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. Information Technology (2025 Pattern)

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 INFORMATION TECHNOLOGY

To be a distinguished and competent education provider in the field of Information Technology by nurturing technically proficient, ethically responsible and socially aware professionals

MISSION OF INFORMATION TECHNOLOGY

- Imparting technical knowledge and practical skills in Information Technology to prepare students for successful careers in industry, academia and entrepreneurship.
- Fostering ethical values, professional responsibility, and effective Communication in students to help them become responsible IT professionals.
- Encouraging innovation, research, and problem-solving abilities through industry-relevant projects, internships and collaborative learning.
- Cultivating awareness of societal needs and sustainability, promoting the development of socially responsible and globally competent graduates.

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. (Information Technology)

Semester – III

Level 5.0																		
Second Year B. Tech. Information Technology																		
Semester III																		
Sl. No.	**Course Code**	**Course Type**	**Course Name**	**Credit Scheme**			**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	IT25PCC-201	Programme Core Course	Basics of Computer Networking	2			2			**25**	**25**	**50**				100		
2	IT25PCC-202	Programme Core Course	Data Structures	2			2			**25**	**25**	**50**				100		
3	IT25PCC-203	Programme Core Course	Data Structures Lab			2			4				**50**		**25**	75		
4	IT25PCC-204	Programme Core Course	Object Oriented Programming and Visual Computing	2			2			**25**	**25**	**50**				100		
5	IT25PCC-205	Programme Core Course	Object Oriented Programming and Visual Computing LAB			2			4				**50**		**25**	75		
6	IT25MDM-206	Multi-disciplinary Minor Course	Digital Electronics & Logic Design	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	IT25VSE-209	Vocational & Skill Enhancement Course	Vocational & Skill Enhancement Course -I			2			4					**25**	**25**	50		
10	IL25EMC-210	Entrepreneurship / Management Course	Principles of Management & 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 Examination**, ESE**- End Semester Examination, **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-208-A	Professional Ethics for Engineers	
ETC25VEC-208-B	Social Connect and Responsibility	

Basket: List of Courses - Vocational & Skill Enhancement Course-I

Course Code	Course Name	
IT25VSE-209-A	System Programming	Choose Any One
IT25VSE-209-B	Computing in Python	
IT25VSE-209-C	Fundamentals of Analytics	

CURRICULUM STRUCTURE:

Second Year B. Tech. (Information Technology)
Semester – IV

Level 5.0																	
Second Year B. Tech. Information Technology																	
Semester IV																	
Sl. No.	**Course Code**	**Course Type**	**Course Name**	**Credit Scheme**			**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	IT25PCC-251	Programme Core Course	Data Science Foundations	2			2			**25**	**25**	**50**				100	
2	IT25PCC-252	Programme Core Course	Database Management System	2			2			**25**	**25**	**50**				100	
3	IT25PCC-253	Programme Core Course	Database Management System Lab			2			4				**50**		**25**	75	
4	IT25PCC-254	Programme Core Course	Data Structures and Algorithms	2			2			**25**	**25**	**50**				100	
5	IT25PCC-255	Programme Core Course	Data Structures and Algorithms Lab			2			4				**25**		**25**	50	
6	IT25MDM-256	Multi-disciplinary Minor Course	Processor Architecture	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	IT25ELC-259	Experiential Learning Course	Community Engagement Project			2			4					**50**		50	
10	IL25EMC-260	Entrepreneurship / Management Course	Entrepreneurship Skill Development		1	1		1	2						**25**	25	
11	IL25AEC-261	Ability Enhancement Course	Modern Indian Languages (Marathi/Hindi)	1		1	1		2						**25**		
Total				12	2	8	12	2	16	**125**	**125**	**250**	**75**	**50**	**125**	**750**	
				22			**30**										

CCE- Comprehensive Continuous Examination**, ESE**- End Semester Examination, **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 (Information Technology)			Semester : III			
Course	Basics of Computer Networks			Code:	IT25PCC-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: Knowledge of basic computer fundamentals**,** Familiarity with operating systems and hardware concepts**,** Basic understanding of binary number systems and digital communication

Course Objectives:

1. To outline the fundamental concepts and terminology of computer networks.
2. To study various network architectures, protocols, and layered models.
3. To explore data transmission techniques and error handling mechanisms.
4. To analyze switching, routing, and congestion control in computer networks.

Course Outcomes:

CO1: Describe the basic concepts of computer networks, topologies, and reference models.

CO2: Explain various transmission media, switching, and multiplexing techniques.

CO3: Analyze and compare error detection, correction, and flow control techniques.

CO4: Explain routing algorithms, congestion control, and transport layer protocols.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Computer Networks and Reference Models** Introduction to Computer Networks: Goals, applications, network hardware and software; Topologies: bus, ring, star, mesh, hybrid; types of networks: LAN, MAN, WAN, Internet; Network architecture: layered structure, OSI reference model, TCP/IP model, protocol stack comparison; Network devices: hub, switch, router, gateway, repeater, modem.	07
II	**Physical and Data Link Layer** Transmission media: guided (twisted pair, coaxial, fiber optic) and unguided (radio, microwave, satellite); Data transmission concepts: analog vs digital, bandwidth, throughput, bit rate; Encoding methods: NRZ, Manchester, Differential Manchester; multiplexing (TDM, FDM, WDM); Data link layer design issues, framing, error detection and correction (parity, CRC, Hamming code), flow control (stop-and-wait, sliding window).	08
III	**Network Layer** Network layer design goals; services provided; switching techniques – circuit, packet, and message switching; Routing algorithms – shortest path (Dijkstra), distance vector, link state, hierarchical routing; Congestion control algorithms; internetworking, IP addressing (IPv4/IPv6), sub-netting, fragmentation; ARP, RARP, ICMP protocols.	07
IV	**Transport and Application Layer** Transport layer: services, multiplexing and demultiplexing, UDP and TCP protocols, flow and error control, congestion control (TCP congestion control); Application layer: client-server model, DNS, HTTP, SMTP, FTP, DHCP; introduction to network security – cryptography basics, authentication, firewalls, SSL.	08

	Total	30

Text Books:

1. Computer Networks – Andrew S. Tanenbaum, David J. Wetherall, 5th Edition, Pearson Education.
2. Data Communications and Networking – Behrouz A. Forouzan, 5th Edition, McGraw Hill.
3. Computer Networking: A Top-Down Approach – James F. Kurose, Keith W. Ross, 7th Edition, Pearson.

Reference Books:

1. Networking All-in-One For Dummies – Doug Lowe, 7th Edition, Wiley.
2. Internetworking with TCP/IP (Volume 1) – Douglas E. Comer, 6th Edition, Pearson Education.
3. Communication Networks – Alberto Leon-Garcia, Indra Widjaja, 2nd Edition, McGraw Hill.

e-Books:

1. Computer Networks – Andrew S. Tanenbaum (Pearson eBook).
2. Data Communication and Networking – Forouzan (McGraw Hill eBook).
3. TCP/IP Illustrated – W. Richard Stevens (Addison Wesley).

MOOC / NPTEL/YouTube Links:

1. https://nptel.ac.in/courses/106/106/106106091/
2. https://nptel.ac.in/courses/106/102/106102064/
3. https://www.coursera.org/learn/introduction-to-networks

Program	S. Y. B. Tech (Information Technology)			Semester: III			
Course	Data Structures			Code:		IT25PCC-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.
4. 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 Examination, 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 Examination; 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 (Information Technology)			Semester: III			
Course	Data Structures Laboratory			Code:	IT25PCC-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 Examination
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/Examination 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 Examination to test the students for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent Examination 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 Examination.
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 (Information Technology)			Semester : III			
Course	Object Oriented Programming and Visual Computing			Code:		IT25PCC-204	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
02	02	-	-	25	25	50	100

Pre-requisites: Basic programming knowledge (C / Python / Java), Fundamentals of mathematics and computer graphics, Understanding of algorithms and problem-solving

Course Objectives:

1. To introduce the principles, features, and need of Object-Oriented Programming.
2. To explain abstraction, encapsulation, inheritance, and polymorphism with implementation.
3. To provide core knowledge of visual computing, perception, and digital imaging.
4. To describe computer graphics basics, 2D/3D transformations, projections, and rendering concepts.

Course Outcomes:

CO1: Analyze OOP principles, program structure, and object-oriented design features.
CO2: Implement OOP-based applications using inheritance, polymorphism, abstraction, and exception handling.
CO3: Examine image formation, color models, sampling, quantization, and the visual computing workflow.
CO4: Apply and evaluate 2D/3D transformations, viewing pipeline, projections, shading, and rendering techniques.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Object-Oriented Programming** Procedural vs Object-Oriented Programming, Need and benefits of OOP, OOP features: Abstraction, Encapsulation, Inheritance, Polymorphism, Class and Object concepts, Constructors and Destructors, Dynamic binding, message passing, Overview of OOP in real-world applications	07
II	**OOP Concepts & Implementation** Access specifiers, Constructor types, Operator overloading, Function overloading & overriding, Inheritance types: Single, Multiple, Multilevel, Hierarchical, Hybrid, Polymorphism (compile-time & run-time), Virtual functions, Abstract classes & interfaces, Exception handling: try, catch, throw, File handling using OOP, Templates: class templates & function templates.	08
III	**Introduction to Visual Computing** Definition and scope of Visual Computing, Human visual perception overview, Image formation model, Digital image representation, Image acquisition, Sampling & quantization, Color models: RGB, HSV, CMYK Basic image operations: Filtering, Thresholding, Edge detection, Applications of visual computing (AI, CV, AR/VR)	07
IV	**Computer Graphics Essentials** Overview of computer graphics, Coordinate systems, 2D transformations: Translation, Rotation, Scaling, Reflection 3D transformations, Viewing pipeline, Orthographic & perspective projections, Window to viewport transformation, Clipping algorithms (Cohen–Sutherland), Shading models (Flat, Gouraud, Phong), Rendering concepts & visibility determination	08
	Total	30

Text Books

1. E. Balagurusamy – Object-Oriented Programming with C++, 8th Edition, McGraw Hill Education.
2. Rafael C. Gonzalez, Richard E. Woods – Digital Image Processing, 4th Edition, Pearson Education.
3. Donald Hearn, M. Pauline Baker – Computer Graphics (C Version), 2nd Edition, Pearson Education.

Reference Books

1. Herbert Schildt – C++: The Complete Reference, 4th Edition, McGraw Hill Education.
2. Richard Szeliski – Computer Vision: Algorithms and Applications, 2nd Edition, Springer.
3. James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes – Computer Graphics: Principles and Practice, 3rd Edition, Addison-Wesley.

E-Sources / Online Materials

1. https://www.academia.edu/43652845/Object_Oriented_Programming_with_Cpp_by_E_Balagurusamy
2. https://archive.org/details/c-the-complete-reference-herbert-schildt
3. https://archive.org/details/digital-image-processing-3rd-ed-gonzalez-woods
4. https://archive.org/details/computer-graphics-c-version-donald-hearn-m.-pauline-baker

MOOC / NPTEL / YouTube Links

1. https://nptel.ac.in/courses/106105151
2. https://nptel.ac.in/courses/106101155
3. https://nptel.ac.in/courses/117105079

Program	S. Y. B. Tech (Information Technology)			Semester : III			
Course	Object Oriented Programming and Visual Computing LAB			Code	IT25PCC-205		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	50	-	25	75

Pre-requisites: Basic knowledge of C/Python programming, Understanding of algorithms and data structures, Familiarity with basic mathematics and graphics

Course Objectives:

1. To provide hands-on exposure to Object-Oriented Programming concepts using C++/Java/Python.
2. To demonstrate abstraction, encapsulation, inheritance, and polymorphism through practical implementation.
3. To introduce core elements of visual computing, including transformations, 2D–3D graphics, and rendering techniques.
4. To apply graphical algorithms and OOP design principles to develop basic animations, image processing tasks, and graphical simulations.

Course Outcomes:

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

CO1: Implement OOP principles—including inheritance, polymorphism, and exception handling using an object-oriented programming language.

CO2: Design and develop graphical applications using visual computing concepts.

CO3: Implement 2D/3D transformations and essential graphical algorithms for rendering and interaction.

CO4: Develop interactive and animation-based applications by integrating OOP concepts with visual computing techniques.

Lab Guidelines:

1. Programs should be written using clean indentation, comments, and proper use of OOP principles such as classes, objects, inheritance, and polymorphism.
2. Only approved languages and tools (C++/Java/Python with OpenGL, Pygame, OpenCV, or graphics.h) should be used as per experiment requirements.
3. Each student must execute programs individually and demonstrate understanding of OOP concepts during implementation.
4. Experiments involving visual computing must properly initialize graphics windows and use correct graphical functions or APIs.
5. All transformation programs must apply the correct mathematical formulas for translation, rotation, scaling, reflection, and shearing.
6. Students must document each experiment in the lab journal, including code, output screenshots, observations, and conclusions.
7. Image processing experiments must use appropriate libraries and show correct results such as grayscale, thresholding, or blurring.
8. Softcopy of all programs, including graphics outputs and mini-project files, must be maintained in an organized folder.
9. Students must ensure originality of code, avoid plagiarism, and follow proper discipline and safety procedures during lab sessions and practical exams.

Course Contents	
Sl. No.	**Suggested List of Experiments/Assignments**
1	**Basic OOP Implementation** **Aim:** To implement classes, objects, constructors, destructors, and dynamic memory allocation in C++/Java/Python.
2	**Inheritance & Polymorphism** **Aim:** To demonstrate single, multilevel, and hierarchical inheritance and runtime polymorphism using virtual functions or method overriding.
3	**Exception Handling & File Handling** **Aim:** To implement programs that use exception handling and file operations for data storage and retrieval.
4	**OOP Design Patterns (Basic)** **Aim:** To implement Factory, Singleton, and Strategy patterns using OOP principles.
5	**Introduction to Visual Computing & Graphics Programming** **Aim:** To initialize graphics windows and draw basic shapes (line, circle, rectangle) using libraries like OpenGL / Pygame / OpenCV / graphics.h. 2D Transformations **Aim:** To apply 2D geometric transformations (translation, rotation, scaling, and reflection, shearing) on objects using matrix multiplication.
6	**2D Transformations** **Aim:** To apply 2D geometric transformations (translation, rotation, scaling, and reflection, shearing) on objects using matrix multiplication.
7	**3D Transformations** **Aim:** To implement 3D transformations (rotation, scaling, and translation) and visualize transformed objects.
8	**Line Drawing & Clipping Algorithms** **Aim:** To implement Bresenham's line drawing algorithm and Cohen–Sutherland line clipping algorithm for graphical applications.
9	**Image Processing Basics** **Aim:** To perform simple image operations such as grayscale conversion, thresholding, blurring using OpenCV or equivalent library.
10	**Mini Project – OOP + Visual Computing Application** **Aim:** To design a small application such as: • Animation of moving objects • 2D/3D interactive graphics demo • Simple game (Ping Pong/Snake/Flappy Bird) • Image filtering application • Shape drawing/transformations visualization Students must demonstrate: • OOP Concepts • Visual Computing Techniques • User Interaction / Graphics Rendering

Reference Books:

1. E. Balagurusamy – Object-Oriented Programming with C++, 8th Edition, McGraw Hill Education.
2. Donald Hearn, M. Pauline Baker – Computer Graphics with OpenGL, 4th Edition, Pearson Education.
3. Herbert Schildt – Java: The Complete Reference, 11th Edition, McGraw Hill Education

Tools / Technologies

1. Bjarne Stroustrup, The C++ Programming Language, Addison-Wesley.
2. Foley, van Dam, Feiner, Hughes, Computer Graphics: Principles and Practice, Addison-Wesley.
3. Mark Lutz, Learning Python, O'Reilly.
4. Adrian Kaehler & Gary Bradski, Learning OpenCV, O'Reilly.

Program	S. Y. B. Tech (Information Technology)			Semester : III			
Course	Digital Electronics & Logic Design			Code:		IT25MDM-206	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
02	02	-	-	25	25	50	100

Pre-requisites: Basic knowledge of electricity and circuits**,** including voltage, current, and resistance. Understanding of basic mathematics**,** including Boolean algebra fundamentals. Familiarity with number systems**,** such as decimal, binary, octal, and hexadecimal. Basic understanding of computer fundamentals**,** including how data is represented in digital form.

Course Objectives:

1. To explain basic digital concepts and number systems.
2. To design and analyze combinational logic circuits.
3. To design and implement sequential logic circuits.
4. To examine various digital logic families and their characteristics.

Course Outcomes:

CO1: Apply knowledge of number systems and Boolean algebra for simplification of logic expressions.
CO2**:** Design and analyze combinational circuits using various logic gates and minimization techniques.
CO3: Design, analyze, and implement sequential circuits using flip-flops and registers.
CO4**:** Compare characteristics of different logic families and apply them in circuit design.

Course Contents

Unit	Description	Duration [Hrs]
I	**Fundamentals of Digital Electronics** Number Systems: Binary, Octal, Decimal, Hexadecimal, Conversions. 1's and 2's Complement, Signed numbers, Binary arithmetic. Boolean Algebra: Postulates and Theorems, DeMorgan's Theorems. Logic Gates: AND, OR, NOT, NAND, NOR, XOR, XNOR. Canonical forms: SOP, POS. Karnaugh Map (K-Map)**:** 2, 3, 4 variable minimization, Don't care conditions.	08
II	**Combinational Logic Design** Combinational Circuit Design Steps. Design and Implementation of: Half Adder, Full Adder, Subtractor. Parallel Adder/Subtractor. Multiplexers, Demultiplexers. Encoders, Decoders. Code Converters (BCD to 7-Segment, Gray to Binary, etc.). Arithmetic Circuits: Binary Adder, Carry Look-Ahead Adder.	07
III	**Sequential Logic Design** Sequential Circuits: Basics, Clocking, Timing. Flip-Flops: SR, D, JK, T Flip-flops – truth tables, excitation tables, characteristic equations. Flip-flop conversions. Registers: SISO, SIPO, PISO, PIPO. Counters: Asynchronous (Ripple), Synchronous Counters, Up/Down Counters, Mod-n Counters. Applications of Registers and Counters.	08
IV	**Digital Logic Families & Programmable Devices** Logic Families: TTL, CMOS – Characteristics (Fan-in, Fan-out, Propagation Delay, Power Dissipation, Noise Margin, Speed, Voltage Levels). TTL NAND Gate operation, CMOS NAND Gate operation. Comparison between TTL and CMOS. Tri-state Logic, Interfacing TTL and CMOS. Programmable Logic Devices: PLA, PAL, ROM	07
	Total	30

Text Books

1. R. P. Jain – Modern Digital Electronics, 4th Edition, Tata McGraw Hill.
2. M. Morris Mano – Digital Design, 5th Edition, Pearson Education.
3. Anand Kumar – Switching Theory and Logic Design, 1st Edition, PHI Learning.

Reference Books

1. Thomas L. Floyd – Digital Fundamentals, 11th Edition, Pearson Education.
2. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss – Digital Systems: Principles and Applications, 11th Edition, Pearson.
3. Charles H. Roth Jr. – Fundamentals of Logic Design, 7th Edition, Cengage Learning.
4. William Fletcher – An Engineering Approach to Digital Design, 1st Edition, Prentice Hall.

E-Sources / Online Materials

- TutorialsPoint – Digital Electronics: https://www.tutorialspoint.com/digital_electronics
- All About Circuits: https://www.allaboutcircuits.com
- GeeksforGeeks – Digital Logic: https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/

MOOC / NPTEL / YouTube Links

1. https://nptel.ac.in/courses/117/105/117105135
2. https://nptel.ac.in/courses/108/102/108102112
3. https://www.edx.org/course/digital-circuit-design

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

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

Course Objectives: 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 learn conceptual clarity and knowledge of Statistical methods and probability.
4. To apply Numerical techniques to approximate solutions for interpolation, integration, and ordinary differential equations.
5. To analyze 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 Statistical methods, such as correlation and regression, to analyze and interpret Experimental data relevant to reliability engineering and probability theory in testing and quality control.
CO4: Obtain Interpolating polynomials, numerically differentiate and integrate functions, and numerically solve differential equations using single-step and multi-step iterative methods in modern scientific computing.
CO5: Apply transforms to engineering systems related to signals, circuits, and control applications.

Course Contents

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

	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.	
V	**Fourier and Z-Transforms** **Fourier Transform:** Introduction to time-domain and frequency-domain representation of signals. Complex exponential form of Fourier series. Fourier integral representation. Fourier Transform and inverse Fourier Transform. Properties of Fourier Transform such as linearity, time shifting, frequency shifting, and scaling. Fourier sine and cosine transforms with inverses. **Z-Transform:** Discrete-time signals and systems. Definition of Z-transform and region of convergence (ROC). Z-transform of basic sequences. Properties of Z-transform. Inverse Z-transform using standard pairs and partial fraction method. **Applications of Z-Transform:** Application of Z-transform in solving linear difference equations, analysis of discrete-time systems, stability analysis, and modeling of simple digital filters., Fourier sine and cosine transforms and their inverses.	**9**
	Total	**45**

Text Books:

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

Reference Books:

1. Kenney, J. F. and Rosen, K. H., Discrete Mathematics, 1st Edition, McGraw-Hill Education, 2012. ISBN: 978-0-07-338309-5
2. Biggs, N. L., Discrete Mathematics, 2nd Edition, Oxford University Press, 2003.ISBN: 978-0-19-850717-8
3. Graham, R. L., Knuth, D. E. and Patashnik, O., Concrete Mathematics: A Foundation for Computer Science, 2nd Edition, Addison-Wesley, 1994. ISBN: 978-0-201-55802-9
4. Deo, N., Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall of India, 1974. ISBN: 978-0-13-363473-0
5. Epp, S. S., Discrete Mathematics with Applications, 4th Edition, Cengage Learning, 2011. ISBN: 978-0-495-39132-6
6. Kreyszig, E., Advanced Engineering Mathematics, Wiley Eastern Ltd., New Delhi (Indian Edition), 1999 (Reprinted). ISBN: 978-81-224-0883-6
7. Jain, M. K., Iyengar, S. R. K. and Jain, R. K., Numerical Methods for Scientific and Engineering Computation, 7th Edition, Khanna Publishers, 2013. ISBN: 978-81-7409-205-9

e-sources:

1. https://onlinecourses.nptel.ac.in/noc20_cs82/preview
2. 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.	8

	Case Studies (Select any one): Call center arrival modelling using Poisson distribution, defect detection in manufacturing using binomial distribution, waiting time analysis using exponential distribution, sensor reading variations modeled using normal distribution.	
III	**Hypothesis Testing** Parameter and statistic, null hypothesis, alternative hypothesis, Type I error, Type II error, significance level, p-value, power of a test, large sample tests (mean, difference of means, proportion, difference of proportions), small sample tests (t-test for mean, t-test for difference of means), chi-square test, F-test for variances, hypothesis testing for real-world decision making. **Case Studies (Select any one):** A/B testing for e-commerce click-through rate improvement, medical data testing for treatment effectiveness, comparison of accuracy between two ML models, evaluating impact of teaching method using student score data.	**10**
IV	**Estimation – Point, Interval & MLE** Point estimation, interval estimation, confidence intervals for mean, confidence intervals for proportion, confidence intervals for binomial, Poisson and normal parameters, properties of estimators (unbiasedness, consistency, efficiency), Maximum Likelihood Estimation, MLE for binomial parameters, MLE for Poisson parameters, MLE for exponential distribution, MLE for normal distribution parameters. **Case Studies (Select any one):** MLE-based click-through rate estimation, estimation of failure rate of electronic components using exponential distribution, estimation of customer arrival rate in retail using Poisson distribution, confidence interval estimation for OTT movie rating averages.	**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, Simpson's 1/3 Rule, Simpson's 3/8 Rule, Error analysis for numerical differentiation & integration.	9
IV	**Probability & Statistical Distributions** Basic Probability Theory, Bayes' Theorem, Random Variables, Discrete & Continuous Probability Distributions: Binomial Distribution, Poisson Distribution, Normal Distribution, Moments, Skewness & Kurtosis.	9

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

Pre-requisites: 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; Examination 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	9

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

Text Books:

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

Reference Books:

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

Pre-requisites: 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; Examination 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 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)			Semester : III			
Course	Universal Human Values			Code		CSE25VEC-208	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	-	2	1	-	-	25	25

Pre-requisites: Prior Knowledge of Social Values, Communication

Course Objectives: The course aims to:

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

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

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

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

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

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

Course Contents

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

	Total	**15**
The subject instructor supposed conduct the activities based on the topic covered during the tutorial sessions. The few activities should be individual or in group. The students supposed to submit the properly written documents.		
The list of suggested activities during Practical Sessions		
1	Introduce yourself in detail. What are your life goals? How do you make goals for your life? How do you distinguish between right and wrong? What are your major accomplishments and faults in life? Observe and study them	
2	Man-made issues such as energy and material resource depletion, pollution, global warming, ozone depletion, deforestation, and soil degradation pose a threat to the survival of life on Earth. What is the source of these ailments and what is the solution, in your opinion?	
3	There is rapidly growing danger due to nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression, and suicidal attempts. What do you think is the root cause of these threats to human happiness and peace? What is the solution in your opinion?	
4	Our "Natural Acceptance" ability allows us to choose what is right or wrong for ourselves. We are not educated to listen to our "Natural Acceptance," which can be confused by perceptual biases and sensory stimuli. Explore the following: (i) What is your natural level of respect for yourself and others? (ii) What is "naturally acceptable" to you: nurturing or exploiting others? Is your lifestyle consistent with your natural acceptance or divergent from it?	
5	Share a personal experience when you demonstrated deliberate devotion to values in a challenging scenario	
6	Identify any two major problems confronting society now and investigate the underlying causes. Can these be handled based on natural acceptance of human values? If so, how should one move in this approach given the current situation?	
7	Having awareness about nature, its four orders and their mutual fulfillment. Activities to be performed- written assignment, chart making.	
8	List down all your desires, Observe whether the desire is related to Self (I) or Body. If it appears to be related to both, see which part of it is related to Self (I) and which part is related to Body.	
9	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 Examination) and on how many occasions you are disrespecting by way of under- Examination, over-Examination or otherwise Examination.	

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

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

MOOC / NPTEL Links:

NPTEL:

1. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
2. https://nptel.ac.in/courses/109104068

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

Pre-requisites: Basic understanding of business management.

Course Objectives:

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

Course Outcomes:

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. 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** Ethics and sustainable engineering- Computer ethics- Analysing ethical problems in research- Ethics in collaborative research- Engineers as expert consultants and advisors- Corporate Social Responsibility (CSR).	4
	Total	**15**

Text Books:

1. Naagarazan, R.S. , "Professional Ethics and Human Values " New age International
2. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall

Reference Books:

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

e-sources:

MOOC / NPTEL/YouTube Links:

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

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	PR	OR	TW	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 as either 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**	3

	Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices.	
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 Experiments/Assignments**
1	**Tree Plantation & Adoption Activity** Students will plant a sapling on campus or a designated location and adopt it for four years. They must record initial environmental conditions, plant type, and growth indicators.
2	**Documentary/Photo Blog on Adopted Plant** Each group will prepare a short documentary or a photo blog about the adopted tree covering: • Plant origin • Botanical features • Usage in daily life Cultural, folklore, and literary significance
3	**Heritage Walk Documentation** Students will participate in a heritage walk within the city to study historical sites, traditional architecture, and community spaces. They will document observations with photographs and short descriptions.
4	**Crafts Corner Study & Documentation** Visit a local crafts workshop (e.g., pottery, weaving, metalwork) to interact with craftsmen and understand techniques, tools, and cultural relevance. Prepare a photo blog or documentary on evolution and practice of the craft.
5	**Organic Farming Exposure Visit** Students will visit an organic farm or agricultural field to learn about: • Organic farming techniques • Soil preparation • Bio fertilizers • Crop rotation • Pest control methods A reflective report will be prepared based on observations.
6	**Wet Waste & Compost Management Practical** Study wet waste collection, segregation, and composting processes in nearby villages or campus. Students will carry out small-scale composting using daily biodegradable waste.
7	**Water Conservation Practices Survey** Survey nearby villages/campus to document traditional and modern water conservation practices such as: • Rainwater harvesting • Check dams

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

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 (Information Technology)				Semester : III		
Course	System Programming				Code	IT25VSE-209-A	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	-	25	25	50

Pre-requisites: Basic knowledge of C/C++ programming. Understanding of computer architecture and operating systems. Familiarity with compilers, assemblers, and linkers.

Course Objectives:

1. To explain the design and implementation of system software such as assemblers, loaders, linkers, and macro processors.
2. To develop skills for writing system-level programs in Linux.
3. To gain hands-on experience in process management, memory management, and file handling.
4. To describe lexical analysis, parsing, and code generation phases of compilers.

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

CO1: Write and execute system-level programs in Linux using C.
CO2: Demonstrate the working of assemblers, linkers, loaders, and macro processors.
CO3: Implement compiler components such as lexical analyzers and parsers.
CO4: Develop tools using process handling, memory management, and file operations in UNIX/Linux.

Lab Guidelines

1. All experiments must be executed in Linux / Ubuntu environment.
2. Use gcc or g++ for compiling system-level programs.
3. Programs must use system calls**,** not standard library calls unless specified.
4. Maintain a proper Laboratory Journal with Aim, Algorithm, Code, Output, and Conclusion.
5. Mini-project should demonstrate integration of at least two system-programming concepts.
6. Viva will be conducted based on experiments and system programming theory.
7. Plagiarism is strictly prohibited

Course Contents

Sl. No.	Suggested List of Experiments/Assignments
1	**Basic Linux Commands & Shell Environment** Explore file handling, process commands, permissions, redirection, pipes, grep, awk, sed.
2	**System Calls in Linux** Write C programs for fork(), exec(), wait(), exit(), getpid(), pipe(), open(), read(), write(), etc.
3	**File Handling Using C System Calls** Create, read, write, append, copy file contents using system calls (not stdio).
4	**Process Management** Implement parent–child processes, orphan process, zombie process demonstration.
5	**Implementation of Lexical Analyzer** Write a program to tokenize input source code (keywords, identifiers, operators, constants). Use C / Python.

6	**Implementation of Recursive Descent Parser** Given a grammar, build a parser to validate input strings.
7	**Macro Processor Implementation** Design a simple macro processor supporting macro definition & expansion.
8	**Two-Pass Assembler Simulation** Simulate Pass-1 & Pass-2: symbol table, literals table, intermediate code, object code.
9	**Linker & Loader Simulation** Write a program to simulate linking and loading of object modules.
10	**Regular Expression Engine (Mini-Lex Tool)** Implement pattern matching using finite automata techniques.
11	**Mini Project (Compulsory)** Build a small system tool such as: Simple compiler front end Shell command simulator Memory allocation simulator Basic text editor using system calls Mini-lex/mini-yacc tool

Reference:

1. D. M. Dhamdhere – Systems Programming and Operating Systems, 2nd Edition, McGraw-Hill Education.
2. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman – Compilers: Principles, Techniques, and Tools, 2nd Edition, Pearson Education.
3. John R. Levine – Lex & Yacc, 2nd Edition, O'Reilly Media.
4. Leland L. Beck – System Software: An Introduction to Systems Programming, 3rd Edition, Addison-Wesley.
5. Brian W. Kernighan, Dennis M. Ritchie – The C Programming Language (ANSI C), 2nd Edition, Prentice Hall.
6. William Stallings – Operating Systems: Internals and Design Principles, 9th Edition, Pearson Education.

Program	S. Y. B. Tech (Information Technology)				Semester : III		
Course	Computing with Python				Code		IT25VSE-209-B
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 Problem-solving technique

Course Objectives:

1. To build strong foundations in Python programming.
2. To develop problem-solving and logical thinking using Python constructs.
3. To write modular programs using functions and data structures.
4. To apply Python for basic data handling and computation tasks.

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

CO1: Use Python syntax to write simple and structured programs.
CO2: Apply decision-making and loop constructs to solve problems.
CO3: Use Python data types — strings, lists, tuples, and dictionaries.
CO4: Write modular code using functions and file operations.

Laboratory Guidelines

To ensure quality and discipline in lab work, students must follow:

1. Write Python programs with proper indentation and comments.
2. Use descriptive variable names.
3. Write programs following this format:
   Aim → Algorithm → Program → Output → Conclusion
4. Maintain a practical journal and a softcopy folder.
5. Each student must execute programs individually.

Course Contents

Sl. No.	Suggested List of Experiments/Assignments
1	Introduction to Python • Installing Python • Using IDLE / VS Code • Running Python scripts • Basic input/output
2	Variables and Data Types • Numbers, strings, booleans • Type conversion • Basic operations
3	Conditional Statements • if, elif, else • Nested conditions • Simple decision-making applications
4	Loops • for loop • while loop • Loop control (break, continue)

5	Functions • Built-in functions • User-defined functions • Function arguments and return values
6	Strings • String operations • Slicing, searching, formatting • String functions
7	Lists and Tuples • Indexing • Appending, inserting, deleting • Traversing lists
8	Dictionaries and Sets • Key–value operations • Adding and removing elements • Practical applications
9	File Handling • Reading and writing files • Working with text files • Exception handling basics
10	Mini Project – Python Application Examples: • Calculator • Student database • Text analyzer • Billing system • Simple data processor

Reference Material

1. Computing with Python – University Style Lab Manual.
2. Reema Thareja – Python Programming, 1st Edition, Oxford University Press.
3. Charles Severance – Python for Everybody: Exploring Data Using Python 3, 1st Edition, Pearson Education.
4. Eric Matthes – Python Crash Course, 2nd Edition, No Starch Press.

Program	S. Y. B. Tech (Information Technology)			Semester : III			
Course	Fundamentals of Analytics			Code	IT25VSE-209-C		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	-	25	25	50

Pre-requisites : Basic understanding of mathematics and statistics, Familiarity with Excel / Google Sheets, Basic programming knowledge (Python preferred), Understanding of datasets, data formats, and data storage, Basic knowledge of data visualization concepts

Course Objectives:

1. To introduce foundational concepts of data analytics and data-driven decision making.
2. To provide hands-on experience in data preprocessing, exploratory data analysis, and visualization.
3. To analyze trends, identify patterns, and derive insights from structured data.
4. To apply analytical techniques using Excel and Python libraries.

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

CO1: Apply basic data preprocessing and statistical techniques.
CO2: Perform exploratory data analysis (EDA) to identify key patterns and insights.
CO3: Analyze datasets using descriptive and inferential analytics.
CO4: Visualize and present analytical findings using Python, Excel, and dashboards.

Lab Guidelines

1. Maintain a detailed lab journal for each experiment.
2. Use real-world datasets (Kaggle, UCI ML Repository, Government portals).
3. Ensure proper labeling and documentation for plots, tables, and dashboards.
4. Use Python (Pandas/Matplotlib/Seaborn/Scikit-Learn) along with Excel.
5. Interpret results clearly and connect analytics outcomes with decision-making.
6. Mini-project must involve end-to-end data analytics.
7. Plagiarism is prohibited; each student must prepare original analysis.

Course Contents

Sl. No.	Suggested List of Experiments/Assignments
1	**Introduction to Analytics Tools** Explore Excel, Google Sheets, Anaconda, Jupyter Notebook, and basic Python libraries (NumPy, Pandas).
2	**Data Importing and Cleaning** Load CSV/Excel datasets. Clean missing values, remove duplicates, and correct inconsistent data.
3	**Descriptive Statistics using Excel/Python** Calculate mean, median, mode, variance, SD, skewness, kurtosis using functions and Pandas.
4	**Exploratory Data Analysis (EDA)** Plot histograms, bar plots, box plots. Identify trends, outliers, and correlations.
5	**Data Visualization Techniques** Create dashboards using Excel Pivot Tables, Charts, and conditional formatting.
6	**Correlation and Covariance Analysis** Analyze relationships between variables using heatmaps and correlation metrics.

7	**Hypothesis Testing** Apply t-test, z-test, chi-square test using Python/Excel's built-in tools.
8	**Trend & Forecasting Analysis** Use moving averages, exponential smoothing, or Excel forecasting functions.
9	**Basic Predictive Analytics (Regression)** Perform simple linear regression using Python (scikit-learn) or Excel Data Analysis Toolpak.
10	**Cluster Analysis (Introductory)** Apply K-Means clustering on a small dataset and interpret clusters.
11	Time Series Plotting Load a time series dataset and plot trends, seasonality, and patterns.
12	**Mini Project – Insight Report** **Description:** Perform complete analysis on any selected dataset: Data cleaning, Descriptive analytics, EDA, Visualization, Final insights. Present findings in a structured report or dashboard.

Reference:

1. Foster Provost, Tom Fawcett – Data Science for Business, 2nd Edition, O'Reilly Media.
2. Wes McKinney – Python for Data Analysis, 2nd Edition, O'Reilly Media.
3. David J. Hand, Heikki Mannila, Padhraic Smyth – Principles of Data Mining, 1st Edition, MIT Press.
4. Anil Maheshwari – Data Analytics Made Accessible, 1st Edition, McGraw Hill Education.
5. John W. Foreman – Data Smart: Using Data Science to Transform Information into Insight, 1st Edition, Wiley.

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	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 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** 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	3

	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 (Information Technology)			Semester : IV			
Course	Data Science Foundations			Code:		IT25PCC-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: Knowledge of basic statistics and mathematics, Fundamentals of programming using Python, Understanding of data structures and algorithms.

Course Objectives:

1. To explain the basic concepts, process, and lifecycle of Data Science.
2. To explore and prepare data for analysis and visualization.
3. To apply statistical methods for data analysis.
4. To study supervised and unsupervised learning techniques for predictive analytics.

Course Outcomes:

CO1: Describe the data science process, data types, and challenges in real-world data.

CO2: Apply data preprocessing and visualization techniques using Python libraries.

CO3: Perform exploratory data analysis using descriptive and inferential statistics.

CO4: Implement basic machine learning models for classification and clustering tasks.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Data Science and Data Handling** Introduction to Data Science: Definition, importance, lifecycle; Data types: structured, unstructured, semi-structured; Role of Data Scientist, Data Engineer, and Data Analyst; Overview of Python for Data Science – libraries like NumPy, Pandas, Matplotlib; Data acquisition, loading, cleaning, and storage; working with CSV, JSON, Excel files.	07
II	**Data Preprocessing and Visualization** Data preprocessing: handling missing values, data transformation, encoding categorical variables, feature scaling; Exploratory Data Analysis (EDA); data visualization using Matplotlib and Seaborn – bar charts, histograms, scatter plots, heatmaps; Descriptive statistics – mean, median, mode, variance, standard deviation; Case study: visualization of real-world datasets.	08
III	**Probability, Statistics and Data Analytics** Introduction to probability theory – events, random variables, probability distributions (binomial, normal); Inferential statistics – hypothesis testing, confidence intervals, p-values, correlation and regression analysis; Sampling techniques, ANOVA; Feature selection using correlation and statistical significance.	07
IV	**Introduction to Machine Learning** Introduction to Machine Learning: supervised vs. unsupervised learning; Supervised learning algorithms – linear regression, logistic regression, decision trees, k-NN; Unsupervised learning – k-means clustering, hierarchical clustering; Model Examination – confusion matrix, accuracy, precision, recall, F1-score; Introduction to scikit-learn; practical examples using datasets.	08
	Total	30

Text Books:

1. Introduction to Data Science – Laura Igual, Santi Seguí, 1st Edition, Springer.
2. Python for Data Analysis – Wes McKinney, 2nd Edition, O'Reilly Media.
3. Practical Statistics for Data Scientists – Peter Bruce, Andrew Bruce, 2nd Edition, O'Reilly Media.

Reference Books:

1. Data Science from Scratch – Joel Grus, 2nd Edition, O'Reilly Media.
2. Hands-On Machine Learning with Scikit-Learn and TensorFlow – Aurélien Géron, 2nd Edition, O'Reilly Media.
3. Data Mining: Concepts and Techniques – Jiawei Han, Micheline Kamber, Jian Pei, 3rd Edition, Morgan Kaufmann.

e-Books:

1. Introduction to Data Science – Free eBook, Springer Open.
2. Python for Data Analysis – O'Reilly Online Library.
3. Statistics for Data Science – Packt Publishing eBook.

MOOC / NPTEL/YouTube Links:

1. https://nptel.ac.in/courses/106/106/106106179/
2. https://nptel.ac.in/courses/106/105/106105189/
3. https://www.coursera.org/specializations/data-science-python

Program	S. Y. B. Tech (Information Technology)			Semester : IV			
Course	Database Management System			Code:		IT25PCC-252	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Data Structures and Algorithms, Basic knowledge of Computer Organization, Fundamentals of Programming in C / Java / Python.

Course Objectives:

1. To explain the fundamental concepts of database management systems.
2. To study data models, conceptual design, and relational models.
3. To apply SQL for data definition, manipulation, and control.
4. To examine normalization, transaction management, and database recovery techniques.

Course Outcomes:

CO1: Explain database concepts, architecture, data models and ER modeling.

CO2: Apply relational algebra and SQL queries for data retrieval and manipulation.

CO3: Analyze and design normalized database schemas for real-world applications.

CO4: Describe transaction management, concurrency control, and recovery mechanisms in DBMS.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Database Systems & Data Models** Introduction to databases, file-based vs DBMS, advantages and applications; DBMS architecture, data independence, schemas and instances, data models – hierarchical, network, relational, object-oriented; database users and administrators; Entity-Relationship (ER) model, attributes, relationships, keys, ER diagram conventions, Extended ER (EER) features, mapping ER to relational schema..	07
II	**Relational Model and SQL** Relational model concepts: domains, tuples, relations, integrity constraints; Relational Algebra: select, project, union, intersection, difference, join, division, rename; Structured Query Language (SQL): DDL, DML, DCL commands; constraints, aggregate functions, joins, subqueries, views, indexes; introduction to PL/SQL – cursors, triggers, stored procedures.	08
III	**Database Design & Normalization** Functional dependencies, closure of attributes, keys, canonical cover; Normalization: 1NF, 2NF, 3NF, BCNF, 4NF; Decomposition – lossless join and dependency preservation; denormalization; case studies on database design.	07
IV	**Transaction Management, Concurrency Control & Recovery** Concept of transaction, ACID properties, transaction states; Concurrency control: serializability, conflict and view serializability; Lock-based, timestamp-based, and optimistic protocols; deadlocks; Recovery systems: log-based recovery, checkpoints; Introduction to storage and indexing – B-tree, B+ tree, hash indexing.	08
	Total	30

Text Books:

1. Fundamentals of Database Systems – Ramez Elmasri, Shamkant B. Navathe, 7th Edition, Pearson Education.
2. Database System Concepts – Abraham Silberschatz, Henry F. Korth, S. Sudarshan, 7th Edition, McGraw Hill Education.
3. Database Management Systems – Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw Hill Education.

Reference Books:

1. SQL, PL/SQL – The Programming Language of Oracle – Ivan Bayross, 4th Edition, BPB Publications.
2. Database Systems: Design, Implementation, and Management – Carlos Coronel, Steven Morris, 13th Edition, Cengage Learning.
3. Data Modeling and Database Design – Narayan S. Umanath, Richard W. Scamell, 1st Edition, Cengage Learning.

e-Books:

1. Database System Concepts – Open Access PDF (McGraw Hill)
2. Fundamentals of Database Systems – Pearson eBook Library
3. Introduction to SQL – w3schools.com / tutorialspoint.com

MOOC / NPTEL/YouTube Links:

1. https://nptel.ac.in/courses/106/106/106106093/
2. https://nptel.ac.in/courses/106/102/106102064/
3. https://www.udemy.com/topic/sql/
4. https://www.coursera.org/search?query=sql%20database

Program	S. Y. B. Tech (Information Technology)				Semester : IV		
Course	Database Management System Laboratory				Code	IT25PCC-253	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	50	-	25	75

Pre-requisites: Knowledge of Database Management System concepts, Basic knowledge of SQL and relational databases, Familiarity with ER modeling and normalization techniques

Course Objectives:

1. To demonstrate practical implementation of database concepts using SQL and PL/SQL.
2. To design, create, and manage databases using relational models.
3. To perform normalization and enforce integrity constraints for consistency.
4. To implement transactions, triggers, and stored procedures for database applications.

Course Outcomes:

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

CO1: Design and create relational databases using SQL DDL and DML commands.
CO2: Apply normalization techniques and integrity constraints for efficient database design.
CO3: Implement views, functions, and triggers using PL/SQL.
CO4: Demonstrate transaction management, concurrency control, and recovery concepts.

Guidelines for Laboratory Work:

1. Practical record/journal should include problem statement, code, output, and observations.
2. Mini-project work should demonstrate integration of SQL and PL/SQL concepts.

Course Contents

Sl. No.	Suggested List of Experiments/Assignments
1	Study of database commands: CREATE, ALTER, DROP, TRUNCATE, and basic DDL operations.
2	Implementation of DML commands: INSERT, UPDATE, DELETE, SELECT with WHERE clause.
3	Implementation of integrity constraints: PRIMARY KEY, FOREIGN KEY, UNIQUE, CHECK, and NOT NULL.
4	Study and implementation of SQL functions: aggregate, string, date, and conversion functions.
5	Implementation of JOIN operations and nested subqueries for multi-table data retrieval.
6	Design and implementation of ER diagram and its conversion into relational schema.
7	Implementation of normalization: 1NF, 2NF, 3NF, and BCNF for sample datasets.
8	Implementation of PL/SQL blocks: procedures, functions, and cursors.
9	Implementation of database triggers and exception handling in PL/SQL.
10	Mini Project: Design and develop a database application using SQL and PL/SQL concepts.

Reference Books:

1. Fundamentals of Database Systems – Ramez Elmasri, Shamkant B. Navathe, 7th Edition, Pearson Education.

2. Database System Concepts – Abraham Silberschatz, Henry F. Korth, S. Sudarshan, 7th Edition, McGraw Hill Education.
3. SQL, PL/SQL – The Programming Language of Oracle – Ivan Bayross, 4th Edition, BPB Publications.

Suggested Tools / Software:

1. Oracle / MySQL / PostgreSQL Database Systems
2. SQL Developer / DBeaver / MySQL Workbench
3. Any ER Diagram Tool (e.g., Draw.io, Lucidchart)

Program	S. Y. B. Tech (Information Technology)			Semester : IV			
Course	Data Structures and Algorithms			Code:		IT25PCC-254	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
02	02	-	-	25	25	50	100

Pre-requisites : Prior knowledge of C Programming / Python Programming

Course Objectives:

1. To explain basic digital concepts and number systems.
2. To design and analyze combinational logic circuits.
3. To design and implement sequential logic circuits.
4. To examine various digital logic families and their characteristics.

Course Outcomes:

CO1: Apply knowledge of number systems and Boolean algebra for simplification of logic expressions.
CO2: Design and analyze combinational circuits using various logic gates and minimization techniques.
CO3: Design, analyze, and implement sequential circuits using flip-flops and registers.
CO4: Compare characteristics of different logic families and apply them in circuit design.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Data Structures and Complexity Analysis** Introduction to data structures: Definition, types, operations. Algorithm analysis: Time and space complexity, Big-O, Big-Theta, Big-Omega. Recursion: Basics, recursion tree, examples. Arrays: Representation, operations, applications. Strings: Representation, operations	08
II	**Linear Data Structures** Linked Lists: Singly, doubly, circular. Stack: Implementation using arrays and linked lists, applications (expression Examination, parentheses matching). Queue: Linear, circular, priority queue, dequeue. Operations: Insertion, deletion, traversal, searching	07
III	**Non-Linear Data Structures** Trees: Binary tree, binary search tree, tree traversal (inorder, preorder, postorder). Graphs: Representation (adjacency matrix, adjacency list), basic graph terminology. Operations: Insertion, deletion, traversal (DFS, BFS). Applications of trees and graphs	08
IV	**Algorithms** Searching: Linear search, binary search. Sorting: Bubble, selection, insertion, merge, quick sort. Hashing: Hash tables, collision resolution (chaining, open addressing). Basic algorithm design techniques: Greedy, divide and conquer, dynamic programming	07
	Total	30

Text Books:

1. Data Structures and Algorithms in C – Adam Drozdek, 2nd Edition, Cengage Learning.
2. Data Structures Using C – Reema Thareja, 2nd Edition, Oxford University Press.
3. Introduction to Algorithms – Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3rd Edition, MIT Press.

Reference Books:

1. Data Structures and Algorithm Analysis in C – Mark Allen Weiss, 2nd Edition, Pearson Education.
2. Fundamentals of Data Structures in C – Ellis Horowitz, Sartaj Sahni, 1st Edition, Galgotia Publications.
3. Algorithms in C – Robert Sedgewick, 3rd Edition, Addison-Wesley.

MOOC / NPTEL / SWAYAM Courses

1. https://nptel.ac.in/courses/106/102/106102064/
2. https://nptel.ac.in/courses/106/102/106102132/
3. https://nptel.ac.in/courses/106/106/106106131/

Program	S. Y. B. Tech (Information Technology)				Semester : III		
Course	Data Structures and Algorithms Lab				Code	IT25PCC-255	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	50	-	25	75

Pre-requisites: Basics of Computer Programming**,** Basics of Mathematics**.**

Course Objectives:

1. To implement fundamental data structures and their operations.
2. To enhance problem solving skills using C/C++ or Python.
3. To develop ability to analyze algorithms through hands-on practice.
4. To build confidence in applying DSA concepts to mini projects.

Course Outcomes:

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

CO1: Implement linear and non-linear data structures using programming languages.
CO2: Apply appropriate data structure techniques to solve computational problems.
CO3: Analyze the time and space complexity of implemented algorithms.
CO4: Develop mini projects applying suitable data structures and algorithmic strategies.

Lab Guidelines:

1. Students must come prepared with the aim, algorithm, and theoretical background of each DSA experiment before entering the lab.
2. All programs should be written using proper indentation, meaningful variable names, and modular coding practices such as functions.
3. Each student must implement data structures (stack, queue, linked list, trees, graphs) strictly as per experiment requirements using C/C++/Python.
4. Students must analyze and write the time and space complexity for every implemented algorithm in their journal.
5. Experiments involving stacks, queues, trees, and sorting should avoid using built-in shortcuts unless explicitly permitted.
6. Every student must create, run, and test their code individually, ensuring correctness through multiple sample inputs.
7. The lab journal must include aim, algorithm/pseudocode, code, input/output, complexity analysis, observations, and conclusion for each experiment.
8. Students must maintain an organized softcopy folder containing all program files named properly by experiment number.
9. Regular attendance, discipline, and timely completion of experiments are mandatory for earning full term-work marks.
10. Plagiarism, copying code, or performing malpractice during lab sessions or practical exams will lead to strict action as per institute guidelines.

Course Contents	
Sl. No.	**Suggested List of Experiments/Assignments**
1	Study of asymptotic notations and complexity calculation through small programs
2	Implementation of **Stack** (array & linked list) and applications (e.g., expression conversion, Examination)
3	Implementation of **Queue** and **Circular Queue**, Priority Queue
4	Implementation of **Linked Lists** – singly, doubly, circular with insert/delete/search operations
5	Implementation of **Binary Tree** and traversals (Inorder, Preorder, Postorder)
6	Implementation of **Binary Search Tree** (insert, delete, search)
7	Implementation of **AVL Tree** (rotations & balancing)
8	Graph representation (Adjacency Matrix / List) and traversal algorithms (BFS, DFS)
9	Implementation of **Sorting algorithms** (Bubble, Insertion, Selection, Merge, Quick, Heap Sort) and performance comparison
10	Implementation of **Searching algorithms** (Linear, Binary, Interpolation)

Reference Books:

1. Reema Thareja - Computer fundamentals and programming in C, Oxford University, 2nd edition, 2017.
2. Yashvant Kanetkar, Let us C ,15th ed, BPS Publication, 2016**.**

Program	S. Y. B. Tech (Information Technology)			Semester : IV			
Course	Processor Architecture			Code:	IT25MDM-256		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Prior knowledge of Logic Design.

Course Objectives:

1. To examine architectural details of PIC18 microcontroller and ARM processor.
2. To apply Embedded C programming for microcontroller-based systems.
3. To explore real-time interfacing techniques and peripherals.
4. To develop real-world embedded applications using microcontroller knowledge.

Course Outcomes:

CO1: Analyze the architecture and memory organization of the PIC18 microcontroller.
CO2: Design and implement Embedded C programs for PIC18 microcontroller applications.
CO3: Evaluate timers, interrupts, and peripheral interfacing of PIC18.
CO4: Analyze architectural and operational features of ARM processors.

Course Contents

Unit	Description	Duration [Hrs]
I	**PIC Microcontroller Fundamentals and Programming** Introduction to microcontrollers: Evolution, microprocessor vs. microcontroller, Selection criteria for microcontrollers in embedded systems. PIC18FXXX architecture and features: Functional block diagram, CPU, memory types. Memory organization: Program memory, data memory, file registers, Access bank, bank switching, addressing modes with examples, Reset and oscillator configurations, Brownout reset, watchdog timer, power down modes. Programming in Embedded C: Introduction to MPLAB X IDE and XC8 Compiler	7
II	**Timers, Interrupts, and Basic I/O Interfacing** I/O Port architecture and programming (bit manipulation techniques). Timer/Counter modules: Registers, delay calculations, timer programming in C. Interrupts: Polling vs interrupts, Interrupt vector table (IVT), types of interrupts, priority, enabling/disabling. Interrupt programming in C: Timer interrupt, external interrupts, and serial interrupt. Case Study: Traffic light controller using timer interrupts	8
III	**Peripheral Interfacing and Communication Protocols** Interfacing peripherals: LEDs, 16x2 LCD (8-bit), 4x4 Matrix Keypad, Relay, Buzzer CCP Modules: Capture, Compare, PWM; DC motor and Stepper motor control ADC and DAC Interfacing: ADC0808, DAC basics, sensor interfacing (e.g. LM35), Serial Communication Protocols: RS232, UART, I2C, SPI, Real-time interfacing: EEPROM (via SPI), RTC DS1306 (via I2C)	7
IV	**Introduction to ARM Architecture & Embedded System Design Trends** ARM and RISC design philosophies, Overview of ARM7, ARM9, ARM11 – features and applications, Programmer's model: Registers, CPSR, SPSR, modes of operation, ARM7 data flow model, Comparison between PIC and ARM architecture,	8

	Suitability of ARM in embedded and mobile systems, Overview of Embedded OS support for ARM (e.g. Free RTOS, µC/OS), Case Study: Embedded system design for home automation using ARM	
	Total	**30**

Text Books:

1. PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18 – Muhammad Ali Mazidi, Rolin D. McKinlay, Danny Causey, 2nd Edition, Pearson Education.
2. ARM System Developer's Guide: Designing and Optimizing System Software – Andrew N. Sloss, Dominic Symes, Chris Wright, 1st Edition, Morgan Kaufmann.

Reference Books:

1. Design with PIC Microcontroller – John B. Peatman, 2nd Edition, Pearson Education.
2. Fundamentals of Microcontrollers and Applications in Embedded Systems – Ramesh S. Gaonkar, 1st Edition, Cengage Learning.
3. ARM Assembly Language Programming & Architecture – Muhammad Ali Mazidi, 1st Edition, MicroDigitalEd.
4. Microchip PIC18FXXX Datasheet – Microchip Technology Inc., Latest Edition.

e-sources: e-Books:

1. PIC Microcontroller & Embedded Systems: Using Assembly and C for PIC18
2. Author: Muhammad Ali Mazidi, Danny Causey, Rolin McKinlay
3. ARM System Developer's Guide: Designing and Optimizing System Software
4. Fundamentals of Microcontrollers and Applications in Embedded Systems – Ramesh Gaonkar.

MOOC / NPTEL/YouTube Links:

1. https://nptel.ac.in/courses/108/102/108102149/
2. https://nptel.ac.in/courses/106/105/106105195/

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

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

Course Objectives: 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: Learn 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.
CO5: Explore YouTube Digital Advertising**.**

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, Pearson, 2022, 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.

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

Pre-requisites: Basic Knowledge of economics & mathematics.

Course Objectives: 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 Content

Unit	Description	Duration [Hrs]
I	**Introduction** Nature and significance of economics, Goods and Utility, Basic Concept of Demand and Supply, Elasticity of Demand- Price elasticity of Demand, Cross elasticity of Demand, Production - Production Function, Production Process and Factors of Production, Market - Introduction to Monopoly, Perfect Competition, Oligopoly and Monopolistic Competition, Cost Concepts, E-commerce.	7
II	**Money- its Examination and function, Bank** Commercial Bank and Central Bank and brief idea about function of banking system. Tax and Subsidy, Type of Tax- Direct and Indirect, Monetary and fiscal policy, Inflation and Business cycle, IPR & WTO, International trade, terms of Trade, Gain from International Trade, Free Trade vs. Protection, Dumping, and Balance of Payment	8
III	**Role of Science, Engineering and Technology In economic Development** 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.	**8**
	Total	**30**

Text Books:

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

Reference Books:

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

e-sources:

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

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

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

Course Objectives:

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:

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

CO1-Explain the basics of digital finance, big data, and regulatory frameworks.
CO2-Analyze digital payments, FinTech trends, and neo-banking models.
CO3- Illustrate 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	8
II	**Digital Payment Systems & Digital Banking Transformation** **Digital Payment Ecosystems:** Historical evolution and digitalization of payment systems (ECS, RTGS, NEFT, IMPS, UPI, mobile wallets, contactless payments), Attributes of a well-functioning payment system and the role of banks. **Fintech Innovations & Disruption:** FinTech startups, challenger banks, and peer-to-peer lending models, FinTech applications across banking, NBFCs, insurance, lending, audit, and compliance, Regulatory guidelines (e.g., RBI guidelines) and risks associated with new payment models. The Future of Digital Banking: How traditional banks are adapting and the rise of neo-banks, Digital banking trends and evolving customer expectations **Case Study:** Unified Payments Interface (UPI) in India	7
III	**Blockchain, Cryptocurrencies & Decentralized Finance**	8

	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)	
IV	**Artificial Intelligence, Machine Learning & 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	**7**
	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/LG-0015196323-0047264745.pdf
2. N. Urbach and M. Roglinger, Big Data and Artificial Intelligence in Digital Finance, 1st edition. Cham, Switzerland: Springer, 2022 Link: https://library.oapen.org/bitstream/id/fefe46c7-4495 49ba-bcab-9cf1851e81e6/978-3-030-94590-9.pdf
3. L. Perlman, An Introduction to Digital Financial Services, 1st edition., 2018. Link: https://www.academia.edu

MOOC/NPTEL/YouTube Links:

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

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

Pre-requisites: Prior knowledge of 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. **Case Study :** S.R. Bommai v. Union of India (1994) – Misuse of President's Rule	4
III	**Government: Union & State** Executive & Legislature, composition, powers and functions, Local Self Governments – Panchayat Raj Institutions & Urban Local Bodies (Municipalities). Statutory	4

	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)	
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. Bharucha, E., Textbookof "Environmental Studies", University Press (2005), 1st Edition ISBN-10:8173715408
2. 'Environmental Science: A Global Concern' Cunningham W.P. & Saigo S.W. 5th edition (1 July 1998) WCB, McGraw Hill
3. "The text book of Environmental studies", Dr. P. D. Raut, Shivaji University, 2013.
4. "A Text Book of Environmental Studies", Dr. D. K. Asthana, S. Chand.
5. "Environmental Pollution, monitoring and control", S. M. Khopkar, New Age Publication.
6. Mahua Basu," Environmental Studies", Cambridge University Press, ISBN-978-1-107-5317-3

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 (Information Technology)			Semester: IV			
Course	Community Engagement Project			Code:	IT25ELC-259		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	-	50	-	50

Pre-requisites: Familiarity with problem-solving methodologies and project planning, Basic programming knowledge is essential.

Course Objectives:

The objective of this course is to provide students with

1. To identify and analyze environmental issues faced by local communities.
2. To identify the use of technology for societal needs.
3. To design and implement innovative solutions using computer-engineering principles to address identified problems.
4. To work in a team with individual contributions to the project development.

Course Outcomes:

After successful completion of the course, Students will be able to :

CO1. Apply their engineering knowledge to analyze communities' need based on real-world environmental problems.
CO2. Design real-world applications by considering suitable requirements.
CO3. Implement real-world applications using suitable tools and technology.
CO4. Work in a team with individual contributions to the development of the project.
CO5. Communicate and demonstrate technical information effectively through project reports, presentations, and interactions with community members and mentors.

Course Guidelines for Implementation

- The purpose of this course is to empower students with the knowledge, skills, and mindset needed to leverage technology for addressing environmental and societal needs.
- Through a hands-on approach, students will learn to identify, analyze, and solve environmental issues faced by local communities using computer-engineering principles.
- By designing and implementing innovative solutions, students will not only gain technical proficiency but also develop teamwork, collaboration, and communication skills essential for making a positive impact on communities and the environment.

Team Formation, Guide Allocation, and Project Identification:

3-4 students can form a team within the same or different disciplines.

- Students are expected to explore and understand environmental challenges that communities face, such as pollution, waste management, water scarcity, resource depletion, climate change, energy transition, natural disasters, biodiversity loss, land degradation, etc.
- The project coordinator, in consultation with a panel of experts, assigns project guides from the same program to provide guidance and support to the teams throughout the project.
- The identified problem statement addressing environmental challenges must be registered with the project coordinator by the team after consulting with their respective project guide.
- Field visits are encouraged to identify the problem statements. Collaborative Work and Progress Reporting:
- Each student on the team must work collaboratively and contribute significantly to the design and development of solutions for registered problem statements, focusing on environmental challenges faced by the community.

- Students should work at least 4 hours per week and shall meet their assigned project guide regularly (at least twice a week) and report the progress of the project work, emphasizing the application of community engineering principles.
- Students are expected to incorporate suggestions from the earlier review.

Documentation and Reporting:

- Students shall maintain a record of all meetings, remarks given by the guide/reviewers, and progress of the work in the project diary, presented during each review presentation.
- For the final assessment, students shall complete the project report in all aspects, including formatting, duly signed by the project guide, Head of the Department.

Data Submission and Additional Outputs:

- Students shall submit all data related to project work in soft copy to their guides, including the project report, A3 size poster, presentation, paper, etc., focusing on community engineering solutions.
    - Students' groups can conduct an awareness programme on Health and Hygiene or in Organic Farming or in Fisheries, about renewable energy, e-waste OR their selected project topic

- Oral Examination shall consist of presentation and demonstration of the project work carried out by the project groups.

Mode of Examination:

Review-I - Problem Identification: (Mid Semester) (Weightage: 50%)

- Students must identify a specific problem statement related to community engineering projects.
- The problem statement should be relevant to environmental science/study-related societal needs and address a real-world issue.
- A brief presentation outlining the identified problem and its significance should be submitted. The presentation should include the background of the problem, literature review, proposed solution approach, and initial findings or developments.
- Students should be prepared to present their progress to a review committee.

Review-II – (Weightage: 50%) (at the end of semester) Solution Development:

- Projects will be evaluated based on the effectiveness of the solution designed and developed using fabrication, coding, modeling, product design, process design, or other relevant processes for identified problem statement. Outcome Examination:
- The project outcome will be assessed regarding its technical feasibility, economic viability, societal impact, and environmental sustainability.
- A detailed report covering the problem identification, literature review, methodology, progress made, challenges faced, and future plan should be submitted.
- Teams must prepare an e-document, uploaded along with a plagiarism check report, detailing their project work and findings.
- Each team member must submit their report, highlighting their individual contributions with a brief abstract of the total work in the initial part of the document. Reports must be unique, and the review will be based on individual contributions.

Reference Books:

1. Waterman, A. Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects. Routledge, 1997.
2. Beckman, M., and Long, J. F. Community-Based Research: Teaching for Community Impact. Stylus Publishing, 2016.
3. Design Thinking for Social Innovation. IDEO Press, 2015.

4. Dostilio, L. D., et al. The Community Engagement Professional's Guidebook: A Companion to The Community Engagement Professional in Higher Education. Stylus Publishing, 2017

Web Links:

1. UNESCO: Education for Sustainable Development https://www.unesco.org
2. EPICS (Engineering Projects in Community Service) https://engineering.purdue.edu/EPICS
3. Ashoka: Innovators for the Public https://www.ashoka.org
4. Design for Change https://www.dfcworld.com
5. NPTEL course: Ecology and Society, https://onlinecourses.nptel.ac.in/noc20_hs77/preview

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 learning the course, the students should 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.

	Detailed Syllabus	
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 of the Startup Ecosystem: Key stakeholders: Incubators, accelerators, angel investors, VCs, Government support schemes (Startup India, Atal Innovation Mission, etc.), Global vs. Indian startup ecosystems	3

II	**Idea Generation & Opportunity Recognition** Creativity Techniques for Idea Generation: Definition and importance of creativity in entrepreneur- ship. Brainstorming: Rules of effective 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, Angel investors: Role, expectations, approach, Brief on incubators, government schemes, crowdfunding.	**6**
	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 2. Select One Idea- Choose the most promising idea from your list 3. Write a 1-page Concept Summary, include the following: • Problem Identified: Describe the specific problem or pain point your idea addresses. • Solution Overview: Briefly describe your business idea. • Target Audience: Identify the group of people or organizations that would benefit. • Market Potential: Discuss the viability and scalability of the idea.
3	Business Model & Customer Validation	To help students develop a clear, structured business model and test its assumptions through customer conversations. The goal is to learn how to validate ideas through real-world feedback and refine the business concept accordingly.	**Part A: Business Model Canvas** 1. Choose a business idea (from Assignment 2 or a new one). 2. Create a Business Model Canvas with all 9 key blocks: o Customer Segments o Value Propositions o Channels o Customer Relationships o Revenue Streams o Key Resources o Key Activities o Key Partnerships o 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:

			o Their pain points o Their reaction to your proposed solution o Willingness to pay or use your product/service 3. Summarize findings in a 1–1.5 page report that includes: o Key customer quotes or paraphrased insights o A revised Value Proposition or Customer Segment block (if needed) 4. 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 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.	**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

		The exercise simulates real-world investor or networking scenarios where entrepreneurs must grab attention quickly.	elements: The Problem – Problem Identification The Solution – Description of your product/service. Value Proposition – The unique value proposition. Target Audience – Audience for your idea. o Call to Action – E.g. request for support, funding, feedback, etc. **Deliver Your Pitch:** o Record a video and submit it with written version of your pitch. o Ensure clear speech, confident body language (for video), and persuasive tone. **Reflection (Short Write-up):** o Share what you learned about communicating your idea Describe challenges or rewards you experienced in the process.

Text Books:

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

Reference Books

1. Ries, Eric. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, 1st Edition, Crown Business, 2011. ISBN: 9780307887894.
2. Kawasaki, Guy. The Art of the Start 2.0: The Time-Tested, Battle-Hardened Guide for Anyone Starting Anything, Portfolio (Penguin Random House), 2015. ISBN: 9781591847847.

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

Pre-requisites : --

अभ्यासक्रमाची उद्दिष्टे :

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

अभ्यासक्रम परिणाम (COs)

अभ्यासक्रम यशस्वीपणे पूर्ण केल्यानंतर विद्यार्थी खालील परिणाम साध्य करू शकतील:

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

Course Contents

Unit	Description	Duration [Hrs]
१.	भाषा आणि व्यक्तिमत्व विकास : सहसंबंध लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे	७
२.	**प्रसारमाध्यमांसाठी लेखन** वृत्तपत्रासाठी बातमीलेखन आणि मुद्रितसंपादन नभोवाणीसाठी भाषणाची संहितालेखन दूरचित्रवाणीसाठी 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