Students will define a basic marketing campaign and align it with estimated costs, pricing, and projected revenue.	You are preparing to launch your business idea. Prepare a combined Marketing and Financial Snapshot including the following **Part A: Marketing Campaign Plan** ▪ Define your target market by identifying primary customers. ▪ Design a mini-campaign using one or more of the following channels: ▪ Social media (e.g., Instagram, LinkedIn) Print/digital flyers Email marketing ▪ Describe the campaign content, including the message or offer to be promoted. ▪ Optionally, create 1–2 sample marketing materials. ▪ Write a 300-word explanation outlining your marketing strategy and expected impact. **Part B: Financial Snapshot** 1. Startup Costs – Estimate your initial costs (fixed + variable) 2. Pricing Strategy – State your pricing model and justification 3. Break-even Analysis – Basic cost vs. sales estimate 4. 6-Month Revenue Projection – Expected sales and income 5. Format: Use a simple table or spreadsheet (optional)

5	Elevator Pitch Video	To help students develop confidence and clarity in presenting their business idea in a short, compelling format. The exercise simulates real-world investor or networking scenarios where entrepreneurs must grab attention quickly	**Prepare a 90-second elevator pitch for your Business idea** (the same or refined idea used in earlier assignments). Your pitch should cover the following elements: o The Problem – Problem Identification o The Solution – Description of your product/service. o Value Proposition – The unique value proposition. o Target Audience – Audience for your idea. o Call to Action – E.g. request for support, funding, feedback, etc. **Deliver Your Pitch:** o Record a video and submit it with written version of your pitch. o Ensure clear speech, confident body language (for video), and persuasive tone. **Reflection (Short Write-up):** o Share what you learned about communicating your idea Describe challenges or rewards you experienced in the process.

Text Books:

1. Bygrave, W.D., Zacharakis, A., & Corbett, A.C. Entrepreneurship, 6th Edition, Wiley, 2025. ISBN: 9781394262809.
2. Drucker, Peter F. Innovation and Entrepreneurship: Practice and Principles, Reprint Edition, Harper Business, 2006. ISBN: 9780060851132.
3. Osterwalder, Alexander & Pigneur, Yves. Business Model Generation: A Handbook for Visionar- ies, Game Changers, and Challengers, 1st Edition, Wiley, 2010. ISBN: 9780470876411.

Reference Books:

1. Ries, Eric. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, 1st Edition, Crown Business, 2011. ISBN: 9780307887894.
2. Kawasaki, Guy. The Art of the Start 2.0: The Time-Tested, Battle-Hardened Guide for Anyone Starting Anything, Portfolio (Penguin Random House), 2015. ISBN: 978159184784

E-Sources: Introduction to Entrepreneurship — Katherine & Jonathan Carpenter (public-domain / Creative Commons course book)
Link- https://www.maktaba.org/book/1134/introduction-to-entrepreneurship?utm

E-Books: Entrepreneurship (OpenStax)
Link- https://openstax.org/books/entrepreneurship/pages/2-introduction?utm_source=chatgpt.com

MOOC / NPTEL/YouTube Links:

1. https://onlinecourses.nptel.ac.in/noc20_ge08/preview
2. https://onlinecourses.nptel.ac.in/noc21_mg70/preview
3. https://onlinecourses.nptel.ac.in/noc20_mg35
4. https://www.coursera.org/learn/entrepreneur-guide-beginners
5. https://wadhwanifoundation.org/
6. https://www.youtube.com/@wadhwani-foundation/videos

Program	S.Y. B.Tech (Ability Enhancement Course)			Semester : IV			
Course	Modern Indian Language (Marathi)			Code:		IL25AEC-261	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	1	2	-	-	-	25	25

Pre-requisites : --

अभ्यासक्रमाची उद्दिष्टे :

१. प्रात भौषिक कौशल्यांची क्षमता विकसित करणे.
२. प्रसारमाध्यमांतिल संज्ञापनातिल स्वरूप आणि स्थान स्पष्ट करणे.
३. व्यक्तिमत्व विकास आणि भाषा यांतील सहसंबंध स्पष्ट करणे.
४. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे यांचे परस्पर संबंध स्पष्ट करणे.
५. प्रसारमाध्यमांसाठी लेखनक्षमता विकसित करणे.

अभ्यासक्रम परिणाम (COs)

अभ्यासक्रम यशस्वीपणे पूर्ण केल्यानंतर विद्यार्थी खालील परिणाम साध्य करू शकतील:

CO1: शैक्षणिक व व्यावसायिक वातावरणात प्रातभाषिक संवाद कौशल्ये प्रभावीपणे प्रदर्शित करणे.
CO2: प्रसारमाध्यमांच्या संज्ञापनातील रचना, भूमिका आणि महत्त्व स्पष्टपणे समजावून सांगणे.
CO3: व्यक्तिमत्व विकास आणि भाषाज्ञान यांतील परस्पर संबंधांचे विश्लेषण करणे.
CO4: लोकशाहीतील जीवनशैली व प्रसारमाध्यमे यांच्यातील परस्पर संबंधांचे मूल्यांकन करणे.
CO5: विविध प्रसारमाध्यमांसाठी अचूक, संरचित आणि प्रभावी लेखन तयार करणे.

Course Contents

Unit	Description	Duration [Hrs]
१.	भाषा आणि व्यक्तिमत्व विकास : सहसंबंध लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे	4
२.	**प्रसारमाध्यमांसाठी लेखन** वृत्तपत्रासाठी बातमीलेखन आणि मुद्रितसंपादन नभोवाणीासाठी भाषणाची संहितालेखन दूरचित्रवाणीासाठी माहितीपटासाठी संहितालेखन	4
३.	भाषा, जीवन व्यवहार आणि नवमाध्यमे, सामाजिक माध्यमे नवमाध्यमे आणि समाजमाध्यमांचे प्रकार : ब्लॉग, फेसबुक, ट्विटर नवमाध्यमे आणि समाजमाध्यमांविषयक साक्षरता, दक्षता, वापर आणि परिणाम	4
४.	वेबसाइट आणि ब्लॉग, ट्विटरासाठी लेखन व्यावसायिक पत्रव्यवहार	3
	Total	15

Course Contents	
Sl. No.	**Suggested List of Experiments**
1	Read a specific column (Sports, political, finance, editorial, education, international news etc) in the daily Marathi newspapers, summarize and present in the practical. A summary should be added as part of the journal. "दैनिक मराठी वर्तमानपत्रांमध्ये विशिष्ट कॉलम (क्रीडा, राजकीय, वित्त, संपादकीय, शिक्षण, आंतरराष्ट्रीय बातम्या इ.) वाचा, सारांश द्या आणि व सादरीकरण करा. त्या संदर्भातील सगळा सारांश जर्नल मध्ये जमा करावा."
2	Write blogs and posts on social media up to 200 words on recent development in their field of study. "सोशल मीडियावर त्यांच्या अभ्यासाच्या क्षेत्रातील अलीकडील विकासावर 200 शब्दांपर्यंत ब्लॉग लिहा, आणि पोस्ट करावा"
3	Professional letter / report writing. a. Write letter to the principal for organizing NSS camp in nearby village. Preparation of the budget, permission letters and report submission in the University "जवळच्या गावात एनएसएस शिबिर आयोजित करण्यासाठी मुख्याध्यापकांना पत्र लिहा. विद्यापीठात बजेट, परवानगी पत्रे आणि अहवाल सादर करणे." b. Write a letter for internship sponsorship to any organization. कोणत्याही संस्थेला इंटर्नशिप प्रायोजकत्वासाठी पत्र लिहा."
4	Book Review – Students are expected to read any novel, fiction or literature book of their choice and write a review on post it on social media of their choice. "पुस्तक पुनरावलोकन - विद्यार्थ्यांनी त्यांच्या आवडीचे कोणतेही कादंबरी, काल्पनिक कथा किंवा साहित्य पुस्तक वाचावे आणि त्यावर पुनरावलोकन लिहून ते त्यांच्या आवडीच्या सोशल मीडियावर पोस्ट करावे अशी अपेक्षा आहे."
5	Participation in Competitions (in college/outside the college) debate, declamation, elocution – A Report should be submitted स्पर्धेमध्ये (महाविद्यालयात/महाविद्यालयाबाहेर) सहभाग वादविवाद, भाषण, वक्तृत्व – अहवाल सादर करावा.
6	Group Activity: Road show, skit play, one-act play गट क्रियाकलाप : रोड शो, स्किट प्ले, एकांकिका
7	Participation in Purushottam karandam, Firodia karandak, Dajikaka Gadgil Karandak and Shreetej Karandak. पुष्कोतम करंडक, फिरोदिया करंडक, दाजीकाका गाडगीळ करंडक आणि श्रीतेज करंडक या स्पर्धेमध्ये सहभाग नोंदवावा.

8	Marathi film Review – Social Marathi movie available and write a review on post it on social media of their choice. मराठी चित्रपट पुनरावलोकन – सामाजिक आशयावर आधारित मराठी चित्रपट उपलब्ध आहे आणि त्या चित्रपटाची समीक्षा करून त्यावर सारांश लिहावा व तो वर्तमानपत्रे किंवा सोशल मीडियावर पोस्ट करावा पसंतीच्या सोशल मीडियावर पोस्ट करा.

संदर्भ ग्रंथ :

१. सायबर संस्कृती, डॉ. रमेश वसखेडे
२. उपयोगित मराठी, संपादक डॉ. केतकी मोडक, संतोष शेंगई, सुजाता शेंगई
३. ओळख माहिती तंत्रज्ञानाची, टिमोथी जे. ओ'लिरी
४. संगणक, अच्युत गोडबोले, मोज प्रकाशन, मुंबई
५. इंटरनेट, डॉ. प्रभोध चौबे, मनोरमा प्रकाशन, मुंबई
६. व्यावहारिक मराठी, डॉ. ल. रा. नसराबादकर, फडके प्रकाशन, कोल्हापूर
७. आधुनिक माहिती तंत्रज्ञानाच्या विश्वात, शिक्षापूंकर दीपक, मराठे उज्ज्वल, उत्कर्ष प्रकाशन, पुणे