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 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)

ESTD : 1906

Course Approval Summary – Board of Studies Computer Engineering

Sl. No.	Approved By	Signature and Stamp of Authority
1	Chairman, Board of Studies, Computer Engineering	HEAD OF THE DEPARTMENT Computer Engineering Nutan Maharashtra Inst. of Engg. & Tech Talegaon Dabhade, Pune - 410 507
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 ENGINEERING

Imbibing Quality Technical Education and Overall Development by Endowing Students with Societal and Ethical skills in Computer Engineers.

MISSION OF COMPUTER ENGINEERING

- To impart engineering knowledge and skills by adopting effective teaching learning processes.
- To develop professional, entrepreneurial & research competencies encompassing continuous intellectual growth.
- To produce educated students to exhibit societal and ethical responsibilities in the working environment.

INDEX

COURSE-WISE CREDIT DISTRIBUTION

Sl. 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										
Sl 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										
Sl 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 Engineering

Semester – III

Level 5.0																		
Second Year B. Tech Computer Engineering																		
Semester III																		
Sl. No.	**Course Code**	**Course Type**	**Course Name**	**Credits**			**Teaching Scheme (Hours/Week)**			**Examination Scheme and Marks**								
										CCE		**ESE**						
				TH	**TUT**	**PR**	**L**	**T**	**P**	**UT**	**FA**	**SA**	**PR**	**OR**	**TW**	**TOTAL**		
										25	**25**	**50**						
1	CE25PCC-201	Programme Core Course	Operating System and Administration	2			2			25	25	50				**100**		
2	CE25PCC-202	Programme Core Course	Data Structures	2			2			25	25	50				**100**		
3	CE25PCC-203	Programme Core Course	Data Structures Laboratory			2			4				50		25	**75**		
4	CE25PCC-204	Programme Core Course	Object Oriented Programming	2			2			25	25	50				**100**		
5	CE25PCC-205	Programme Core Course	Object Oriented Programming Laboratory			2			4				50		25	**75**		
6	CE25MDM-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	CE25VSEC-209	Vocational and Skill Enhancement Course	Vocational and 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, **T/TUT**-Tutorial, **UT**- Unit Test, **FA**–Formative Assessment, **SA** – Summative Assessment

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	Vectors and Transforms	
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	
CE25VSEC-209A	Scientific Computing with Python	Choose Any One
CE25VSEC-209B	Scientific Computing with R Programming	
CE25VSEC-209C	Scientific Computing with MatLab	

CURRICULUM STRUCTURE
Second Year B.Tech. Computer Engineering

Semester – IV

Level 5.0																		
Second Year B. Tech Computer Engineering																		
Semester IV																		
Sl. No.	**Course Code**	**Course Type**	**Course Name**	**Credits**			**Teaching Scheme (Hours/Week)**			**Examination Scheme and Marks**								
										CCE		**ESE**						
				TH	**TUT**	**PR**	**L**	**T**	**P**	**UT**	**FA**	**SA**	**PR**	**OR**	**TW**	**TOTAL**		
										25	**25**	**50**						
1	CE25PCC-251	Programme Core Course	Software Engineering	2			2			25	25	50				100		
2	CE25PCC-252	Programme Core Course	Database Management System	2			2			25	25	50				100		
3	CE25PCC-253	Programme Core Course	Database Management System Laboratory			2			4				50		25	75		
4	CE25PCC-254	Programme Core Course	Advanced Data Structures	2			2			25	25	50				100		
5	CE25PCC-255	Programme Core Course	Advanced Data Structures Laboratory			2			4				25		25	50		
6	CE25MDM-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	CE25ELC-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, **T/TUT**-Tutorial, **UT**- Unit Test, **FA**–Formative Assessment, **SA** – Summative Assessment

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 Constitution	Choose Any One
AIDS25VEC-258	Environmental Science	

Course Syllabus

Semester-III

Program	S.Y. B.Tech (Computer Engineering)			Semester: III			
Course	Operating System and Administration			Code:	CE25PCC-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: Prior knowledge of programming fundamentals is essential.

Course Objectives: This course aims at enabling students:

1. To introduce the fundamental concepts, structure, and functions of operating systems.
2. To understand process management, scheduling, and deadlock handling mechanisms.
3. To learn memory management and virtual memory
4. To study file system organization and administration

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

CO1: Explain fundamentals of Operating Systems, including types, structures and system calls and process

CO2: Analyze IPC mechanisms and solutions of process synchronization for dealing with deadlock.

CO3: Apply techniques of memory management to solve memory management problems

CO4: Apply file management policies and command-line tools for system administration

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Operating Systems and Process** Overview of Operating Systems, OS Structure, System Components, Types of Operating Systems. System Calls, Operating System Services. Process Concept -Process states, Process control block, Threads -Introduction, POSIX / pthreads. Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms.	7
II	**Inter Process Communication and Deadlock** Inter process Communication mechanisms: Pipes, shared memory, Message passing Process Synchronization: Introduction, Critical Section Problem, Hardware Support for Synchronization, Mutex Locks, Semaphores, Synchronization problem: Reader-writer, producer-consumer problem, Dining Philosophers problem. Deadlocks: Conditions, Prevention, Avoidance (Banker's Algorithm), Detection, Recovery	8
III	**Memory Management** Introduction, Contiguous and non-contiguous, Partitioning - Fixed and Variable, Fragmentation, Memory Allocation Strategies, Paging, Segmentation, Virtual Memory: Basics, Demand paging, Page Fault, Page	7

	Replacement Algorithm: First in First Out (FIFO), Least Recently Used (LRU), Optimal	
IV	**File Management and Administration** File management: Directory Structure, File Systems in Operating System., Disk scheduling algorithms (FIFO, SSTF, SCAN, C-SCAN) Roles of a system administrator, Linux Shell & command-line tools, File permissions & ACLs, Package management (APT, YUM, DNF), System services & logging (journalctl), Networking basics: ifconfig, ip, netplan	**8**
	Total	**30**

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts" 9th Edition-2013, WILEY, ISBN 978-1-118-06333-0.
2. Stallings W., "Operating Systems - internals and design principles", 9th Edition - 2018, Pearson, ISBN - 13: 978 – 013 – 467 – 0959

Reference Books:

1. Andrew S. Tanenbaum; "Modern Operating Systems", Prentice Hall of India Publication; 4th Edition - 2015. ISBN - 13: 978 – 0133 – 591620.
2. Thomas W. Doeppner, "Operating System in depth: Design and Programming", WILEY, 1st Edition -2011, ISBN: 978- 0-471-68723-8.
3. Dhamdhere D., "Systems Programming and Operating Systems", Revised 2nd Edition- 2009, McGraw Hill, ISBN - 13: 9780074635797.

e-Books:

1. https://repository.dinus.ac.id/docs/ajar/Operating_System.pdf

MOOC / NPTEL/YouTube Links:

1. NPTEL Course: Operating System- by Prof. Sorav Bansal, IIT Delhi. https://archive.nptel.ac.in/courses/106/102/106102132/
2. NPTEL Course: Operating System Fundamentals – by Prof. Santanu Chattopadhyay, IIT Kharagpur https://archive.nptel.ac.in/courses/106/105/106105214/

Program	S.Y. B.Tech (Computer Engineering)			Semester: III			
Course	Data Structures			Code:		CE25PCC-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: Prior knowledge of programming fundamentals, problem solving skills is essential.

Course Objectives: This course aims at enabling students:

1. To introduce the fundamental concepts of data organization and memory representation.
2. To develop the ability to analyze, select, and apply efficient searching and sorting techniques for data organization and retrieval.
3. To introduce the concept of stacks, their implementation methods, and their role in expression processing and function execution.
5. To introduce queue structures, their variations, and implementation techniques, and to demonstrate their role in system-level applications such as scheduling and resource management.

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

CO1: Choose appropriate data structures by evaluating the memory requirements of a given application.

CO2: Implement suitable searching and sorting algorithms for a given problem scenario.

CO3: Apply stack operations to perform expression conversion and evaluation, and to manage recursion and function call execution.

CO4: Utilize appropriate queue structures to efficiently solve problems in CPU scheduling, task management, and resource allocation.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Data Structures and Memory Representation** Concept of data, information, and data structures; Abstract Data Types (ADT); Classification of Data Structure; Array: types, operations on array; memory representation Linked list: types – singly, doubly, circular linked lists, operations, memory representation.	8
II	**Searching and Sorting Techniques** **Searching: Linear** and binary search with examples. **Sorting:** internal and external sorting, stable and unstable sorting, Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort.	7
III	**Stack** Definition, Stack operations, Stack as an ADT, implementation using arrays and linked lists; applications – recursion, Infix, Prefix, Postfix Expression conversion, Expression evaluation; stack frame and function call mechanism.	8

IV	**Queue** Definition, Queue operations, implementation using arrays and linked lists; circular queue, double-ended queue, priority queue; applications of queues in system design (e.g., CPU scheduling, print queue).	**7**
	Total	**30**

Text Books:

1. Sartaj Sahni, "Data Structures, Algorithms & Applications in C++", 2nd Edition-2005, Universities Press, ISBN-13: 9788173715228
2. Yashavant P. Kanetkar, "Data Structure Through C++", 4th Edition -2022, BPB Publications, ISBN-13: 978-8176567077.

Reference Book:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 2nd Edition- 2001, Pearson Education, ISBN: 978-0201361223.
2. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures in C++", 2nd Edition-2007, Silicon Press, ISBN-13: 978-0929306407.
3. D. S. Malik, "Data Structures Using C++", 2nd Edition- 2012, Cengage Learning, ISBN: 978-8131518236.

e-Books:

1. https://archive.org/details/fundamentalsofda00elli
2. https://archive.org/details/datastructuresusingc_202011
3. https://web.itu.edu.tr/~sgunduz/courses/bil206_15/cormen.pdf
4. https://archive.org/details/datastructuresalgorithmanalysisincmarkallenweiss

MOOC / NPTEL / SWAYAM Courses:

1. Naveen Garg, "Data Structures and Algorithms", NPTEL, IIT Delhi, 2015. https://nptel.ac.in/courses/106/102/106102064/
2. Sanjiva Prasad, "Introduction to Automata, Languages and Computation", NPTEL, IIT Delhi, 2018. https://nptel.ac.in/courses/106/102/106102132/
3. Anupam Basu, "Artificial Intelligence", NPTEL, IIT Kharagpur, 2018. https://nptel.ac.in/courses/106/106/106106131/

Program	S.Y. B.Tech (Computer Engineering)			Semester: III			
Course	Data Structures Laboratory			Code:	CE25PCC-203		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	50	-	25	75

Pre-requisites: Prior knowledge of Programming language and Data structures is essential.

Course Objectives: This course aims at enabling students:

1. To implement arrays and linked lists for efficient data storage and retrieval.
2. To apply fundamental searching and sorting algorithms for data organization.
3. To help students understand the stack data structure and its applications in expression evaluation
4. and backtracking.
5. To familiarize students with queue types and operations for managing sequential data processing.

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

CO1: Perform operations such as insertion, deletion, and traversal on arrays and linked lists.
CO2: Implement various searching and sorting techniques.
CO3: Solve problems such as expression conversion/evaluation using stack.
CO4: Apply Queue data structure in scheduling and resource management tasks such as CPU scheduling, task buffering, and request handling.

Guidelines for Laboratory Conduction

The instructor is expected to conduct **Three assignments from each group (A, B, C, D).** The instructor may set multiple sets of assignments and distribute them among batches of students.

Guidelines for Students Journal and term work assessment

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory Concept in brief, algorithm, flowchart, test cases, Test Data Set (if applicable), mathematical model (if applicable), conclusion/analysis.
Continuous assessment of laboratory work should be done based on overall performance of student. Assessment of the student should be based on predefined rubrics finalized during course meetings.

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at

the time of evaluation to test the students for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of the student's academics.	
Suggested List of Experiments/Assignments	
Sl. No	**Problem Statement**
Group A	
1	Write a program for the Student Information System which stores details of **N students** (Roll No, Name, CGPA). Write functions for the following: a. Insert a new student at a given position b. Delete a student by roll number c. Search a student by roll number and display the record d. Display all students stored in the array
2	Create a program to maintain **daily attendance** of students using a singly linked list. Write functions to: a. Insert attendance (P/A) at the end of the list b. Update the attendance of a given day c. Calculate total number of Present and Absent days d. Display the complete attendance list
3	Write a program to maintain a list of students sorted by **roll number** using a doubly linked list. Implement functions to: a. Insert a student so that the list remains sorted b. Delete a student by roll number c. Traverse the list forward to display all students d. Traverse backward to display all students in reverse order
4	Write a program that stores Internal Assessment (IA) marks of N students using both **array** and **linked list**. Implement: a. Insert student marks in both structures b. Display memory representation/index nodes c. Count how many students scored more than 80 marks
Group B	
5	Write a program for preparing a merit list of students based on CGPA. Implement: a. Selection sort for descending CGPA b. Insertion sort and count number of shifts **c.** Display the top 5 students
6	Write a program for an academic office to search a student record (Roll No, Name, Division). Implement: a. Linear search by Name

	b. Binary search by Roll Number (use sorting) c. Display number of comparisons for each search
7	Write a program to arrange student percentages using Quick Sort. Implement: a. Partition the list b. Recursively apply Quick Sort c. Display the sorted percentage list
8	Write a program to store the percentage of students in an array. Write function for sorting array of floating-point numbers in ascending order using: a. Selection Sort b. Bubble sort and display top five scores.
Group C	
9	Write a program to simulate the browser history of a student portal using a stack. Implement functions to: a. Visit a new page (push URL) b. Go back to the previous page (pop URL) c. Display the current page d. Show the entire browsing history stack
10	Given a marks calculation formula (infix), write a program to: a. Convert infix expression to postfix b. Evaluate postfix expression for given inputs
11	Write a Program for Parenthesis checking in an expression using stack.
12	Write a program for the College Billing System to compute the final payable fees of a student. The administrator enters the fee calculation formula in infix form, for example: a. Read the fee formula in infix form as entered by the administrator. b. Convert the infix expression into postfix using a stack. c. Display the postfix expression after conversion. d. Accept values for Tuition, Hostel, ExamFee, and Scholarship from the user. e. Evaluate the postfix expression using a stack. f. Display the final payable fees for the student. g. Also display intermediate stack contents during postfix conversion and evaluation.
Group D	
13	Write a program to simulate the admission queue of students. a. Enqueue student token number b. Dequeue and display student processes c. Display front and rear token number d. Display complete queue

14	Write a program using circular queue for bus pass distribution. a. Insert student IDs in circular queue b. Delete student ID as pass is issued c. Detect queue full/empty conditions d. Display the circular queue
15	Write a program using **priority queue** where priority = higher CGPA. a. Insert student with CGPA b. Delete the highest CGPA student c. Display queue after each operation d. Count students processed
16	Student Service Desk Using Deque: Write a program using deque for student service requests. a. Add emergency cases at front b. Add normal cases at rear c. Serve from front d. Display deque after each operation

Reference Book:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 2nd Edition- 2001, Pearson Education, ISBN: 978-0201361223.
2. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures in C++", 2nd Edition-2007, Silicon Press, ISBN-13: 978-0929306407.
3. D. S. Malik, "Data Structures Using C++", 2nd Edition- 2012, Cengage Learning, ISBN: 978-8131518236.

Program	S.Y.B. Tech (Computer Engineering)			Semester: III			
Course	Object Oriented Programming			Code:		CE25PCC-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: Prior knowledge of Programming and Problem Solving is essential.

Course Objectives: This course aims at enabling students:

1. To introduce object-oriented programming concepts and their implementation in C++.
2. To develop problem-solving skills using class-based and modular programming.
3. To design robust and efficient applications by using inheritance, polymorphism, exception handling, pointers and file operations.
4. To prepare students for GUI programming and application development.

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

CO1: Implement reusable programming code by using inheritance, polymorphism, exception handling and pointers.
CO2: Develop the application using object-oriented programming language (C++).
CO3: Analyze the strengths of object-oriented programming.
CO4**:** Perform file handling operations using Object Oriented Programming**.**

Course Contents

Unit	Description	Duration [Hrs]
I	**Fundamentals of Object-Oriented Programming** Introduction to object-oriented programming, Need of OOP, Fundamentals of OOP – class, object, datatypes, abstraction, encapsulation, inheritance, polymorphism, message passing. C++ Programming- Basics, Functions, Constructor and destructor, Inline function, friend function. **Case Study** Story of C++ invention by Bjarne Stroustrup	07
II	**Inheritance and Polymorphism** **Inheritance** – Types of Inheritance: single, multilevel, multiple, hierarchical and hybrid, Ambiguity in Multiple Inheritance. **Polymorphism-**Introduction to Polymorphism, Types of Polymorphism, Operator Overloading concepts. **Case Study** Study about use of C++ SDKs wrappers for Java and .Net.	08
III	**Exception Handling and Pointers** **Exception Handling-** Fundamentals of Exception Handling, multiple catching nested try statements uncaught exceptions throw and rethrow Stack unwinding.	08

	Pointers: declaring and initializing pointers, indirection Operators, Memory Management: new and delete, Pointers to Objects, this pointer, Pointers Vs Arrays, accessing Arrays using pointers. **Case Study** Study about use of exception handling in Symbian Operating System that was developed using C++.	
IV	**File Handling** Classes for file stream operation, Opening and closing a File-File mode, Error Handling functions in file, File Operations on Characters, File Operations on Binary Files Variables, Class Objects, Sequential File Organization, Direct Access Files, indexed sequential File organization, Linked Organization. **Case Study** Study features used for Microsoft Office, Internet Explorer and Visual Studio that are written in Visual C++	**07**
	Total	**30**

Text Books:

1. Ivor Horton, Peter Van Weert, "Beginning C++20", Novice Professional, Sixth Edition, 2020, ISBN-13:978-1484258835 (ISBN-10: 1484258835)
2. Robert Lafore, "OOP in C++", Pearson Publishing, 4th Edition, 2001, ISBN:0672323087 (ISBN 13: 9780672323089)

Reference Books:

1. E. Balagurusamy, "Object-Oriented Programming with C++", McGraw Hill Education, Eighth Edition, Sept. 2020, ISBN-13: 978-9389949186.
2. Herbert Schildt, C++The complete reference, Eighth Edition, McGraw Hill Professional, 2011, ISBN:978-00 72226805.
3. Bjarne Stroustrup, The C++ Programming language, Third edition, 2008, Pearson Education. ISBN 9780201889543
4. Matt Weisfeld,"The Object-Oriented Thought Process", Third Edition Pearson ISBN-13:075-2063330166.

e-Books:

1. https://www.ebookphp.com/object-oriented-programming-in-c-epub-pdf/
2. For https://www.springer.com/gp/book/9781447133780

MOOC/ Video Lectures available at:

1. NPTEL Course: Fundamentals of Object Oriented Programming By Prof. Balasubramanian Raman, IIT Roorkee
   https://onlinecourses.nptel.ac.in/noc25_cs34/
2. Basics of Object Oriented Programming (Free Course)
   https://www.mygreatlearning.com/academy/learn-for-free/courses/basics-of-object-oriented-programming
3. NPTEL Course: Data Structures and Algorithms By Naveen Garg , IIT Delhi
   https://nptel.ac.in/courses/106/102/106102064/

Program	S.Y. B.Tech (Computer Engineering)			Semester: III			
Course	Object Oriented Programming Laboratory			Code	CE25PCC-205		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	25	-	50	75

Pre-requisites: Prior knowledge of Object-Oriented Programming (OOP) concepts is essential.

Course Objectives: This course aims at enabling students:

1. To utilize Object-Oriented Programming concepts to solve real-world problems.
2. To develop the ability to design and implement modular, reusable, and maintainable programs using OOP concepts.
3. To provide hands-on experience in solving real-time problems through object-oriented approaches.
4. To strengthen practical skills in using constructors, file handling, exception handling, and dynamic memory management.

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

CO1: Design reusable programming code by using inheritance, polymorphism, and exception handling concepts.

CO2: To implement efficient object initialization and resource management by using constructors and destructors.

CO3: By applying the concept of map associative container, class and function template design the application.

CO4: Apply file-handling techniques to store and retrieve data effectively from secondary storage.

Guidelines for Students:

1. Each student must perform all the assignments.
2. Assignments should be implemented in C++ language.
3. Operating System recommended: - 64-bit Open-source Linux or its derivative.
4. Programming tools recommended: - G++/GCC, Eclipse

Course Contents

Suggested List of Experiments/Assignments

Sl. No.	Problem Statement
1	Implement a class Complex which represents the Complex Number data type. Implement the following Constructor (including a default constructor which creates the complex number 0+0i). Overload operator+ to add two complex numbers. Overload operator* to multiply two complex numbers. Overload operators << and >> to print and read Complex Numbers.
2	To create a class staff having fields: Staff-id, name, salary and functions accept() and display(). Calculate DA=25% of basic salary, HRA=800, I-tax=15% of basic salary.

	Display the pay slip using appropriate output format. 1) To accept the data 2) To display the data 3) To sort the data by name
3	Imagine a publishing company which does marketing for book and audio cassette versions. Create a class publication that stores the title (a string) and price (type float) of publications. From this class derive two classes: book which adds a page count (type int) and tape which adds a playing time in minutes (type float). Write a program that instantiates the book and tape class, allows user to enter data and displays the data members. If an exception is caught, replace all the data member values with zero values.
4	Write a C++program to implement the matrix ADT using a class. The operations supported by this ADT are: a. Reading a matrix. b. Addition of matrices. c. Printing a matrix. d. Subtraction of matrices. e. e) Multiplication of matrices
5	Write a program to illustrate default constructor, parameterized constructor and copy constructors. Program should illustrate the order of execution of constructors and destructors when a new class is derived from more than one base class.
6	Write a C++ Write a program that creates an output file, writes information into the file, closes it, then reopens the same file as an input file and reads the stored information for display.
7	Write C++ programs that illustrate how the following forms of inheritance are supported: a. Single inheritance b. Multiple inheritance c. Multilevel inheritance d. Hierarchical inheritance.
8	Design and implement a generic Library Management System in C++ using Class Templates.
9	Write a program in C++ to use map associative container. The keys will be the names of states and the values will be the populations of the states. When the program runs, the user is prompted to type the name of a state. The program then looks in the map, using the state name as an index and returns the population of the state.
10	Develop a C++ program for simulation of any real time application with required functionalities. For eg. ATM machine with functionalities like checking account balance, with drawing, and depositing money. Use try, catch, and finally blocks to handle potential exceptions such as insufficient funds (throwing Arithmetic Exception) and invalid input (throwing Illegal Argument Exception). Ensure that the application continues to run smoothly after handling exceptions.
Mini-Projects	
11	Design mini project that uses all OOP assignment concepts.

Reference Books:

1. Herbert Schildt, "C++: The Complete Reference", Mc Graw Hill Education,4th Edition, July 2017, ISBN-10:007053246X (ISBN-13: 978-0070532465)
2. Matt Weisfeld, "The Object-Oriented Thought Process", 3rd Edition Pearson ISBN-13:075 2063330166.
3. Bjarne Stroustrup, "The C++ Programming language", Pearson Education, 3rd Edition, 2008, ISBN 9780201889543.

Program	S.Y. B.Tech (Computer Engineering)			Semester: III			
Course	Computer Organization and Architecture			Code:		CE25MDM-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: Prior knowledge of computer systems and digital logic is essential.

Course Objectives: This course aims at enabling students:

1. To learn the workings of computer systems and their foundational rules.
2. To study the Instruction Level Architecture and Instruction Execution
3. To analyses the current state of art in memory system design
4. To describe how I/O devices are accessed and its principles.
5. To provide the knowledge on Instruction Level Parallelism

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

CO1: Describe the structure, functions, and interconnections of computer components.
CO2: Apply binary arithmetic algorithms and illustrate instruction execution within CPU organization.
CO3: Analyze memory design issues, cache mapping, and data flow through various hierarchy levels.
CO4: Evaluate system performance using pipelining and efficient I/O techniques.

Course Contents

Unit	Description	Duration [Hrs]
I	**Data representation** Data Types, Complements, Fixed-Point Representation, Conversion of Fractions, Floating-Point Representation, Gray codes, Decimal codes, Alphanumeric codes, Error Detection Codes. **Register Transfer and Micro operations:** Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit.	7
II	**Basic Computer Organization and Design** Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instruction, Input-Output Instruction, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic. **Central Processing Unit:** General Register Organization, Stack organization, Instruction Format, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC, CISC.	8
III	**Pipelining** Basic Concepts of Pipelining, Throughput and Speedup, Pipeline Hazards.	7

	Parallel Processors: Introduction to Parallel Processors, Concurrent access to memory and Cache Coherency.	
IV	**Input-output Organization** I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, Privileged and Non-Privileged Instructions, Software Interrupts. **Memory organization:** Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Writing into Cache, Cache Initialization, Virtual Memory.	**8**
	Total	**30**

Text Books:

1. M. Morris Mano, "Computer System Architecture", Pearson, 3rd Edition, 1993, ISBN-13: 978-0131755635
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Elsevier, 5th Edition, 2013, ISBN-13: 978-0124077263
3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, and Naraig Manjikian, "Computer Organization and Embedded Systems", McGraw Hill Higher Education, 6th Edition, 2011, ISBN-13: 978-0073380650

Reference Books:

1. John P. Hayes, "Computer Architecture and Organization", WCB/McGraw-Hill, 3rd Edition, 1998, ISBN-13: 978-0070273559
2. William Stallings, "Computer Organization and Architecture: Designing for Performance", Pearson Education, 10th Edition, 2015, ISBN-13: 978-0134101613
3. Vincent P. Heuring and Harry F. Jordan, "Computer System Design and Architecture", Pearson Education, 2nd Edition, 2003, ISBN-13: 978-0130484406

MOOC / NPTEL/YouTube Links:

1. Computer Architecture and Organization (IIT Kharagpur, Prof. Indranil Sengupta & Kamalika Datta)
   https://nptel.ac.in/courses/106105163
2. Computer Organization and Architecture (IIT Madras, Prof. Kamakoti)
   https://nptel.ac.in/courses/106106166
3. Computer Organization and Architecture: A Pedagogical Aspect (IIT Guwahati, Prof. Santhosh Biswas, et al.)
   https://nptel.ac.in/courses/106103180
4. Computer Architecture (IIT Delhi, Prof. S R Sarangi)
   https://nptel.ac.in/courses/106102157

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: Prior knowledge of algebra, trigonometry, and calculus from First-Year Engineering Mathematics.

Course Objectives: This course aims at enabling students:

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 principal 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.	9

	Probability, Probability density function, and Central limit theorem, Probability distributions: Binomial, Poisson, Normal, and Test of 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 transform 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-2019, McGraw-Hill Education, ISBN: 978-1-259-67651-2.
2. Kolman, B., Busby, R. C., & Ross, S., "Discrete Mathematical Structures", 6th Edition-2009/2010, Pearson/Prentice Hall, ISBN: 978-0-13-229751-6.
3. Lipschutz, S., & Lipson, M., Schaum's Outline of Discrete Mathematics, Revised 3rd Edition-2009, McGraw-Hill Education, ISBN: 978-0-07-161586-0.
4. Grimaldi, R. P., "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition- 2004 (reprints 2013), Pearson/Addison-Wesley, ISBN: 978-0-321-21103-3.
5. Ramana, B. V., Higher Engineering Mathematics, 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

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: This course aims at enabling students:

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** 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.	**8**
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.	**9**
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.	**8**
	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 and 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: Prior knowledge of basic understanding of algebra and arithmetic operations, Fundamental concepts of probability (events, sample space, basic rules) is essential.

Course Objectives: This course aims at enabling students:

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.	8
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.	7

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 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	**10**
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 Study**: Case studies based on binomial distribution and hypothesis testing for real-life decision problems.	**10**
	Total	**44**

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

e-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

Program	S.Y. B.Tech (Open Elective Course-I)			Semester : III			
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: Prior knowledge of Engineering Mathematics, Algebra, Calculus, and Programming Concepts is essential.

Course Objectives: This course aims at enabling students:

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

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

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

CO3: Apply probability concepts and apply 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,	9

	Simpson's 1/3 Rule, Simpson's 3/8 Rule, Error analysis for numerical differentiation & integration .	
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** 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.	**9**
	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	SY 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: Prior knowledge of Univariate Calculus, Multivariate Calculus is essential.

Course Objectives: This course aims at enabling students:

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 to find the solutions of linear differential equations.	**9**
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.), 10 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 HillEditions, 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	SY 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: Prior Knowledge of Univariate Calculus**,** Multivariate Calculus**,** Fourier series, Collection, classification, and representation of data is essential.

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: After learning the course, the students should 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; Evaluation of integrals by using Laplace transform; Transforms of some special functions- periodic function, Heaviside unit step function, Dirac delta function.	9
	Inverse Laplace Transform	9

II	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.	
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	**9**
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	**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, Stokes' 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), 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	PR	OR	TW	Total
2	-	2	1	-	-	25	25

Pre-requisites: Basic knowledge of Social Values, Communication is essential.

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	4

	in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order	
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.

Suggested list of Experiments/Assignments

Sl. No.	**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 fulfilment. 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	Form 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, 1999, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak

2. P. Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
3. N. Tripathy, 2003, Human Values, New Age International Publishers.
4. E. G. Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press

e-Sources:

1. Jeevan Vidya: Ek Parichaya — A. Nagaraj (1999)
   https://uhvparivar.org/publications/otherbooks/Jeevan-Vidya-ek-Parichay.pdf

e-Books:

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

MOOC / NPTEL/YouTube Links:

1. Swayam Course on "Understanding Human Being Nature and Existence Comprehensively" by Dr. Kumar Sambhav
   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
   https://nptel.ac.in/courses/109104068
3. UHV Lecture Series – Prof. R. R. Gaur
   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-208A		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	2	1	-	-	25	25

Pre-requisites: Prior knowledge of business management is essential

Course Objectives: This course aims at enabling students:

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 them 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: After completion of course, the 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.	**4**
II	**Engineering as Social Experimentation** Engineering as Experimentation-Engineers as responsible Experimenters-A balanced outlook on Law.	**3**
III	**Social Impact of Technology and Engineering** Ethos 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-**	**4**

	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).	
	Total	**15**

Course Contents	
Sl. No.	**Suggested List of Experiments/Assignments**
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, cybersecurity, 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	TW	OR	PR	Total
2	-	2	1	25	-	-	25

Course Objectives: This course aims at enabling students:

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: After completion of the course, the student 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**

Course Contents	
Sl. No.	**Suggested List of Assignment/Experiments**
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

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 Engineering)			Semester: III			
Course	Scientific Computing with Python			Code			CE25VSEC-209A
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	25	25	-	50

Pre-requisites: Prior knowledge of python programming including variables, loops, functions, and file handling is essential.

Course Objectives: This course aims at enabling students:

1. To introduce students to Python programming concepts used in scientific and engineering applications.
2. To develop the ability to use NumPy for efficient numerical computation and array-based problem solving.
3. To perform data handling, preprocessing, and analysis using Pandas.
4. To Provide hands-on experience in visualizing scientific and real-world data using Matplotlib and Seaborn.
5. Build analytical skills to model, interpret, and solve scientific problems using Python tools.
6. Encourage students to apply computational methods to real-world datasets and develop mini analytical projects.

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

CO1: Understand the fundamentals of Python programming for scientific computing.

CO2: Apply NumPy operations for numerical computation, matrix manipulation, and vectorized processing.

CO3: Analyze datasets using Pandas by performing data cleaning, transformation, and aggregation operations.

CO4: Create different types of scientific and statistical visualizations using Matplotlib and Seaborn.

Course Contents

Sl. No.	Suggested List of Experiments/Assignments (All are Compulsory)
1	Write a Python program to demonstrate python data types (int, float, complex, str, list, tuple, dict, set, frozenset, bool, NoneType) and its operations using its built-in functions and math functions on Jupyter Notebook and Python IDE. Tool: Python basics (math module)
2	Create 1D, 2D NumPy arrays and perform indexing, slicing, reshaping, and mathematical. **Functions:** np.array, np.arange, np.linspace, np.reshape, np.sum, np.mean
3	Apply vectorized operations, broadcast rules, and universal functions. **Functions:** np.add, np.sqrt, np.exp, broadcasting features
4	Generate random numbers, simulate distributions, and compute statistics. **Functions:** np.random.rand, np.random.randn, np.random.randint, np.random.normal
5	Create Series, DataFrames, import/export CSV files, and perform basic operations. **Functions:** pd.Series, pd.DataFrame, df.head, df.tail, df.describe, df.to_csv

6	Handle missing values, replace data, filter rows & columns, sort and group values. **Functions:** df.isnull, df.fillna, df.dropna, df.sort_values, df.groupby
7	Plot line, bar, scatter, and histogram using Matplotlib. **Functions:** plt.plot, plt.bar, plt.scatter, plt.hist, plt.xlabel, plt.ylabel
8	Multi-plot figures, subplots, styling, legends, and grid. **Functions:** plt.subplot, plt.legend, plt.grid, plt.title
9	Create statistical plots using Seaborn. **Functions:** sns.lineplot, sns.barplot, sns.histplot, sns.boxplot, sns.scatterplot
10	Load a real-world dataset and perform summary statistics & visual analysis. **Tools:** Pandas, Matplotlib, Seaborn **Activites:** Missing values detection, correlation matrix (sns.heatmap)
11	Solve matrix equations, find eigenvalues, inverse, transpose. **Functions:** np.linalg.solve, np.linalg.inv, np.linalg.eig
12	**Mini Project – Data Analysis & Visualization** **Aim:** Students choose a dataset (weather, sports, sales, etc.) and perform: a. Cleaning with Pandas b. Analysis with NumPy c. Visualization with Matplotlib/Seaborn d. Prepare a brief report

Reference Books:

1. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2nd Edition, 2020, Green Tea Press,
2. “Scientific Computing with Python (SciPy Lecture Notes)”, SciPy Community, Online Publication, Latest Edition, 2024.
3. Robert Johansson, “Numerical Python: A Practical Techniques Approach”, 3rd Edition, 2023. Apress,

Program	S.Y. B.Tech (Computer Engineering)			Semester: III			
Course	Scientific Computing with R Programming			Code	CE25VSEC-209B		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	25	25	-	50

Pre-requisites: Prior knowledge of Basics of Computer and Basics of Mathematics is essential.

Course Objectives: This course aims at enabling students:

1. To understand R syntax, data types, and core programming concepts
2. To use control structures (loops, conditions) and vectorized operations
3. To create Professional Data Visualizations by using ggplot2 to produce high-quality plots
4. To understand numerical algorithms (root finding, optimization, ODEs)

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

CO1: Implementation of install R and perform basic operations by using functions.
CO2: Implement numeric functions and loops in R language.
CO3: Perform data manipulation using tidyr and linear algebra.
CO4: Implement parallel computing using functions of R-language.

Course Contents

Sl. No.	Suggested List of Experiments/Assignments (All are Compulsory)
1	R Basics & Environment Setup: Install R and RStudio. Use basic R operations (arithmetic, variables, functions). Working with vectors, matrices, factors, lists, and data frames. Write a simple script that reads a CSV file and summarizes it.
2	Implement R- Control Flow & Functions: Create custom functions with default parameters. Use if / else, for, and while loops. Vectorized vs. non-vectorized code (performance comparison). Implement a numeric function (e.g., factorial, Fibonacci)
3	Data Manipulation with tidyverse: Use dplyr for filtering, joining, grouping, and summarizing data. Data reshaping with tidyr. Import/export data in different formats (CSV, Excel, RDS)
4	Implement Scientific Visualization R: Create plots using ggplot2 (scatter, line, histogram, density, boxplot), multi-panel figures with facet_wrap(), Customize themes and annotations, Produce a publication-quality figure
5	Implement the bisection method and Newton–Raphson method**.** Compare convergence behavior on nonlinear equations. Test methods on functions of your choice
6	Implement optimization by using optim() for single-variable and multi-variable optimization. Implement gradient descent manually. Apply optimization to a real dataset (e.g., fitting a nonlinear model)

7	Implementation Gaussian elimination by using R's built-in solvers (solve (), eigen decomposition, SVD). Condition numbers and numerical stability experiments
8	Solve ODEs. Implement Euler's method and RK4 manually using deSolve package. Compare numerical solutions to analytical solutions where possible
9	Generate random variables from various distributions, Monte Carlo integration and estimate π using random sampling and Simulate of a simple physical or probabilistic system (e.g., random walk)
10	Implement Parallel computing by using parallel or for each and Profiling code using Rprof() or bench. Compare the speed difference.

Reference Books:

1. Robert L. Kabacoff – "R in Action", 2nd edition, 2025. Dreamtech Press, ISBN: 9789351198079
2. Hadley Wickham and Garrett Gorlemund, "R for Data Science", 1st edition-2025, Kindle and Paperback Publisher. ISBN: 978-0-12-381479-1

Program	S.Y. B.Tech (Computer Engineering)			Semester: III			
Course	Scientific Computing with MatLab			Code		CE25VSEC-209C	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	25	25	-	50

Pre-requisites: Prior knowledge of Basics of Basics of Computer and Basics of Mathematics is essential

Course Objectives: This course aims at enabling students:

1. To understand the versatile MATLAB programming language
2. Apply the fundamental techniques through MATLAB Programming
3. Familiarize the versatile Arduino programming language
4. Apply the fundamental techniques through Arduino Programming

Course Outcomes: After learning the course, the students should be able to:

CO1: Apply the programming knowledge and techniques for implementation of simple programs on MATLAB.

CO2: Create Data & Graphics Proficiency to effectively use MATLAB for data manipulation using arrays, vectors.

CO3: Apply the fundamentals of Image processing for implementation of simple programs on Image.

CO4: Create 2D/3D plots, annotating graphs, and customizing visual outputs.

Course Contents

Sl. No.	Suggested List of Experiments (All are Compulsory)
1	Create 2-D matrix by using MatLab commands and perform below operations on it, a. Create arrays of zeros/ones b. Generate Identity matrix c. Generate Random numbers d. size(A) / length(A)-Dimensions of array e. A' -Transpose f. A(:) -Convert to column vector
2	Write a basic MATLAB program to declare variables, perform basic operations on variables and use trigonometric function (Sine/Cosine) & plot the graph.
3	Implement below basic mathematical operations on 2-D matrix, a. Find sum and mean value b. Find min-value and max-value c. Find determinant of matrix d. Identify Eigenvalues and eigenvectors e. Derive Fast Fourier Transform
4	Implement Branch control statement and loop control statement in MatLab.
5	Write MATLAB code to print the sum of the first 10 natural numbers using (For Loop).

6	Perform input data handling by using linspace(), reshape(), sort(), unique(), find() inbuilt functions of MatLab.
7	Implement various techniques of plotting in MatLab and compare the techniques on the basis of time and space complexity.
8	Implement below operations on image, a. Read image b. Display image c. Convert to grayscale d. Detect edges
9	Write a MATLAB program to define an array & perform various operations. Create a matrix & perform addition of two matrices.
10	Perform image enhancement by adjusting brightness, contrast and represent image by using histogram.

Reference Books:

1. Daniel T. Valentine, Brian H. Hahn – "Essential MATLAB for Engineers and Scientists", 8th edition, 2022, Academic Press,. ISBN 032399590X
2. Stormy Attaway – "Matlab: A Practical Introduction to Programming and Problem Solving", 3rd edition, 2013, Academic Press. ISBN 978-9351072553

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

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

Course Objectives: This course aims at enabling students:

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, startup ecosystem

Course Outcomes: After completion of the course, the 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**	3

	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 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 Radically Successful Businesses, 1st Edition, Crown Business, 2011. ISBN: 9780307887894.
3. Osterwalder, Alexander & Pigneur, Yves. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, 1st Edition, Wiley, 2010. ISBN: 9780470876411.

MOOC / NPTEL/YouTube Links

1. https://www.coursera.org/learn/entrepreneur-guide-beginners
2. https://onlinecourses.nptel.ac.in/noc21_mg70/preview
3. https://onlinecourses.nptel.ac.in/noc20_ge08/preview

Course Syllabus

Semester-IV

Program	S.Y.B.Tech (Computer Engineering)			Semester: IV			
Course	Software Engineering			Code:		CE25PCC-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: Prior knowledge of data structures OOP Concept, DBMS & SQL is essential.

Course Objectives: This course aims at enabling students:

1. To provide a comprehensive understanding of software engineering principles, software process models, and the role of agile and plan-driven development approaches.
2. To develop the ability to perform effective requirements engineering, including elicitation, analysis, modeling, negotiation, and validation of software requirements.
3. To equip students with skills in software project estimation, scheduling, and design by applying suitable estimation models, design concepts, architectural principles, and quality guidelines.
4. To enable students to understand and apply key practices in risk management, software configuration management, and software testing techniques for ensuring reliable and high-quality software systems.

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

CO1: Apply key software engineering principles and process models to plan and organize software development activities.

CO2: Conduct requirements engineering tasks such as elicitation, analysis, modeling, specification, validation, and management to produce clear and accurate requirements.

CO3: Estimate project effort, plan schedules, and apply software design concepts.

CO4: Identify potential software risks and implement appropriate risk mitigation and configuration management practices across the project lifecycle.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Software Engineering and Software Process Models** **Software Engineering Fundamentals** Introduction to software engineering, The Nature of Software, Defining Software, Software Engineering Practice. **Software Process:** A Generic Process Model, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, Unified Process.	7
II	**Software Requirements Engineering & Analysis** Introduction to Requirements Engineering, Requirements Elicitation, Requirements Analysis, Requirements Modeling, Requirements Specification, Requirements Validation & Verification, Requirements Management	8

III	**Estimation, Scheduling & Design Engineering** **Estimation & Scheduling: -** Estimation for Software Projects: The Project Planning Process, Defining Software Scope and Checking Feasibility Software Project Estimation, The Structure of Estimation Models, The COCOMO II Mode, Project Scheduling, Defining task for software project. **Design Concepts:** Design within the Context of Software Engineering, The Design Process, Software Quality Guidelines and Attributes, Design Concepts - Abstraction, Architecture, design Patterns.	**7**
IV	**Risks and Software Configuration Management** **Risk Management:** Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring, and Management, The RMMM Plan. **Software Configuration Management**: Software Configuration Management, The SCM Repository The SCM Process, Configuration Management for any suitable software system.	**8**
	Total	**30**

Text Books:

1. Roger Pressman, "Software Engineering: A Practitioner 's Approach", McGraw Hill, ISBN 0–07–337597–7
2. Ian Sommerville, "Software Engineering", Addison and Wesley, ISBN 0-13-703515-2

Reference Books:

1. Rajib Mall, "Fundamentals of Software Engineering", PHI, ISBN-13: 978-8120348981
2. Joseph Phillips, IT Project Management -On Track from Start to Finish, Tata Mc Graw-Hill, ISBN13: 978-0-07106727-0, ISBN-10: 0- 07-106727-2
3. Carlo Ghezzi, "Fundamentals of Software Engineering", PHI, ISBN-10: 0133056996
4. Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer, ISBN 13: 9788173192715.
5. S K Chang, "Handbook of Software Engineering and Knowledge Engineering", World Scientific, Vol I, II, ISBN: 978-981-02-4973-1

e-Books:

1. Software Engineering – Roger S. Pressman
   https://ebookpdf.com/roger-s-pressman-software-engineering

MOOC / NPTEL/YouTube Links:

1. Software Engineering by Prof.Rajib Mall, IIT Kharagpur
   https://swayam.gov.in/nd1_noc19_cs69/preview
2. Software Engineering By Dr. B. LAVANYA, University of Madras
   https://swayam.gov.in/nd2_cec20_cs07/preview

Program	S.Y. B.Tech (Computer Engineering)			Semester: IV			
Course	Database Management Systems			Code:		CE25PCC-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: Prior knowledge of basic data structures, programming fundamentals is essential

Course Objectives: This course aims at enabling students:

1. To provide fundamental knowledge of database concepts, architectures, and data models.
2. To make students familiar with building database design.
3. To develop the ability to write efficient SQL queries for data definition, manipulation, and control.
4. To introduce the fundamental concepts of transactions, ACID properties, and their importance in database reliability.

Course Outcomes: After learning the course, the students should be able to:

CO1: Design E-R Model for given requirements and convert the same into database tables.
CO2: Implement normalization techniques, to construct optimized relational database designs.
CO3: Apply SQL to write queries for given requirements.
CO4: Analyze different transaction management strategies.

Course Contents

Unit	Description	Duration [Hrs]
I	**Foundations of Databases and ER Model** Introduction of Data, Information, Database and DBMS, Characteristics and applications of DBMS, key, Database architecture, levels of Abstraction ER model and ER diagrams, Extended ER Features: Specialization, Generalization, Aggregation.	7
II	**Relational Database design** Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Relational Integrity: Domain, Referential Integrities, Enterprise Constraints, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, 2NF, 3NF, BCNF.	8
III	**SQL** SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators, Tables: Creating, Modifying, Deleting, Updating, SQL DML Queries: SELECT Query and clauses, Views: Creating, Dropping, Updating using Indexes, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, SQL Functions, Nested Queries.	7
IV	**Database Transaction Management**	8

	Transaction concept, Transaction states, ACID properties, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules, Concurrency Control: Lock-based, Time-stamp based Deadlock handling, Recovery methods: Shadow- Paging and Log-Based Recovery	
	Total	**30**

Text Books:

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", 7th Edition, 2020, McGraw Hill Publishers, ISBN 978-0-07-802215-9.
2. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", 2014, BPB Publications ISBN: 9788176569644.
3. Connally T, Begg C., "Database Systems- A Practical Approach to Design, Implementation and Management", Pearson Education, 5th Edition, 2010, ISBN 81-7808-861-4.
4. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled", 2013, Addison Wesley, ISBN-10: 0321826620, ISBN 13: 978-0321826626.

Reference Books:

1. C. J. Date, "An Introduction to Database Systems", 8th Edition, 2004, Addison-Wesley ISBN 0321189566.
2. S. K. Singh, "Database Systems: Concepts, Design and Application", 2009, Pearson Education ISBN 9788177585674.
3. Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide",3rd Edition, 2019, O"Reilly Publications, ISBN 9781491954461.
4. Kevin Roebuck, "Storing and Managing Big Data - NoSQL, HADOOP and More",2011, Emereo Pty Limited, ISBN 1743045743, 9781743045749.

MOOC / NPTEL/YouTube Links:

1. NPTEL–Database Management System (IIT Madras)
   https://nptel.ac.in/courses/106105175
2. NPTEL–Database Systems (IISc Bangalore) Coursera
   https://nptel.ac.in/courses/106104135
3. Database Systems Concepts & Design (ASU)
   https://www.coursera.org/specializations/database-systems

Program	S.Y. B.Tech (Computer Engineering)			Semester: IV			
Course	Database Management System Laboratory			Code:		CE25PCC-253	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	50	-	25	75

Pre-requisites: Prior knowledge of computer operation and programming logic, data structures and algorithms is essential.

Course Objectives: This course aims at enabling students:

1. To develop Database programming skills.
2. To develop basic Database administration skills.
3. To learn, understand and execute process of software application development.
4. To learn redundancies schema on database

Course Outcomes: After completing this course, students will be able to:

CO1: Design E-R Model for given requirements and convert the same into database tables

CO2: Implement SQL queries for given requirements, using different SQL concepts

CO3: Develop a complete software application by considering actual requirements and using database concepts & Software Engineering concepts.

CO4: Design database schema by identifying Implement different keys.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open-source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus. Operating System recommended: - 64-bit Open-source Linux or its derivative Programming tools recommended: - MYSQL/Oracle, ERD plus, ER Win

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of the student. Each Laboratory assignment assessment of the student should be based on predefined rubrics finalized during course meetings.

Guidelines for Practical Examination

Problem statements must be decided jointly by the internal examiner and external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So,

adhering to these principles will consummate our team efforts to the promising start of student's academics.	
Course Contents	
Suggested List of Experiments/Assignments	
Sl. No.	**Problem Statement**
Group A: SQL	
1	Decide a case study related to real time application in group of 2-3 students and formulate a problem statement for application to be developed. Propose a Conceptual Design using ER features using tools like ERD plus, ER Win etc. (Identifying entities, relationships between entities, attributes, keys, cardinalities, generalization, specialization etc.) Convert the ER diagram into relational tables and normalize Relational data model
2	Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence, Synonym, different constraints etc.
3	Implement SQL queries to familiarize students with essential SQL commands in MySQL - to create a new user, create a table considering different data types, Insert, Select, Update, Delete, Drop, Alter, distinct, describe, Truncate command.
4	Implement sql queries to provide students with hands-on experience in implementing various data constraints using SQL commands in MySQL. (NOT NULL, UNIQUE, PRIMARY KEY, FOREIGN KEY, and DEFAULT)
5	Implement sql queries for different SQL concepts for SQL computation (arithmetic operators, logical operators, pattern matching, IN and NOT IN predicates, and MySQL built-in functions).
6	Implement SQL queries for different SQL concepts such as grouping data, using the GROUP BY clause, employing the HAVING clause, applying the EXISTS/NOT EXISTS operators, Creating and using Database Views.
7	Write SQL queries to demonstrate the different SQL concepts like subqueries, performing various join operations, and using set operators in MySQL.
8	Implement SQL queries to demonstrate the nested queries in SQL using MySql.
Group B:- Mini Project	
9	Using the database concepts covered in Group A, develop an application with following details: Follow the same problem statement decided in Assignment -1 of Group A. Follow the Software Development Life cycle and other concepts learnt in Software Engineering Course throughout the implementation. Develop application considering: Front End: Java/Perl/PHP/Python/Ruby/.net/any other language

	Backend: MySQL/Oracle Student should develop application in group of 2-3 students and submit the Project Report which will consist of documentation related to different phases of Software Development Life Cycle: Title of the Project, Abstract, Introduction Software Requirement Specification Conceptual Design using ER features, Relational Model in appropriate Normalize form Graphical User Interface, Source Code Testing document Conclusion. **Note:** Instructor should maintain progress report of mini project throughout the semester from project group Practical examination will be on assignments given above in Group only Mini Project in this course should facilitate the Project Based Learning among students

Reference Books:

1. C. J. Date, "An Introduction to Database Systems", Addison-Wesley, 8th Edition, 2004, ISBN 0321189566.
2. S. K. Singh, "Database Systems: Concepts, Design and Application", Pearson Education, 2009, ISBN 9788177585674.
3. Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide", O‟Reilly Publications, 3rd Edition, 2019 ISBN 9781491954461.
4. Kevin Roebuck, "Storing and Managing Big Data - NoSQL, HADOOP and More", Emereo Pty Limited, 2011, ISBN 1743045743, 9781743045749.

Program	S.Y.B.Tech (Computer Engineering)			Semester: IV			
Course	Advanced Data Structures			Code:		CE25PCC-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: Prior knowledge of programming concepts, problem solving, Data structures is essential.

Course Objectives: This course aims at enabling students:

1. To Introduce tree traversal techniques (In order, Preorder, Post order), height balanced tree and threaded binary tree.
2. To Develop the ability to apply traversal and path-finding techniques to solve real-world problems.
3. To Explain the principles of hashing and collision management to design efficient data retrieval and storage solutions.
4. To Demonstrate heap structures and priority queue operations.

Course Outcomes: After successful completion, the student will be able to:

CO1: Implement binary trees and BSTs operations using arrays or linked representations.
CO2: Apply graph representations and algorithms to solve computational problems.
CO3: Implement efficient hashing mechanisms to resolve collisions effectively.
CO4: Utilize heaps for implementing priority-based operations.

Course Contents

Unit	Description	Duration [Hrs]
I	**Hashing** Hashing concept and need; hash functions – division, mid-square, folding; collision resolution – chaining, open addressing (linear probing, quadratic probing, double hashing); rehashing; hash table performance analysis; real-life applications of hashing (symbol tables, database indexing).	8
II	**Graph** Graph terminology and types; graph representations – adjacency matrix and adjacency list; graph traversals – BFS and DFS; spanning trees (Kruskal's and Prim's algorithms); shortest path algorithms (Dijkstra's, Bellman-Ford); graph applications – networking, scheduling, path finding.	7
III	**Tree** Tree terminology, types of trees; binary tree and its representation; binary search tree (BST); tree traversals – in order, preorder, post order; threaded binary tree; height-balanced trees (AVL trees – concept and rotations); applications of trees (expression tree, decision tree).	8
IV	**Heap Structures and Priority Queues**	7

	Heap properties; binary heap – creation, insertion, deletion; happify; heap sort; min-heap and max-heap; implementation of priority queue using heap; applications in job scheduling and event simulation.	
	Total	**30**

Text Books:

1. Sartaj Sahni, Data Structures, Algorithms and Applications in C++, Universities Press, 2nd Edition, 2005, ISBN: 978-8173715228.
2. D. S. Malik, Data Structures Using C++, Cengage Learning, 2nd Edition, 2012, ISBN: 978-8131518236.
3. Varsha H. Patil, Data Structures Using C++, Oxford University Press, 1st Edition, 2012, ISBN: 978-0198066231

Reference Books:

1. Seymour Lipschutz, "Data Structures", Schaum's Outline Series, McGraw-Hill Education, Revised First Edition (2014), ISBN-13: 978-1259029967.
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", CareerMonk Publications (2021), ISBN: 9780615459813

e-Books:

1. https://archive.org/details/fundamentalsofda00elli
2. https://archive.org/details/datastructuresusingc_202011
3. https://web.itu.edu.tr/~sgunduz/courses/bil206_15/cormen.pdf

MOOC / NPTEL / SWAYAM Courses:

1. Naveen Garg, Data Structures and Algorithms, NPTEL (IIT Delhi), 2015 [Online course]. https://nptel.ac.in/courses/106/102/106102064/
2. Sanjiva Prasad, Introduction to Automata, Languages and Computation, NPTEL (IIT Delhi), 2018 [Online course]. https://nptel.ac.in/courses/106/102/106102132/
3. Anupam Basu, Artificial Intelligence, NPTEL (IIT Kharagpur), 2018 [Online course]. https://nptel.ac.in/courses/106/106/106106131/

Program	S.Y.B.Tech (Computer Engineering)			Semester: IV			
Course	Advanced Data Structures Laboratory			Code:		CE25PCC-255	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	25	-	25	50

Pre-requisites: Prior knowledge of programming concepts, problem solving, data structures is essential

Course Objectives: This course aims at enabling students:

1. To understand advanced data structures and their applications in problem-solving.
2. To develop efficient algorithms using trees, graphs, hashing, and heaps.
3. To implement real-world problems using appropriate data structure techniques.
4. To analyze the performance and efficiency of various data structure operations.

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

CO1: Apply data structures to solve computational and real-life problems.
CO2: Construct programs using trees, graphs, hashing, and heaps.
CO3: Demonstrate traversal, searching, and optimization techniques in laboratory tasks.
CO4: Evaluate the correctness and efficiency of implemented algorithms.

Guidelines for Laboratory Conduction

The instructor is expected to conduct **Three assignments from each group (A, B, C, D).** The instructor may set multiple sets of assignments and distribute them among batches of students.

Guidelines for Students Journal and term work assessment

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory Concept in brief, algorithm, flowchart, test cases, Test Data Set (if applicable), mathematical model (if applicable), conclusion/analysis.

Continuous assessment of laboratory work should be done based on overall performance and Laboratory assignments performance of student. Each Laboratory assignment assessment should be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each Laboratory assignment assessment include timely completion performance, innovation, efficient codes, punctuality and neatness.

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to test the students for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will

not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of the student's academics.	
Course Contents	
Suggested List of Experiments/Assignments	
Sl. No.	**Problem statement**
Group A	
1	Write a program to Represent a small family hierarchy (grandparent → parent → child) as a tree. Implement traversal to list all members in preorder (elders first).
2	Write programs to perform BST operations: inorder, preorder, and postorder traversals.
3	Write a program to Construct a decision tree for a medical diagnosis dataset (e.g., symptoms → disease). Students can implement traversal to simulate decision-making.
4	Write a program to build an expression tree from a postfix expression and evaluate it.
Group B	
5	Write a program for Friend Circle Finder: a. Represent students as nodes and friendships as edges. b. Use DFS to find all students connected to a given student (their friend circle).
6	Write a program for cities as nodes and roads as edges. Use BFS to check if all cities are connected (is the graph connected?).
7	Write a program for NMIET Campus Navigation System: a. Represent your college campus as a graph (buildings = nodes, paths = edges with distances). b. Implement Dijkstra's algorithm to find the shortest path between two buildings. c. Add weights for time (crowded paths slower) and compare results.
8	Write a program for Bus Route Optimization: a. Represent bus stops as nodes and routes as weighted edges (distance or travel time). b. Apply Prim's algorith**m** to design a minimum-cost bus route network. c. Compare Prim's vs Kruskal's MST outputs.
Group C	
9	a. Write a program to store student records (roll number → name). b. Use a hash table to quickly search for a student by roll number. c. Demonstrate collision handling with chaining.
10	Build a hash table to store contacts (phone number → person's name). a. Implement insert, search, and delete operations. b. Show how collisions are resolved using linear probing.

11	Write a Program for Duplicate Detection in Files: Insert into a hash table and detect duplicates when a collision occurs with the same hash value.
12	Write a Program to Store variable names as keys in a hash table.Support operations like a. insert (new variable), b. search (check if declared), c. delete (remove variable).
Group D	
13	Write a program to insert a set of integers into a min-heap and display the heap array. a. Example: Input = {40, 20, 30, 10} → Heap array = {10, 20, 30, 40}. b. Show step-by-step heapify process.
14	Write a program to build a max-heap from given numbers. a. Insert a new element and delete the maximum element. Example: Input = {15, 10, 20}, insert 25 → max = 25, delete → heap adjusts.
15	Write a program to implement Given an unsorted array, convert it into a heap using heapify. Show each step of heapify.
16	Write a program to implement a priority queue using a min-heap. Schedule jobs based on priority (lower number = higher priority). Example: Jobs = {(Job1, 3), (Job2, 1), (Job3, 2)} → Execution order = Job2 → Job3 → Job1.

Reference Books:

1. Seymour Lipschutz, "Data Structures", Schaum's Outline Series, McGraw-Hill Education, Revised First Edition (2014), ISBN-13: 978-1259029967.
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", CareerMonk Publications(2021), ISBN: 9780615459813

Program	S.Y.B.Tech (Computer Engineering)			Semester: IV			
Course	Microprocessor and Microcontroller			Code:		CE25MDM-256	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisite: Prior knowledge of Number System and Logic gates is essential.

Course Objectives: This course aims at enabling students:

1. To introduce the fundamental concepts and architectures of microprocessors and microcontrollers.
2. To explain the assembly language programs using the 8086 and 8051 instruction sets.
3. To Provide knowledge of peripheral interfacing techniques and system-level design using 8086 and 8051.
4. To Introduce ARM architecture and develop competence in ARM instruction set and programming.
5. To Prepare students to analyze and design embedded system components using modern processor architectures.

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

CO1: Explain architectural features of 8086, 8051, and ARM processors and compare different processing paradigms.

CO2: Implement assembly language programs using 8086, 8051, and ARM instruction sets for solving computational tasks.

CO3: Design interfacing circuits for common peripherals using 8086 and 8051 microcontrollers.

CO4: Apply ARM architectural concepts for basic system-level programming and exception handling.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Microprocessors** 8-bit and 16-bit Microprocessors, Intel Pentium Overview, Intel Core Series (i3, i5, i7), 80386 DX Features and Architecture, Programmers Model, Operating Modes, Addressing modes and data types, **Initialization**- Processor State after Reset. Functional pin Diagram, I/O Organization, Memory Organization (Memory banks).	7
II	**Memory Organization and Interrupts:** **Memory Management:** Global Descriptor Table, Local Descriptor Table, Interrupt Descriptor Table, GDTR, LDTR, IDTR. Formats of Descriptors and Selector, Segment Translation, Page Translation, Combining Segment and Page Translation. **Interrupts:** Interrupt Control & status registers, Interrupt Vector Table (IVT), ISR, Hardware and software Interrupts.	8

III	**Introduction to 8051 Microcontroller** Difference between microprocessor and microcontroller, Microcontroller classification, Feature and block diagram of 8051, Program Status Word (PSW), Overview of Instruction set, memory organization, Interrupt structure, timers and its modes. **Serial communication:** Concept of baud rate, Data transmission and reception using Serial port. Delay using Timer (0&1) and interrupt, Data transmission and reception using Serial port.	**7**
IV	**ARM Architecture & Programming** ARM Design Philosophy, ARM Architecture Overview, ARM Processor States (ARM, Thumb, Jazelle), Registers, Modes, Conditional Execution, Pipelining, Vector Tables, Exception Handling, ARM -7 Instruction Set, Data Processing, Branch, Load–Store Instructions, SWI Instructions, Loading Techniques, ARM Assembly Programming.	**8**
	Total	**30**

Text Books:

1. Douglas Hall, "Microprocessors & Interfacing", McGraw Hill, Revised 2 Edition-2006, ISBN 0- 07-100462-9
2. A. Ray, K. Bhurchandi, Advanced Microprocessors and peripherals: Arch, Programming & Interfacing", Tata McGraw Hill,2004, ISBN 0-07-463841-6
3. Ajay Deshmukh, "Microcontrollers – (Theory and application)", 2004, TMH, ISBN 0-07-058595-4
4. Mohammad Ali Mazidi, Janice G. Mazidi, Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems, 2nd Edition-2014, Pearson, India.

Reference Books:

1. James Turley- "Advanced 80386 Programming Techniques", McGraw-Hill, ISBN:10:0078813425, 13: 978-0078813429.
2. Muhammad Ali Mazidi, ARM Assembly Language Programming & Architecture: 1, 2016, 2nd Edition.
3. Joseph Yiu, The Definitive Guide to ARM® Cortex®-M0 and Cortex-M0+ Processors, 2015, 2nd Edition, Elsevier Science & Technology, UK

e-Books:

1. Intel 80386 Programmer's Reference Manual 1986, Intel Corporation, Order no.: 231630-011, December 1995.
2. Intel 80386 Hardware Reference Manual 1986, Intel Corporation, Order no.: 231732-001, 1986.

MOOC / NPTEL/YouTube Links:

1. NPTEL – Microprocessors and Microcontrollers by Prof. Santanu Chaudhury, IIT Delhi https://nptel.ac.in/courses/108/102/108102157
2. NPTEL – Advanced Microprocessors (Covers 80386/486 fundamentals) by Prof. Anshul Kumar, IIT Delhi: https://nptel.ac.in/courses/106/102/106102062

3. NPTEL – Embedded Systems (Includes 8051 programming & interfacing) by Prof. Prabhu Ramachandran, IIT Bombay:
   https://nptel.ac.in/courses/117/105/117105135
4. NPTEL – Microcontrollers and Applications by Prof. Dhananjay Gadre (8051-based experiments)
   https://nptel.ac.in/courses/117/106/117106091

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: Prior knowledge of marketing terms such as target audience, branding, product, pricing, etc. is essential

Course Objectives: This course aims at enabling students:

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 Advertising Account, Facebook audience & types, Designing Facebook Advertising campaigns, Facebook Avatar, Apps, Live, Hashtags **Case study**: App Store Optimization (ASO)	**8**
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-2022, Pearson, ISBN: 9781292738086.
2. Rajan Gupta & Supriya Madan, "Digital Marketing", Dreamtech Press, 2023, ISBN: 9789355511522.

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: Prior knowledge of economics & mathematics is essential.

Course Objectives: This course aims at enabling students:

1. To enable the students to understand the economic theories which may be applied to maximize return and the 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 successful completion of the course, learner 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, 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.	8
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	8

	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	
III	**Role of Science, Engineering and Technology in economic Development** 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	**7**
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.	**7**
	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	SY 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: Prior knowledge of Finance and Economics**,** Cyber Security & Digital Payments is essential.

Course Objectives: This course aims at enabling students:

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: After 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 blockchain, cryptocurrencies, 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,	7

	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 **Case Study:** Unified Payments Interface (UPI) in India	
III	**Blockchain, Cryptocurrencies & Decentralized Finance** **Blockchain Technology:** Fundamentals of blockchain and underlying cryptographic techniques, Smart contracts and decentralized finance (DeFi) applications. Cryptocurrencies & Digital Assets: Overview and evolution of cryptocurrencies (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/fefe46c7-449549ba-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	PR	OR	TW	Total
2	1	-	1	-	-	25	25

Pre-requisites: Prior 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: Analyze 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 itslegal 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.	4

	Case Study : S.R. Bommai v. Union of India (1994) – Misuse of President's Rule	
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 1. Durga Das Basu, "Introduction to the Constitution of India", 24th edition,2020, Prentice Hall of India, New Delhi, ISBN-109388548868
2. Clarendon Press, Subhash C, Kashyap, — "Our Constitution: An Introduction to India's Constitution and constitutional Laws", 5th edition, 2014, NBT, ISBN-9781107034624

Reference Books:

1. Maciver and Page, "Society: An Introduction Analysis", 4th edition-2007, Laxmi Publications, ISBN-100333916166
2. PM 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-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.
   https://onlinecourses.nptel.ac.in/noc20_lw03/preview
2. Playlist on YouTube: “Constitutional Studies” (NPTEL) lectures by law professors covering fundamentals, history, structure, rights etc.
   https://www.youtube.com/playlist?app=desktop&list=PLyqSpQzTE6M-Zj2GBVpJ3c7cfvMTcKrPL&utm_source=chatgpt.com

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

Pre-requisites: Prior **k**nowledge 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 Comprehend 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.

Course Contents

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	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. Bharucha, E., - "Textbook of Environmental Studies", Universities Press (2005), ISBN-10:8173715408
2. Mahua Basu,- "Environmental Studies‖, Cambridge University Press", ISBN-978-1-107-5317-3

e-Sources:

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

Program	S.Y. B.Tech (Computer Engineering)			Semester: IV			
Course	Community Engagement Project			Code:		CE25ELC-259	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	-	50	-	50

Pre-requisites: Prior knowledge of social and ethical responsibilities, Teamwork and communication skills is essential.

Course Objectives: This course aims at enabling students:

1. To establish a mutually beneficial relationship between the college and the community.
2. To engage with their local community, fostering empathy, teamwork, and problem
3. To understand challenges faced by the local community and the role of engineering in addressing those challenges.
4. To evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact

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

CO1: Identify local community needs and challenges by engaging with stake holders and evaluating real-world problems.

CO2: Implement practical, creative, and context-specific solutions using engineering principles to address community issues.

CO3: Evaluate the effectiveness of their interventions and articulate lessons learned through reports and presentations.

CO4: To apply technical knowledge and skills to design solutions or interventions that create a positive impact on the community.

Course Contents

Guidelines for Laboratory Conduction

- A group of 3 to 4 students could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay/college premise.
- Each group /practical batch is allotted to a faculty member of the department as a mentor.
- A division of 60 students can have 3 batches of minimum 20 students. Practical load of 4 hours to be allocated to each batch.
- The group of students will be associated with a government official / village authority /NGOs etc. concerned, allotted by the district administration, during the duration of the project.
- The Community Engagement Project should be different from the regular programmes of NSS/NCC /Green Club/Hobby Clubs, Special Interests Groups etc.
- An activity book has to be maintained by each of the students to record the activities under taken/involved and will be countersigned by the concerned mentor/HoD.
- Project report shall be submitted by each student/group of students.

- Students groups can conduct an awareness programme on Health and Hygiene or in Organic Farming or in Fisheries or in advocating prohibition of liquor or about renewable energy, e waste management or any other activity in an area of their studies and as per his/her aptitude.

Guidelines for Oral Examination

- An internal evaluation shall also be conducted by a committee constituted by the HoD. Evaluation to be done based on the active participation of the student and marks could be awarded by the mentor/HoD.
- Oral Examination shall consist of presentation and demonstration of the project work carried out by the project groups.

Suggestive list of topics under Community Engagement Project

The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a student/group of students shall,

- Use/ miss-use of cell phones
- Career orientation of youth
- Water facilities and drinking water availability
- Health and hygiene of the school going students, home makers and old personals
- Health intervention and awareness programmes
- Horticulture
- Herbal and Nutrition
- Traditional and Modern health care methods
- Food habits
- Air /Sound /Water pollution
- Plantation and Soil protection
- Renewable energy and Solar Systems
- Yoga awareness and practice
- Health care awareness programmers and their impact
- Organic farming
- Food adulteration
- Incidence of Diabetes and other chronic diseases
- Blood groups and blood levels
- Chemicals in daily life
- Music and dance
- Women education and empowerment

Project Scope

- Conduct workshops or awareness drives on topics like digital literacy, environmental sustain ability, mental health, or career planning for local stakeholders.
- 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).

- Organize clean-up drives, tree plantations, recycling campaigns, or energy conservation initiatives.
- Promote health through awareness programs on hygiene, nutrition, and exercise.
- Teach basic computer or technical skills to students, staff, or the community

Proposal Submission

CEP Group should submit a two-page project proposal, preferably prior to the term commencement outlining the following:

- Title of the project
- Aim, Objective and expected outcome
- Plan of execution (timeline and activities).
- Place of the CEP and involvement of any local authority, NGP
- Required resources (if any).
- Get approval from the designated faculty mentor.

Learning Resources

Reference Books:

1. Waterman, A. "Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects"-,2nd Edition-2015, Routledge, ISBN: 978-1-63220-570-4
2. Beckman, M., and Long, J. F. "Community-Based Research: Teaching for Community Impact",1st Edition-2016, Stylus Publishing, ISBN: 978-1-62036-355-3

Program	S.Y. B.Tech (Entrepreneurship Management Course)			Semester: IV			
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: Prior knowledge of Engineering Environment, Communication Skills, Mathematical and Analytical Skills are essential.

Course Objectives: This course aims at enabling students:

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

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

CO1: Describe the role of entrepreneurship in economic growth and the startup 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, Intrapreneurship (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	3

	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	
II	**Idea Generation & Opportunity Recognition** Creativity Techniques for Idea Generation: Definition and importance of creativity in entrepreneur- ship. Brainstorming: Rules of effective 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.	**3**
III	**Business Model Development** Introduction to Business Model Canvas: Definition and purpose of a business model, Overview of the Business Model Canvas by Osterwalder, Benefits of using BMC for startups. Key Components of BMC: Value Proposition: Defining what unique value the product/service of- fers. Addressing customer pain points. Customer Segments: Identifying target customers. Creating customer personas Revenue Models: Direct sales, subscriptions, freemium, licensing, etc. Basic Market Research for Validation: Importance of market research in early-stage business de- velopment. 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, de- cision, action. Early-Stage Customer Acquisition Tactics: Word-of-mouth & referrals, Influencer mar- keting (micro-influencers), Email marketing basics, building a landing page and collecting lead. Crafting an Elevator Pitch: Definition and purpose, Key elements: Problem, solution, value propo- sition, target audience, Delivery tips: Clarity, brevity, confidence Overview of Funding Sources: Public & private capital sources, venture capital, debt financing. Bootstrapping: Meaning, benefits, and risks,	**6**

	Angel investors: Role, expectations, approach, Brief on incubators, government schemes, crowdfunding.	
	Total	**15**

Suggested List of Experiments/Assignments			
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 Ideas can be tech-based, social impact, service-based, or product-based Select One Idea- Choose the most promising idea from your list 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.	**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,

		The goal is to learn how to validate ideas through real-world feedback and refine the business concept accordingly.	Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, Cost Structure 3. 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 stratey 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 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: The Problem – Problem Identification The Solution – Description of your product/service. Value Proposition – The unique value proposition. Target Audience – Audience for your idea. Call to Action – E.g. request for support, funding, feedback, etc. **Deliver Your Pitch:** Record a video and submit it with written version of your pitch. Ensure clear speech, confident body language (for video), and persuasive tone. **Reflection (Short Write-up):** 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-2025, Wiley, ISBN: 9781394262809.
2. Drucker, Peter F. "Innovation and Entrepreneurship: Practice and Principles", Reprint Edition-2006, Harper Business, ISBN: 9780060851132.
3. Osterwalder, Alexander & Pigneur, Yves. "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers", 1st Edition-2010, Wiley, ISBN: 9780470876411.

Reference Books:

1. Ries, Eric. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, 1st Edition-2011, Crown Business, 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: 9781591847847

MOOC/NPTEL/YouTube Links:

e-sources:

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

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	७
२.	**प्रसारमाध्यमांसाठी लेखन** वृत्तपत्रासाठी बातमीलेखन आणि मुद्रितसंपादन नभोवाणीासाठी भाषणाची संहितालेखन दूरचित्रवाणीासाठी माहितीपटासाठी संहितालेखन	७
३.	भाषा, जीवन व्यवहार आणि नवमाध्यमे, सामाजिक माध्यमे नवमाध्यमे आणि समाजमाध्यमांचे प्रकार : ब्लॉग, फेसबुक, ट्विटर नवमाध्यमे आणि समाजमाध्यमांविषयक साक्षरता, दक्षता, वापर आणि परिणाम	७
४.	वेबसाइट आणि ब्लॉग, ट्विटरासाठी लेखन व्यावसायिक पत्रव्यवहार	७
	Total	२८

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

Course Contents	
Sl. No.	**Suggested List of Experiments/Assignments**
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