Dhirubhai Ambani
Institute of Information and Communication Technology

DA-IICT Road, Gandhinagar, Gujarat, India 382007.
Tel.: +91 79 6826 1700 I Fax: +91 79 6826 1710 I Web: www.daiict.ac.in

NAAC Accredited
Recipient of Centre of Excellence Award by the Government of Gujarat
Recipient of '5 Star' in GSIRF Ranking by Government of Gujarat

**ENGINEERS WITH
SOCIAL RESPONSIBILITY**

POs, PSOs & COs

PROGRAM: BACHELOR OF TECHNOLOGY IN INFORMATION AND COMMUNICATION TECHNOLOGY, BTECH (ICT)

PO No.	Programme Outcomes
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and

	cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO No.	Program Specific Outcomes (PSOs)
PSO1	To apply the theoretical concepts of computer engineering and practical knowledge in analysis, design and development of computing systems and interdisciplinary applications.
PSO2	Develop system solutions involving both hardware and software modules
PSO3	To work as a socially responsible professional by applying ICT principles in real-world problems.

Course Outcomes (COs) – Program Outcomes (POs) – Program Specific Outcomes (PSOs)

Basic Electronic Circuits (3-0-2-4)

Course Objective: The objective of this course is to provide students the fundamental idea of electronic circuits and components. The course will enable students with the skills of working with different circuit elements like resistor, capacitor, inductor, diode, transistor, operational amplifier. The content is designed to help students not only to analyze a circuit but also to design an electronic circuit with necessary components.

Course Outcomes: After completion of this course, students should be able to:
- Understand the working principles of electronic circuits [PO1, PO12].
- Analyze a given circuit using mathematical knowledge [PO1, PO2, PO4].
- Identify any issues in a circuit, and propose a solution [PO2, PO3, PO4].
- Work in a group for a laboratory experiment, and present their results [PO9, PO10].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X	X					X	X		X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the working principles of electronic circuits	PO1, PO12 / PSO1	U	F, C
2	CO2: Analyze a given circuit using	PO1, PO2, PO4 / PSO1, PSO2	U, Ap	F, C, P

	mathematical knowledge			
3	CO3: Identify any issues in a circuit, and propose a solution	PO2, PO3, PO4 / PSO1, PSO2	U, An	F, C, P
4	CO4: Work in a group for a laboratory experiment, and present their results	PO9, PO10 / PSO2, PSO3	Ap, An, E	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the Basic Electronics course can be employed in industries focusing on chip manufacturing, hardware.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in basic electronics that become prerequisite for other subsequent courses..
Focus on entrepreneurship	No	-

Introduction to Programming (3-0-0-3)

Course objective: This course aims to introduce problem solving techniques using C programming to help the students to develop analytical and logical skills. The course starts with basic concepts of computer programming and follows in building up knowledge in program development, deployment and testing to solve computational problems. The course also provides visualization of memory and time requirements

for solving problems using C programming language. The coverage of this course includes problem solving techniques, flow charts, algorithms development, pseudo codes, and implementation of algorithms using C programming.

Course Outcomes: After completion of this course, students should be able to:

- understand the basic programming skills in C. [PO1. PO12]
- Understand the syntax and semantics of flow-chart, data types and structured programming. [PO1. PO4]
- Apply skills in problem solving techniques. [PO2. PO3, PO4]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X		X								X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the basic programming skills in C	PO1, PO12 / PSO1	U	F, C
2	CO2: Understand the syntax and semantics of flow-chart, data types and structured programming	PO1, PO4 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Apply skills in problem solving techniques.	PO1, PO3, PO4 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the Programming course can be employed in industries focusing on coding, web development.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in basic programming skills that become prerequisite for other subsequent courses..
Focus on entrepreneurship	Yes	The students apply their coding skills in entrepreneurship, start-up.

Introduction to Programming Lab (0-0-4-2)

Course objective: This course aims to provide hands-on practical knowledge on C programming on topics, exercises and use cases discussed in the course, Introduction to Programming.

Course Outcomes: After completion of this course, students should be able to:
- Understand the basic programming skills in C. [PO1, PO12]
- Understand the syntax and semantics of flow-chart, data types and structured programming. [PO1, PO4]
- Apply skills in problem solving techniques. [PO2, PO3, PO4]
- Work in a group for a laboratory experiment, and present their results [PO9, PO10]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO1 2
X	X		X					X	X		X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1 Understand the basic programming skills in C	PO1, PO12 / PSO1	U	F. C
2	CO2: Understand the syntax and semantics of flow-chart, data types and structured programming	PO1 PO4/ PSO1. PSO2	U. Ap	F. C P
3	CO3: Apply skills in problem solving techniques	PO2, PO3, PO4 / PSO1, PSO2	U, An	F, C, P
4	CO4: Work in a group for a laboratory experiment, and present their results	PO9, PO10 / PSO2, PSO3	Ap, An, E	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the Basic Electronics course can be employed in industries focusing on chip manufacturing, hardware.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in basic electronics that become prerequisite for other subsequent courses..

Focus on entrepreneurship	Yes	The students apply their coding skills in entrepreneurship, start-up.

Calculus (3-1-0-4)

Course objective: The students after completing the course will get a basic overview of Calculus and its applications. They will get an insight into how it is used in various applications (both old and new). Through this course student can develop the ability to apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems, understand and create mathematical arguments for solving problems, understand mathematical structures such as functions, variables, integrations and learn their uses, develop skills towards mathematical modeling and analysis of engineering problems.

Course Outcomes: After completion of this course, students should be able to:
- Model some physical situations with functions, differential equations or integrals. [PO2, PO5, PO12]
- Solve the models created and also determine the reasonableness of solutions, including sign, size, units of measurement and accuracy. [PO1, PO2, PO3, PO4]
- Communicate mathematics and explain solutions to problems both verbally and in written sentences. [PO12]
- Acquire manipulation and computation competence. [PO4, PO12].
- Develop an appreciation of calculus as a coherent body of knowledge and as a human accomplishment. [PO12]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X		X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Model some physical situations with functions, differential equations or integrals	PO2, PO5, PO12 / PSO1	U, An	F, C
2	CO2: Solve the models created and also determine the reasonableness of solutions, including sign, size, units of measurement and accuracy	PO1, PO2, PO3, PO4 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Communicate mathematics and explain solutions to problems both verbally and in written sentences	PO12 / PSO1, PSO2	U, An	F, C, P
4	CO4: Acquire manipulation and computation competence	PO4, PO12 / PSO2, PSO3	Ap, An	F, C, P
5	CO5: Develop an appreciation of calculus as a coherent body of knowledge and as a human accomplishment	PO12/PSO1	U	F, C

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	No	-
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in calculus that become prerequisite for other subsequent courses.
Focus on entrepreneurship	No	

Introduction to ICT (1-0-2-2)

Course Objective: This course is designed to provide students a contextual understanding of different facets of ICT along with the practical exposure to basic engineering tools.

Course Outcomes: After completion of this course, students should be able to:
- Understanding different pillars of ICT [PO1, PO12].
- Draw and visualize engineering tools using Autocad [PO1, PO2, PO5].
- Understand Computer Numerical Control (CNC) machines and use them for engineering design [PO2, PO3, PO5].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X		X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understanding different pillars of ICT	PO1, PO12 / PSO1	U	F, C
2	CO2: Draw and visualize engineering tools using Autocad	PO1, PO2, PO5 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Understand CNC machines and use them for engineering design	PO2, PO3, PO5 / PSO1, PSO2	U	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M': Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on service on chip, prototype design.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in ICT that become prerequisite for other subsequent courses.
Focus on entrepreneurship	No	-

PC110 Language and Literature (3-0-0-3)

Course Objective: This course is designed to introduce students to the study of the English language and literature at the undergraduate level. It follows a two-pronged approach, first, teaching the English language through literature; secondly, introducing the students to the world of literature and teaching them strategies of reading and comprehending.

Course Outcomes: After completion of this course, students should be able to:
- Upskills their language proficiency [PO4, PO6, PO8, PO12].
- Understand post-colonial literature [PO7, PO8, PO12].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
			X		X	X	X				X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Upskills their language proficiency	PO4, PO6, PO8, PO12 / PSO1	U	F, C
2	CO2: Understand post-colonial literature	PO7, PO8, PO12 / PSO1, PSO2	U	F, C

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	Communication skills and language proficiency helps students in employment.
Focus on Skill development	Yes	The students develop necessary skills for communicative english, writing and presentation skills
Focus on entrepreneurship	No	-

Digital Logic and Computer Organization (3-0-2-4)

Course objective: This course provides an introduction to the design and implementation of digital circuits and microprocessors. Topics include transistor network design, Boolean algebra, combinational circuits, sequential circuits, finite state machine design, processor pipelines, and memory hierarchy. Design methodology using both discrete components and hardware description languages is covered in the course.

Course Outcomes: After completion of this course, students should be able to

- Understand and verify digital logic gates using IC chips, and realize the combinational digital circuit for a given logical function [PO1, PO3 PO12].
- Understand Instruction cycle, I/O fundamentals and interrupts [PO1, PO2, PO5].
- Design a data and control path for the MIPS instruction set architecture [PO2, PO3, PO5]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X		X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand and verify digital logic gates using IC chips, and realize the combinational digital circuit for a given logical function	PO1, PO3, PO12 / PSO1	U	F, C
2	CO2: Understand Instruction cycle, I/O fundamentals and interrupts	PO1, PO2, PO5 / PSO1, PSO2	U	F, C
3	CO3: Design a data and control path for	PO2, PO3, PO5 / PSO1, PSO2	U, Ap	F, C, P

	the MIPS instruction set architecture			

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on systems design and VLSI.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in computer organization that become prerequisite for other subsequent courses.
Focus on entrepreneurship	No	-

Data Structures (3-0-0-3)

Course objective: The course aims to introduce the concept of data structures, and their indispensability in implementing algorithms and also how they aid in improving performance. An extensive coverage of the well-known and important data structures and routines/algorithms associated with them will be covered.

Course Outcomes: After completion of this course, students should be able to:
- Understand basic and abstract data types [PO1, PO12].
- Analyze complexity of various data structures [PO2, PO3, PO4].
- Apply skills for solving problems [PO2, PO3, PO4]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X	X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand basic and abstract data types	PO1, PO12 / PSO1	U	F, C
2	CO2: Analyze complexity of various data structures	PO2, PO3, PO4 / PSO1, PSO2	U, An	F, C, P
3	CO3: Apply skills for solving problems	PO2, PO3, PO4 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software development, coding and computing.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in data structures that become prerequisite for other subsequent courses.

Focus on entrepreneurship	Yes	Data structure is a foundational course that helps in exploring startups, entrepreneurship.

Data Structures Lab using OOP (1-0-2-2)

Course objective: Aim of this course is to provide practical exposure to different data structures and algorithms concepts that are taught in the course "IT205: Data Structures". Preferred programming language is C++.

Course Outcomes: After completion of this course, students should be able to:

- Implement basic and abstract data types [PO1, PO12].
- Analyze complexity of various data structures [PO2, PO3, PO4].
- Apply skills for solving problems [PO2, PO3, PO4]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO1 2
X	X	X	X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Implement basic and abstract data types	PO1, PO12 / PSO1	U	F, C
2	CO2: Analyze complexity of various data structures	PO2, PO3, PO4 / PSO1, PSO2	U, An	F, C, P

| 3 | CO3: Apply skills for solving problems | PO2, PO3, PO4 / PSO1, PSO2 | U, Ap | F, C, P |

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software development, coding and computing.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in data structures that become prerequisite for other subsequent courses.
Focus on entrepreneurship	Yes	Data structure is a foundational course that helps in exploring startups, entrepreneurship.

Discrete Mathematics (3-1-0-4)

Course objective: Students are expected to learn logical reasoning to solve a variety of problems to learn different proof methods, algorithms to solve problems, and to learn discrete probability and number theory to solve problems.

Course Outcomes: After completion of the course, the students should acquire:

- A basic overview of discrete mathematics [PO1, PO12]
- Understand how the concepts are used in various applications [PO3, PO4, PO5].
- Apply skills learned in the course for problem solving [PO2, PO3, PO5]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X	X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: A basic overview of discrete mathematics	PO1, PO12 / PSO1	U	F, C
2	CO2: Understand how the concepts are used in various applications	PO3, PO4, PO5 / PSO1, PSO2	U	F, C, P
3	CO3: Apply skills learned in the course for problem solving	PO2, PO3, PO5 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software development.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in discrete mathematics that become prerequisite for other subsequent courses.

Focus on entrepreneurship	No	-

HM106 Approaches to Indian Society (3-0-0-3):

Course Objective: This course aims to construct a comparative framework for the understanding of different cultures with particular reference to social organization, politics, religion and symbolism illustrated with various ethnographic examples. The course is designed to provide with the means to apply basic anthropological understandings of society and culture in the analysis of meanings, actions and explanations that is the basis for communication in the society. Students will be expected to reflect upon the Indian society utilizing the readings and lectures.

Course Outcomes: Upon passing the courses, students should have a:
- Basic critical and analytical understanding of how social and cultural diversity is approached in anthropology [PO1, PO7, PO12]
- How the diversity of culture, implicit in anthropological explanations, is to be understood [PO6, PO7, PO8].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X					X	X	X				X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Basic critical and analytical understanding of how social and cultural	PO1, PO7, PO12 / PSO1	U	F, C

	diversity is approached in anthropology			
2	CO2: How the diversity of culture, implicit in anthropological explanations, is to be understood	PO6, PO7, PO8 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E. Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	No	-
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in culture, society and identity.
Focus on entrepreneurship	No	-

Electromagnetic Theory (3-1-0-4)

Course objective: The course is targeted at students of engineering who want to understand medium and its response to a signal. Electromagnetic waves are the simplest signal, its propagation, energy associated with such waves and the techniques to understand its behavior in different media, are what are under the scope of this course.

Course Outcomes: After successful completion of the course, the student will have the ability to

- Understand and analyze complicated engineering and real-world situations by physical reasoning in terms of simple fundamental physical laws. [PO1. PO2 PO12].
- Formulate mathematical models by applying abstract concepts to complex problems and solving the model using approximations if necessary [PO3. PO4].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO1 2
X	X	X	X								X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand and analyze complicated engineering and real-world situations by physical reasoning in terms of simple fundamental physical laws	PO1, PO2, PO12 / PSO1	U	F, C
2	CO2: Formulate mathematical models by applying abstract concepts to complex problems and solving the model using approximations if necessary	PO3, PO4 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	No	-
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in the course that becomes a prerequisite for other subsequent courses.
Focus on entrepreneurship	No	-

Exploratory Project 1 (0-1-0-1) and Exploratory Project 2 (0-0-2-1)

Objective: This course allows students to explore their surroundings to identify interesting problems that admit a hardware based solution and design and make such a product by leveraging the engineering workshop skills learnt in the first semester. Students are expected to work in groups of 8 to 10 under a faculty mentor and conceive and implement a project over two semesters. The course will conclude with a class demonstration and exhibition.

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

- Explore different opportunities for doing projects in ICT [PO1, PO8, PO9, PO12].
- Perform hands-on activities using ICT tools and technologies [PO8, PO12].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X							X	X			X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Explore different opportunities for doing projects in ICT	PO1, PO8, PO9, PO12 : PSO1	U	F, C
2	CO2: Perform hands-on activities using ICT tools and technologies	PO8, PO12 / PSO1	U, Ap	F, C. P

CL. Cognitive Process Domain [R: Remember. U: Understand; Ap: Apply; An: Analyze. F Evaluate: C Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	No	-
Focus on Skill development	Yes	The students develop necessary skills to develop hands-on knowledge in the course that becomes a prerequisite for other subsequent courses.
Focus on entrepreneurship	No	-

Signals and Systems (3-1-0-4)

Course Objective: This course concentrates on classification and description of signals and systems. The emphasis is primarily on linear time invariant systems using both the time domain and frequency domain representations.

Course Outcomes: After completion of the course, students should be able to:
- Understand characteristics of signals [PO1, PO3]
- Understand various transforms [PO1, PO5].
- Compute and determine various transformation [PO1, PO12]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X		X		X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand characteristics of signals	PO1, PO3 / PSO1	U	F, C
2	CO2: Understand various transforms	PO1, PO5 / PSO1	U	F, C, P
3	CO3: Compute and determine various transformation	PO1, PO12 / PSO1	U, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze, E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication engineering.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in signals and systems that become prerequisite for other subsequent courses.

Focus on entrepreneurship	No	-

Design and Analysis of Algorithms (3-1-0-4)

Course Objective: This course intends to provide a rigorous introduction to fundamental techniques in the design and analysis of algorithms.

Course Outcomes: Students who complete the course should have the ability to do the following:

- Understand the correctness of algorithms using inductive proofs and invariants [PO1, PO12].
- Analyze worst-case running times of algorithms using asymptotic analysis. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms and analyze them [PO2].
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Synthesize dynamic programming algorithms, and analyze them [PO2, PO3].
- Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Synthesize greedy algorithms, and analyze them [PO2,PO3, PO4, PO12].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
X	X	X	X								X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the correctness of algorithms using inductive proofs and invariants	PO1 / PSO1	U	F, C

2	CO2: Analyze worst-case running times of algorithms using asymptotic analysis. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms and analyze them	PO2 / PSO1, PSO2	U, An	F, C, P
3	CO3: Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Synthesize dynamic programming algorithms, and analyze them	PO2, PO3 / PSO1, PSO2	U, An	F, C, P
4	CO4: Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Synthesize greedy algorithms, and analyze them	PO2, PO3, PO4, PO11 / PSO2, PSO3	Ap, An, E	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software development, coding and computing.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in Algorithms that become prerequisite for other subsequent courses.

Focus on entrepreneurship	Yes	Algorithms is a foundational course that helps in exploring startups, entrepreneurship.

Linear Algebra (3-1-0-4)

Course Objective: Vectors are an essential idea to understand numerous natural phenomena. Its applications start right from mechanics and electrostatics and magnetostatics. These applications use equations involving vectors. Such ideas are abstracted to study solutions of a system of linear equations in several variables.

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

- Solve systems of linear equations and understand the nature of the solutions [PO1, PO2, PO12].
- Demonstrate matrix representation of linear operators and understand the concepts through linear operators and matrices [PO1, PO2].
- Perform calculations with vectors, eigenvalues and eigenvectors in "n" dimensions [PO2, PO12].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
X	X										X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Solve systems of linear equations and understand the nature of the solutions	PO1, PO2, PO12 / PSO1	U, Ap	F, C

2	CO2: Demonstrate matrix representation of linear operators and understand the concepts through linear operators and matrices	PO1, PO2 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Perform calculations with vectors, eigenvalues and eigenvectors in "n" dimensions	PO2, PO12 / PSO1, PSO2	U, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on Machine Learning, Data Science.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in Linear Algebra that become prerequisite for other subsequent courses.
Focus on entrepreneurship	No	-

HM216 Science, Technology, Society (3-0-0-3)

Course objective: This course is designed to encourage students to understand, explore and critically analyze ways in which science and technology work in diverse

social contexts. It draws its basic approaches from Science and Technology studies (STS) which is a growing field of interdisciplinary studies that seeks to understand how science and technology shape human lives and livelihoods and how society and culture, in turn, shape the development of science and technology.

Course Outcomes: After completion of the course students should be able to understand:

- What are the debates STS studies raise about science and technology and society that compel us to question our received ideas and assumptions about science, technology and human progress? [PO1, PO12]
- How have the questions and problems raised by historical and sociological studies of science and technology informed our understanding of the career of modern science and technology in India? [PO4, PO6, PO7]
- What are the techno-social imaginaries that influence our attitude toward science and technology in contemporary times? [PO7, PO8]
- How do we deploy the benefits of science and technology to build more inclusive societies and economies? [PO6, PO10, PO12]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X			X		X	X	X		X		X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: What are the debates STS studies raise about science and technology and society that compel us to question our received ideas and	PO1, PO12 / PSO1	U	F, C

	assumptions about science, technology and human progress?			
2	CO2: How have the questions and problems raised by historical and sociological studies of science and technology informed our understanding of the career of modern science and technology in India?	PO4, PO6, PO7 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: What are the techno-social imaginaries that influence our attitude toward science and technology in contemporary times?	PO7, PO8 / PSO1, PSO2	U, Ap	F, C, P
4	CO4: How do we deploy the benefits of science and technology to build more inclusive societies and economies?	PO6, PO10, PO12 / PSO2, PSO3	Ap, An, E	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	No	-
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in science, technology and society.
Focus on entrepreneurship	No	-

Computer Systems Programming (3-0-2-4)

Course objective: The course takes an introductory look at the core abstractions in operating systems: processes, virtual memory and files. It takes an in-depth look at the OS services provided by system calls, how system calls work, and how they can be used. Students will become familiar with writing application programs using system calls.

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

- Understand the importance of system programming, kernel subsystems, types of kernel, embedded and real time systems [PO1, PO2, PO12].
- Implement process scheduling policy and signaling mechanisms for real time and non-real time processes [PO2, PO5].
- Understand and implement features as per POSIX standards [PO1, PO12].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X			X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the importance of system programming, kernel subsystems, types of kernel, embedded and real time systems	PO1, PO2, PO12 / PSO1	U	F, C
2	CO2: Implement process scheduling policy and signaling mechanisms for real time and non-real time processes	PO2, PO5 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Understand and implement features as per POSIX standards	PO1, PO12 / PSO1, PSO2	U, Ap, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software engineering, developer.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in systems software that become prerequisite for other subsequent courses.

Focus on entrepreneurship	No	-

Probability and Statistics (3-0-1-4)

Course objective: The course introduces students to the basics of probability and statistics. Probability theory has wide scale applications in mathematics, engineering and finance. The student is introduced to the axiomatic way of looking at probability invented by Kolmogorov. The different types of random variables (both discrete and continuous) are introduced with context and examples. The student learns the limit theorems such as the central limit theorem with their applications. The course ends with some introductory statistics in the form of estimation and regression. The course has mathematical rigor but at the same time practical examples as well as an experimental approach where the students can simulate probabilistic situations on a computer is encouraged.

Course Outcomes: After completion of the course, students should be able to:
- Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, variances [PO1, PO2, PO4, PO12].
- Define and explain the different statistical distributions (e.g., Normal, Binomial, Poisson) and the typical phenomena that each distribution often describes [PO2, PO5].
- Apply the concepts of interval estimation, confidence intervals and hypothesis testing [PO2, PO4, PO5].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
X	X		X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, variances	PO1, PO2, PO4, PO12 / PSO1	U	F, C
2	CO2: Define and explain the different statistical distributions (e.g., Normal, Binomial, Poisson) and the typical phenomena that each distribution often describes	PO2, PO4 / PSO1, PSO2	U, An	F, C, P
3	CO3: Apply the concepts of interval estimation, confidence intervals and hypothesis testing	PO2, PO4, PO5 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	No	-

Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in probability and statistics that become prerequisite for other subsequent courses.
Focus on entrepreneurship	No	

HM116 Principles of Economics (3-0-0-3)

Course Objective: This course provides students an understanding of what is Economics, the problems of Economic Organization, what, how and for whom to produce.

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

- Understand the functioning of different types of markets including Monopoly, Monopolistic competition, Oligopoly, and Perfect Competition and the corresponding equilibrium conditions in each market [PO1, PO6, PO12].
- Analyze market efficiencies, consumer surplus, producer surplus and social welfare in economic markets [PO6, PO7].
- Understand theory of labour markets and associated equilibrium wages, employment and unemployment rates with applications in the ICT industry [PO6, PO7].
- Apply macroeconomics principles to estimate the welfare of countries including the determination of GDP, standard of living and unemployment rates [PO6, PO7, PO12].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
					X	X					X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the functioning of different types of markets including Monopoly, Monopolistic competition, Oligopoly, and Perfect Competition and the corresponding equilibrium conditions in each market	PO1, PO6, PO12 / PSO1	U	F, C
2	CO2: Analyze market efficiencies, consumer surplus, producer surplus and social welfare in economic markets	PO6, PO7 / PSO1, PSO2	U, An	F, C, P
3	CO3: Understand theory of labour markets and associated equilibrium wages, employment and unemployment rates with applications in the ICT industry	PO6, PO7 / PSO1	U	F, C

4	CO4: Apply macroeconomics principles to estimate the welfare of countries including the determination of GDP, standard of living and unemployment rates	PO6, PO7, PO12 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	No	-
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in economics that helps students taking related elective courses.
Focus on entrepreneurship	No	-

Introduction to Communication Systems (3-0-2-4)

Course objective: This is a foundation course for analog and digital communication and other advanced communication courses. The objective of this course is to make the students appreciate what a telecommunication system is, why it is required and its fundamental concepts.

Course Outcomes: After completion of the course, students should be able to:
- Understand the principles of basic communication systems including time, frequency, and antenna diversity [PO1, PO12].

- Understand the impact of channel encoding/decoding schemes including linear block codes, cyclic, and convolutional codes on output bit error probability [PO4, PO5].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X			X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the principles of basic communication systems including time, frequency, and antenna diversity	PO1, PO12 / PSO1	U	F, C
2	CO2: Understand and apply the impact of channel encoding /decoding schemes including linear block codes, cyclic, and convolutional codes on output bit error probability	PO4, PO5 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	No	-
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in communication systems that become prerequisite for other subsequent courses.
Focus on entrepreneurship	No	-

Database Management Systems (3-0-2-4)

Course objective: This course covers all essential topics in database management, in particular, relational databases. The exposure obtained by the students in this course serve as a required prerequisite to several elective courses in the areas of Software Engineering.

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

• Understand the principles of relational algebra and entity-relationship diagrams [PO1, PO2, PO4].

• Understand and apply the concepts of database design and implementation [PO2, PO4, PO5, PO12]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X		X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the principles of relational	PO1, PO2, PO4 / PSO1	U	F, C

	algebra and entity-relationship diagrams			
2	CO2: Understand and apply the concepts of database design and implementation	PO2, PO4, PO5, PO12 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R. Remember; U: Understand; Ap: Apply; An. Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Details
Focus on Employability	The students taking DBMS course can be employed to industries focusing on database and software development.
Focus on Skill development	The students develop necessary skills to work with real use cases using databases.
Focus on entrepreneurship	The students can work on real time projects focusing on development of small, medium and large enterprises through entrepreneurship/self-employability and start-ups.

Embedded Hardware Design (3-0-2-4)

Course Objective: This course aims to cover computing devices, associated peripherals and networks along with high level software(C) and hardware language (Verilog HDL) which are used in the design of a modern day embedded system.

Course Outcomes: After completion of the course, students should be able to:
- Understand essential hardware components, SOC, and their usage in embedded systems [PO1, PO4, PO5, PO12].

- Acquire skills in hardware language and visualize it through embedded systems [PO4, PO5, PO6].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X			X	X	X						X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand essential hardware components, SOC, and their usage in embedded systems	PO1, PO4, PO5, PO12 / PSO1	U	F, C
2	CO2: Acquire skills in hardware language and visualize it through embedded systems	PO4, PO6, PO6 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on chip manufacturing, hardware.
Focus on Skill development	Yes	The students develop necessary skills to

		develop foundational knowledge in embedded systems.
Focus on entrepreneurship	Yes	Embedded Hardware Design offers a lot of opportunities for start-ups, entrepreneurship

Digital Communications (3-0-2-4)

Course objective: The course aims to cover introduction to digital communication systems and digitization of analog signals-analog versus digital communications.

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

- Understand the necessary concepts in digital communication [PO1, PO4, PO12].
- Visualize various aspects of signals through analog-digital-analog [PO3].
- Analyze communication complexity with respect to different channels [PO2, PO4].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X	X								X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the necessary concepts in digital communication	PO1, PO4, PO12 / PSO1	U	F, C
2	CO2: Visualize various aspects of	PO3 / PSO1, PSO2	U, Ap	F, C, P

		signals through analog-digital-analog			
3		CO3: Analyze communication complexity with respect to different channels	PO2, PO4 / PSO1, PSO2	U, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication engineering.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in digital communication..
Focus on entrepreneurship	No	-

Computer Networks (3-0-2-4)

Course objective: The course explains the evolution of computer and communication networks and the design principles of modern network architectures. Primary focus is on system level concepts and engineering design and implementation issues. Some of the recent advancements including multimedia networking, and Software Defined Networking (SDN) will also be studied. In addition, we will study the design and implementation of modern network applications using sockets libraries. The associated laboratory component is designed to expose students to the network simulation tools for the analysis of traffic and network protocols.

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

- Understand digital information flow from source to destination over OSI and TCP stack [PO1, PO12].
- Understand the network protocol stacks in the Internet [PO1, PO3].
- Determine and implement appropriate medium access control protocol to avoid collision of packets during transmission in a given medium [PO3, PO4].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X		X	X								X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand digital information flow from source to destination over OSI and TCP stack	PO1, PO12 / PSO1	U	F, C
2	CO2: Understand the network protocol stacks in the Internet	PO1, PO3 / PSO1, PSO2	U	F, C, P
3	CO3: Determine and implement appropriate medium access control protocol to avoid collision of packets during transmission in a given medium	PO3, PO4 / PSO1, PSO2	U, Ap	F, C, P

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on Software Engineering, Network Administrator.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in computer networks.
Focus on entrepreneurship	No	-

Software Engineering (3-0-2-4)

Course objective: The Software Engineering course introduces the basic principles, practices, tools and techniques required to engineer large complex software systems. The course is project intensive, where students learn by example and practice. The main objective is to understand and learn how complexity and change are engineered during large software development. Here, we would focus on the methodologies (processes), techniques (methods), and tools that can be used to successfully design and validate large software. Wherever relevant, we will make use of various technologies (e.g., DevOps, CASE) to represent various aspects of software development.

Course Outcomes: After completion of the course, students should be able to:
- Understand software engineering principles and existing software process models [PO1, PO12].
- Develop software requirement specification documents for a given project using software requirement engineering principles [PO5, PO6].
- Implement software project management including project scheduling, software size metrics and cost estimation methods [PO11].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X				X	X					X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand software engineering principles and existing software process models	PO1, PO12 / PSO1	U	F, C
2	CO2: Develop software requirement specification documents for a given project using software requirement engineering principles	PO5, PO6 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Implement software project management including project scheduling, software size metrics and cost estimation methods	PO11 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on Software Engineering.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in software engineering.
Focus on entrepreneurship	Yes	Software Engineering is an essential course for start-ups and entrepreneurship.

Environmental Science (3-0-0-3)

Course objective: Sensitize students on various issues and problems of the environment affecting our society. Allow students to do hands-on exercise on a few specific problems related to the environment. Enable the student to conceive ICT based solutions to environmental problems. With the broad understanding of the environment and underlying principles, the students should be able to relate the changes and challenges of environment related issues.

Course Outcomes: After completion of the course, students should be able to:
- Understand the importance of the environment for our society [PO1, PO7, PO12].
- Visualize ICT based solutions to environmental problems [PO7, PO8].
- Relate the changes and challenges of environment related issues [PO7, PO8]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X						X	X				X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the importance of the environment for our society	PO1, PO7, PO12, PSO1	U	F, C
2	CO2: Visualize ICT based solutions to environmental problems	PO7, PO8 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Relate the changes and challenges of environment related issues	PO7, PO8 / PSO1	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	No	-
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in environmental science.
Focus on entrepreneurship	No	-

Executive Registrar
DA-IICT, Gandhinagar

Dhirubhai Ambani
Institute of Information and Communication Technology

DA-IICT Road, Gandhinagar, Gujarat, India 382007.
Tel.: +91 79 6826 1700 I Fax: +91 79 6826 1710 I Web: www.daiict.ac.in

NAAC Accredited
Recipient of Centre of Excellence Award by the Government of Gujarat
Recipient of '5 Star' in GSIRF Ranking by Government of Gujarat

**ENGINEERS WITH
SOCIAL RESPONSIBILITY**

PROGRAM: BACHELOR OF TECHNOLOGY IN MATHEMATICS AND COMPUTING, BTECH (MnC)

PO No.	Program Outcomes
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and

	cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO No.	Program Specific Outcomes (PSOs)
PSO1	PSO1: To model computational problems by applying mathematical concepts and solving real-world problems using algorithmic techniques.
PSO2	To apply the mathematical and statistical approaches for analyzing, designing and development of computing systems in interdisciplinary applications.

Course Outcomes (COs) – Program Outcomes (POs) – Program Specific Outcomes (PSOs)

MC111 Mathematical, Algorithmic, and Computational Thinking (3-1-0-4)
Course objective: This course aims to motivate students with mathematical, analytical, logical thinking with emphasis on algorithmic and computational thinking.

Course Outcomes: After completion of this course, students should be able to:
- Understand logical, analytical, quantitative and computational thinking [PO1, PO12].
- Learn and apply algorithmic and computational thinking [PO1, PO2, PO6].
- Use modern tools and technologies for mathematical and computational problems [PO2, PO3, PO5, PO11].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X		X	X					X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand logical, analytical, quantitative and computational thinking	PO1, PO12 / PSO1	U	F, C
2	CO2: Learn and apply algorithmic and computational thinking	PO1, PO2, PO6 / PSO1, PSO2	U, AP	F, C
3	CO3: Use modern tools and technologies for mathematical and computational problems	PO2, PO3, PO5, PO11 / PSO1, PSO2	U, Ap	F, C, P

CL. Cognitive Process Domain [R Remember: U: Understand. Ap: Apply. An. Analyze: E Evaluate. C: Crete]

KC. Knowledge Domain [F: Factual: C Conceptual: P: Procedural M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on computing.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in mathematical and algorithmic thinking.
Focus on entrepreneurship	No	-

MC112 Computer Organization and Programming (3-0-0-3)

Course objective: This course provides an introduction to the design and implementation of digital circuits and microprocessors. Topics include transistor network design, Boolean algebra, combinational circuits, sequential circuits, finite state machine design, processor pipelines, and memory hierarchy. Design methodology using both discrete components and hardware description languages is covered in the course.

Course Outcomes: After completion of this course, students should be able to:

- Understand and verify digital logic gates using IC chips, and realize the combinational digital circuit for a given logical function [PO1, PO3, PO12].
- Understand Instruction cycle, I/O fundamentals and interrupts [PO1, PO2, PO5].
- Design a data and control path for the MIPS instruction set architecture [PO2, PO3, PO5]

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X	X		X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand and verify digital logic gates using IC chips, and realize the combinational digital circuit for a given logical function	PO1, PO3, PO12 / PSO1	U	F, C
2	CO2: Understand Instruction cycle, I/O fundamentals and interrupts	PO1, PO2, PO5 / PSO1, PSO2	U	F, C
3	CO3: Design a data and control path for the MIPS instruction set architecture	PO2, PO3, PO5 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on systems design and VLSI.
Focus on Skill development	Yes	The students develop necessary skills to

		develop foundational knowledge in computer organization that become prerequisite for other subsequent courses.
Focus on entrepreneurship	No	

MC113 Computer Organization and Programming Lab 0-0-4-2)

Course objective: This course provides an introduction to the design and implementation of digital circuits and microprocessors. Topics include transistor network design, Boolean algebra, combinational circuits, sequential circuits, finite state machine design, processor pipelines, and memory hierarchy. Design methodology using both discrete components and hardware description languages is covered in the course.

Course Outcomes: After completion of this course, students should be able to:
- Understand and verify digital logic gates using IC chips, and realize the combinational digital circuit for a given logical function [PO1, PO3, PO12].
- Understand Instruction cycle, I/O fundamentals and interrupts [PO1, PO2, PO5].
- Design a data and control path for the MIPS instruction set architecture [PO2, PO3, PO5]

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X	X		X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand and verify digital logic gates using IC chips, and realize the combinational digital circuit for a given logical function	PO1 PO3, PO12 / PSO1	U	F, C
2	CO2: Understand Instruction cycle, I/O fundamentals and interrupts	PO1, PO2, PO5 / PSO1, PSO2	U	F, C
3	CO3: Design a data and control path for the MIPS instruction set architecture	PO2, PO3, PO5 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on systems design and VLSI.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in computer organization that become prerequisite for other subsequent courses.
Focus on entrepreneurship	No	-

MC116 Digital Logic Design (1-0-2-2)

Course objective: This course provides an introduction to digital logic design and its applications.

Course Outcomes: After completion of this course, students should be able to:

- Understand and verify digital logic gates using IC chips, and realize the combinational digital circuit for a given logical function [PO1, PO3, PO12].
- Understand Instruction cycle, I/O fundamentals and interrupts [PO1, PO2, PO5].
- Design a data and control path for the MIPS instruction set architecture [PO2, PO3, PO5]

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
X	X	X		X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand and verify digital logic gates using IC chips, and realize the combinational digital circuit for a given logical function	PO1, PO3, PO12 / PSO1	U	F, C
2	CO2: Understand Instruction cycle, I/O fundamentals and interrupts	PO1, PO2, PO5 / PSO1, PSO2	U	F, C
3	CO3: Design a data and control path for the MIPS instruction set architecture	PO2, PO3, PO5 / PSO1, PSO2	U, Ap	F, C, P

CL Cognitive Process Domain [R. Remember U: Understand. Ap Apply: An Analyze. E: Evaluate: C. Crete]

KC Knowledge Domain [F. Factual: C: Conceptual: P: Procedural: M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on systems design and VLSI.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in computer organization that become prerequisite for other subsequent courses.
Focus on entrepreneurship	No	-

MC123 Discrete Mathematics (3-1-0-4)

Course objective: Students are expected to learn logical reasoning to solve a variety of problems to learn different proof methods, algorithms to solve problems, and to learn discrete probability and number theory to solve problems.

Course Outcomes: After completion of the course, the students should acquire:

- A basic overview of discrete mathematics [PO1, PO12]
- Understand how the concepts are used in various applications [PO3, PO4, PO5].
- Apply skills learned in the course for problem solving [PO2, PO3, PO5]

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X	X	X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: A basic overview of discrete mathematics	PO1, PO12 / PSO1	U	F, C
2	CO2: Understand how the concepts are used in various applications	PO3, PO4, PO5 / PSO1, PSO2	U	F, C, P
3	CO3: Apply skills learned in the course for problem solving	PO2, PO3, PO5 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software development.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in discrete mathematics that become prerequisite for other subsequent courses.

Focus on entrepreneurship	No	-

PC110 Language and Literature (3-0-0-3)

Course Objective: This course is designed to introduce students to the study of the English language and literature at the undergraduate level. It follows a two-pronged approach, first, teaching the English language through literature; secondly, introducing the students to the world of literature and teaching them strategies of reading and comprehending.

Course Outcomes: After completion of this course, students should be able to:
- Upskills their language proficiency [PO4, PO6, PO8, PO12].
- Understand post-colonial literature [PO7, PO8, PO12].

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
			X		X	X	X				X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Upskills their language proficiency	PO4, PO6, PO8, PO12 / PSO1	U	F, C
2	CO2: Understand post-colonial literature	PO7, PO8, PO12 / PSO1, PSO2	U	F, C

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	Communication skills and language proficiency helps students in employment.
Focus on Skill development	Yes	The students develop necessary skills for communicative English, writing and presentation skills
Focus on entrepreneurship	No	-

MC125 Functions of Single Variable and ODEs (3-1-0-4)

Course Objective: The course provides foundational knowledge in functions of single variable and ODEs.

Course Outcomes: After completion of the course, students should be able to:
- Understand the basics of functions of two and more variables [PO1, PO12].
- Learn and apply series and sequences [PO2, PO4, PO5, PO12]
- Understand and apply ODEs [PO2, PO4, PO5, PO12]

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X		X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the basics of functions of two and more variables	PO1, PO12 / PSO1	U	F, C
2	CO2: Learn and apply series and sequences	PO2, PO4, PO5, PO12 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Understand and apply Vector calculus	PO2, PO4, PO5, PO12 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking this course can be employed to industries focusing on Maths and Computing.
Focus on Skill development	Yes	The students develop necessary foundational skills in functions of single variable and ODEs.
Focus on entrepreneurship	No	-

MC212 Database Management Systems (3-0-2-4)

Course objective: This course covers all essential topics in database management, in particular, relational databases. The exposure obtained by the students in this course serve as a required prerequisite to several elective courses in the areas of Software Engineering.

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

- Understand the principles of relational algebra and entity-relationship diagrams [PO1, PO2. PO4].

- Understand and apply the concepts of database design and implementation [PO2, PO4, PO5. PO12]

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X		X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the principles of relational algebra and entity-relationship diagrams	PO1, PO2, PO4 / PSO1	U	F, C
2	CO2: Understand and apply the concepts of database design and implementation	PO2, PO4, PO5, PO12 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand: Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking DBMS course can be employed to industries focusing on database and software development.
Focus on Skill development	Yes	The students develop necessary skills to work with real use cases using databases.
Focus on entrepreneurship	Yes	The students can work on real time projects focusing on development of small, medium and large enterprises through entrepreneurship/self-employability and start-ups.

MC215 Linear Algebra (3-1-0-4)

Course Objective: Vectors are an essential idea to understand numerous natural phenomena. Its applications start right from mechanics and electrostatics and magnetostatics. These applications use equations involving vectors. Such ideas are abstracted to study solutions of a system of linear equations in several variables.

Course Outcomes: After completion of the course, students should be able to:
- Solve systems of linear equations and understand the nature of the solutions [PO1, PO2, PO12].
- Demonstrate matrix representation of linear operators and understand the concepts through linear operators and matrices [PO1, PO2].
- Perform calculations with vectors, eigenvalues and eigenvectors in "n" dimensions [PO2, PO12].

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X										X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Solve systems of linear equations and understand the nature of the solutions	PO1, PO2, PO12 / PSO1	U, Ap	F, C
2	CO2: Demonstrate matrix representation of linear operators and understand the concepts through linear operators and matrices	PO1, PO2 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Perform calculations with vectors, eigenvalues and eigenvectors in "n" dimensions	PO2, PO12 / PSO1, PSO2	U, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on Machine Learning, Data Science.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in Linear Algebra that become

		prerequisite for other subsequent courses.
Focus on entrepreneurship	No	-

MC122 Object Oriented Programming (2-0-2-3)

Course Objective: This course introduces basic concepts of object-oriented programming principles, design techniques, and analysis tools.

Course Outcomes: After successful completion of the course, the student will have the ability to:

- Understand and apply the core concepts of object-oriented programming efficiently [PO1, PO12].
- Use Java-based tools/libraries and develop basic software applications [PO3, PO5].

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X		X		X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand and apply the core concepts of object-oriented programming efficiently	PO1, PO12 / PSO1	U	F, C
2	CO2: Use Java-based tools/libraries and develop basic software applications	PO3, PO5 / PSO1, PSO2	U, Ap	F, C, P

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the Programming course can be employed in industries focusing on coding, web development.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in OOPs and OODs.
Focus on entrepreneurship	Yes	The students apply their coding skills in entrepreneurship, start-up.

MC211Functions of Several Variables and PDEs (3-1-0-4)

Course Objective: The course provides foundational knowledge in functions of several variables and PDEs.

Course Outcomes: After completion of the course, students should be able to:
- Understand the basics of functions of two and more variables [PO1, PO12].
- Learn and apply series and sequences [PO2, PO4, PO5, PO12]
- Understand and apply Vector calculus [PO2, PO4, PO5, PO12]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X		X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1. Understand the basics of functions of two and more variables	PO1. PO12 / PSO1	U	F. C
2	CO2: Learn and apply series and sequences	PO2, PO4, PO5, PO12 / PSO1, PSO2	U, Ap	F. C. P
3	CO3: Understand and apply Vector calculus	PO2, PO4, PO5, PO12 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand: Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking this course can be employed to industries focusing on Maths and Computing.
Focus on Skill development	Yes	The students develop necessary foundational skills in functions of several variables.
Focus on entrepreneurship	No	-

MC124 Data Structures and Algorithms (3-0-2-4)

Course objective: The course aims to introduce the concept of data structures, and their indispensability in implementing algorithms and also how they aid in improving

performance. An extensive coverage of the well-known and important data structures and routines/algorithms associated with them will be covered.

Course Outcomes: After completion of this course, students should be able to:

- Understand basic and abstract data types [PO1, PO12].
- Analyze complexity of various data structures [PO2, PO3, PO4].
- Apply skills for solving problems [PO2, PO3, PO4]

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
X	X	X	X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand basic and abstract data types	PO1, PO12 / PSO1	U	F, C
2	CO2: Analyze complexity of various data structures	PO2, PO3, PO4 / PSO1, PSO2	U, An	F, C, P
3	CO3: Apply skills for solving problems	PO2, PO3, PO4 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software development, coding and computing.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in data structures that become prerequisite for other subsequent courses.
Focus on entrepreneurship	Yes	Data structure is a foundational course that helps in exploring startups, entrepreneurship.

HM106 Approaches to Indian Society (3-0-0-3)

Course Objective: This course aims to construct a comparative framework for the understanding of different cultures with particular reference to social organization, politics, religion and symbolism illustrated with various ethnographic examples. The course is designed to provide with the means to apply basic anthropological understandings of society and culture in the analysis of meanings, actions and explanations that is the basis for communication in the society. Students will be expected to reflect upon the Indian society utilizing the readings and lectures.

Course Outcomes: Upon passing the courses, students should have a:
- Basic critical and analytical understanding of how social and cultural diversity is approached in anthropology [PO1, PO7, PO12]
- How the diversity of culture, implicit in anthropological explanations, is to be understood [PO6, PO7, PO8].

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X					X	X	X				X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Basic critical and analytical understanding of how social and cultural diversity is approached in anthropology	PO1, PO7, PO12 / PSO1	U	F, C
2	CO2: How the diversity of culture, implicit in anthropological explanations, is to be understood	PO6, PO7, PO8 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	No	-
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in culture, society and identity.
Focus on entrepreneurship	No	-

MC216 Probability and Random Processes (3-1-0-4)

Course Objectives: This course aims to provide foundational knowledge in probability, random variables, and random processes.

Course Outcomes: After completing this course, a student

- Should be able to understand the basic concepts of probability, random variables, stochastic processes, and a few of their applications in various scientific, technological, and societal applications [PO1, PO12].
- Should have the capability to analyze, comprehend, design & develop engineering processes and systems for a variety of applications and thus demonstrating professional ethics & concern for societal wellbeing [PO2, PO3, PO4, PO11].

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X	X	X							X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Should be able to understand the basic concepts of linear algebra, probability, random variables, stochastic processes, and a few of their applications in various scientific, technological, and societal applications	PO1, PO12 / PSO1	U	F, C
2	CO2: Should have the capability to analyze, comprehend, design & develop engineering processes and systems for a variety of	PO2, PO3, PO4, PO11 / PSO1, PSO2	U, Ap, An	F, C, P

| | applications and thus demonstrating professional ethics & concern for societal wellbeing | | | |

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on machine learning, data science.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in linear algebra and random processes.
Focus on entrepreneurship	No	-

MC213 Design and Analysis of Algorithms (3-1-0-4)

Course Objective: This course intends to provide a rigorous introduction to fundamental techniques in the design and analysis of algorithms.

Course Outcomes: Students who complete the course should have the ability to do the following:

- Understand the correctness of algorithms using inductive proofs and invariants [PO1].
- Analyze worst-case running times of algorithms using asymptotic analysis. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms and analyze them [PO2].
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Synthesize dynamic programming algorithms, and analyze them [PO2,PO3].

- Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Synthesize greedy algorithms, and analyze them [PO2,PO3, PO4, PO12].

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X	X	X								X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the correctness of algorithms using inductive proofs and invariants	PO1 / PSO1	U	F, C
2	CO2: Analyze worst-case running times of algorithms using asymptotic analysis. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms and analyze them	PO2 / PSO1, PSO2	U, An	F, C, P
3	CO3: Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Synthesize dynamic programming algorithms, and analyze them	PO2, PO3 / PSO1, PSO2	U, An	F, C, P
4	CO4: Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Synthesize greedy algorithms, and analyze them	PO2, PO3, PO4, PO11 / PSO2, PSO3	Ap, An, E	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand, Ap: Apply, An: Analyze, E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual, C: Conceptual, P: Procedural, M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software development, coding and computing.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in Algorithms that become prerequisite for other subsequent courses.
Focus on entrepreneurship	Yes	Algorithms is a foundational course that helps in exploring startups, entrepreneurship.

MC214 Operating Systems (3-0-2-4)

Course Objective: The purpose of this course is to provide the students with an introduction to system-level programming in a UNIX/Linux environment. Students will be introduced with the standard Linux commands, memory management, interacting with the operating system by making system calls for file management, file execution, process control, and inter-process communication, shell scripting, Sockets and using TCP/IP, Shell principles, exec family of functions, naming conventions, and so on. A primary goal of the course then is to train the students in a systems programming context to develop code that is robust.

Course Outcomes:

● Understand the importance of system programming, kernel subsystems, types

of kerne , embedded and real time systems [PO1. PO2, PO12]

- Implement process scheduling policy and signaling mechanisms for real time and non-real time processes [PO2. PO5].
- Understand and implement I/O features device drivers. IPC [PO1. PO12].

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X			X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the importance of system programming, kernel subsystems, types of kernel, embedded and real time systems	PO1, PO2, PO12 / PSO1	U	F, C
2	CO2: Implement process scheduling policy and signaling mechanisms for real time and non-real time processes	PO2, PO5 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Understand and implement I/O features device drivers	PO1, PO12 / PSO1, PSO2	U, Ap, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software engineering, developer.

Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in operating systems.
Focus on entrepreneurship	No	-

MC221 Mathematical Statistics (3-1-0-4)

Course Objective: The objective of this course is to cover the basic methods of Statistical decision making. Initial lectures are devoted to strengthening the statistical foundation of students. Thereafter, different statistical decision making methods have been briefly introduced.

Course Outcomes: After completion of this course, students will

- Learn the fundamental concepts and the basic tools of statistics used in Data Science [PO1, PO12].
- Learn to use R/Python for implementation of the statistical tools [PO1, PO2, PO11].
- Acquire the skill to analyze data in a systematic and logical manner to answer important research questions arising in different disciplines [PO2, PO4].
- Know how to measure and attach a measure of uncertainty to the inference drawn from data [PO4, PO5].

COs-POs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X		X	X						X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Learn the fundamental concepts and the basic tools of statistics used in Data Science	PO1, PO12 / PSO1	U	F, C
2	CO2: Learn to use R/Python for implementation of the statistical tools	PO1, PO2, PO11 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Acquire the skill to analyze data in a systematic and logical manner to answer important research questions arising in different disciplines	PO2, PO4 / PSO1, PSO2	U, An	F, C, P
4	CO4: Know how to measure and attach a measure of uncertainty to the inference drawn from data	PO4, PO5 / PSO2	Ap, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on data science.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in statistical methods.
Focus on entrepreneurship	No	-

MC222 Theory of Computation (3-1-0-4)

Course Objective: The objective of this course is to discuss history of computing, models of computing, regular expressions.

Course Outcomes: After completion of this course, students should be:

- Learn the fundamental concepts models of computation [PO1, PO12]
- Understand and analyse automata and regular expressions [PO2, PO4, PO5].

CO-PO Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X		X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Learn the fundamental concepts models of computation	PO1, PO12 / PSO1	U	F, C
2	CO2: Understand and analyze automata and regular expressions	PO2, PO4, PO5 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries

		focusing on theory of computation.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in models of computation.
Focus on entrepreneurship	No	-

MC224 Parallel and Distributed Algorithms (3-1-0-4)

Course Objective: The objective of this course is to discuss history of computing, models of computing, regular expressions.

Course Outcomes: After completion of this course, students should be:

- Understand parallel algorithm models - Shared memory models and interconnection networks, performance of parallel algorithms, cost and optimality, dense algorithms [PO1, PO12].
- Learn and apply parallel query processing, dense LU factorization, comparator networks and sorting – OEMS, BSMS, analysis and applications of parallel algorithmic techniques, optimal list colouring, optimal list ranking, expression tree evaluation [PO2, PO4, PO5].

CO-PO Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X		X	X							X

Course Outcomes and Competencies

Sr No.	Course Outcome	PO/PSO	CP D	KD
1	CO1: Understand parallel algorithm models - Shared memory models and interconnection networks, performance of parallel algorithms. cost and optimality, dense algorithms	PO1. PO12 PSO1	U	F, C
2	CO2: Learn and apply parallel query processing, dense LU factorization, comparator networks and sorting – OEMS. BSMS, analysis and applications of parallel algorithmic techniques. optimal list colouring, optimal list ranking, expression tree evaluation	PO2, PO4, PO5 / PSO1, PSO2	U, Ap	F. C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on distributed systems.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in parallel and distributed algorithms.
Focus on entrepreneurship	No	-

MC225 Numerical and Computational Methods (3-0-2-4)

Course Objective: The course discusses the role of numerical methods for computational science.

Course Outcomes: After completion of this course, students should be able to:

- Understand the depth understanding of the fundamental numerical and mathematical concepts used in computational science [PO1, PO12].
- Ability to understand the precision issues that arise when applying iterative numerical methods to solve optimization problems [PO4, PO5].

CO-PO Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
X			X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the depth understanding of the fundamental numerical and mathematical concepts used in data science methods	PO1, PO12 / PSO1	U	F, C
2	CO2: Ability to understand the precision issues that arise when applying iterative numerical methods to solve optimization problems	PO4, PO5 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on computational and data science.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in numerical methods for computational problems.
Focus on entrepreneurship	No	-

MC222 Real and Complex Analysis (3-1-0-4)

Course Objective: The course provides foundational knowledge in real and complex analysis.

Course Outcomes: After completion of the course, students should be able to:
- Understand countable and uncountable sets, concepts of metric space, open ball, closed ball, limit point of a set, ordered set, lub, glb, compact set, Heine Borel theorem, Weierstrass theorem, Cantor set [PO1, PO12].
- Learn Cauchy's theorems on limits of sequences of real numbers, fundamental theorem of limits, Bolzano-Weierstrass theorem, criteria for convergent sequence, criteria for divergent sequence, Cauchy sequence [PO2, PO4, PO5, PO12]
- Understand and apply min-max theorem, location of root and Bolzano's theorem, uniform continuity [PO2, PO4, PO5, PO12]

POs COs Matrix.

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X		X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CP D	KD
1	CO1: Understand countable and uncountable sets, concepts of metric space, open ball, closed ball, limit point of a set, ordered set, lub, glb, compact set, Heine Borel theorem, Weierstrass theorem, Cantor set	PO1, PO12 / PSO1	U	F, C
2	CO2: Learn Cauchy's theorems on limits of sequences of real numbers, fundamental theorem of limits, Bolzano-Weierstrass theorem, criteria for convergent sequence, criteria for divergent sequence, Cauchy sequence	PO2, PO4, PO5, PO12 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Understand and apply min-max theorem, location of root and Bolzano's theorem, uniform continuity	PO2, PO4, PO5, PO12 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking this course can be employed to industries focusing on Maths and Computing.
Focus on Skill development	Yes	The students develop necessary foundational skills in real and complex analysis.
Focus on entrepreneurship	No	-

MC313 Algebraic Structures (3-1-0-4)

Course Objective: Algebraic structures are an essential idea to understand numerous natural phenomena.

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

- Solve systems of linear equations and understand the nature of the solutions [PO1, PO2, PO12].
- Demonstrate matrix representation of linear operators and understand the concepts through linear operators and matrices [PO1, PO2].
- Perform calculations with vectors, eigenvalues and eigenvectors in "n" dimensions [PO2, PO12].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X										X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Solve systems of linear equations and understand the nature of the solutions	PO1, PO2, PO12 / PSO1	U, Ap	F, C
2	CO2: Demonstrate matrix representation of linear operators and understand the concepts through linear operators and matrices	PO1, PO2 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Perform calculations with vectors, eigenvalues and eigenvectors in "n" dimensions	PO2, PO12 / PSO1, PSO2	U, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on Machine Learning, Data Science.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in Algebraic structures.
Focus on entrepreneurship	No	-

HM216 Science, Technology, Society (3-0-0-3)

Course objective: This course is designed to encourage students to understand, explore and critically analyze ways in which science and technology work in diverse social contexts. It draws its basic approaches from Science and Technology studies (STS) which is a growing field of interdisciplinary studies that seeks to understand how science and technology shape human lives and livelihoods and how society and culture, in turn, shape the development of science and technology.

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

- What are the debates STS studies raise about science and technology and society that compel us to question our received ideas and assumptions about science, technology and human progress? [PO1, PO12]
- How have the questions and problems raised by historical and sociological studies of science and technology informed our understanding of the career of modern science and technology in India? [PO4, PO6, PO7]
- What are the techno-social imaginaries that influence our attitude toward science and technology in contemporary times? [PO7, PO8]
- How do we deploy the benefits of science and technology to build more inclusive societies and economies? [PO6, PO10, PO12]

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X			X		X	X	X		X		X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: What are the debates STS studies raise about science and technology and society that compel us to question our received ideas and assumptions about science, technology and human progress?	PO1, PO12 / PSO1	U	F, C
2	CO2: How have the questions and problems raised by historical and sociological studies of science and technology informed our understanding of the career of modern science and technology in India?	PO4, PO6, PO7 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: What are the techno-social imaginaries that influence our attitude toward science and technology in contemporary times?	PO7, PO8 / PSO1, PSO2	U, Ap	F, C, P
4	CO4: How do we deploy the benefits of science and technology to build more inclusive societies and economies?	PO6, PO10, PO12 / PSO2, PSO3	Ap, An, E	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	No	-

Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in science, technology and society.
Focus on entrepreneurship	No	-

MC226 Environmental Studies (2-0-0-2)

Course objective: Sensitize students on various issues and problems of the environment affecting our society. Allow students to do hands-on exercise on a few specific problems related to the environment. Enable the student to conceive ICT based solutions to environmental problems. With the broad understanding of the environment and underlying principles, the students should be able to relate the changes and challenges of environment related issues.

Course Outcomes: After completion of the course, students should be able to:
- Understand the importance of the environment for our society [PO1, PO7, PO12].
- Visualize ICT based solutions to environmental problems [PO7, PO8].
- Relate the changes and challenges of environment related issues [PO7, PO8]

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X						X	X				X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the importance of the environment for our society	PO1, PO7, PO12 / PSO1	U	F, C
2	CO2: Visualize ICT based solutions to environmental problems	PO7, PO8 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Relate the changes and challenges of environment related issues	PO7, PO8 / PSO1	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	No	-
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in environmental science.
Focus on entrepreneurship	No	-

MC311 Mathematical Optimization (3-1-0-4)

Course Objective: The main purpose of this course is to provide the students working knowledge of optimization methods in a few selected areas.

Course Outcomes: After successful completion of the course the student will have the ability to:

- Understand and analyze complicated engineering and real-world situations by physical reasoning in terms of simple fundamental physical laws [PO1, PO12].
- Formulate mathematical models by applying abstract concepts to complex problems and solving the model using approximations if necessary [PO2, PO3, PO4].

CO-PO Matrix

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X	X	X								X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand and analyze complicated engineering and real-world situations by physical reasoning in terms of simple fundamental physical laws	PO1, PO12 / PSO1	U	F, C
2	CO2: Formulate mathematical models by applying abstract concepts to complex problems and solving the model using approximations if necessary	PO2, PO3, PO4 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on data science.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in optimization.
Focus on entrepreneurship	No	-

MC312 Modelling and Simulation (3-0-2-4)

Course Objective: The course aims to provide exposure in modelling and simulation.

Course Outcomes: After completion of this course, students should be able to:

- Understand modeling process, Modeling Concepts, Model Classifications, System Dynamics Models [PO1, PO12].
- Learn Stochastic Models, Discrete and Continuous distributions, Markov Chains, Limit theorem for Markov Chains in discrete and continuous time, Poisson processes [PO2, PO3, PO4, PO5].
- Understand Cellular Automata Simulations, Binary and probabilistic cellular automata, using spin system and applications [PO4, PO5].

CO-PO Matrix :

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X	X	X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand modeling process, Modeling Concepts, Model Classifications, System Dynamics Models	PO1, PO12 / PSO1	U	F, C
2	CO2: Learn Stochastic Models, Discrete and Continuous distributions, Markov Chains, Limit theorem for Markov Chains in discrete and continuous time, Poisson processes	PO2, PO3, PO4, PO5 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Understand Cellular Automata Simulations, Binary and probabilistic cellular automata, Ising spin system and applications	PO4, PO5 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on machine learning.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in machine learning.
Focus on entrepreneurship	Yes	Machine Learning offers enormous scope for entrepreneurship.

MC321 Machine Learning (3-0-2-4)

Course Objective. The course starts with linear regression and then discusses supervised and unsupervised learning.

Course Outcomes: After completion of this course, students will

- Develop a deep understanding of the fundamental mathematical and statistical concepts used in machine learning models [PO1, PO12].
- Develop the systematic and deep understanding of the popular machine learning models [PO4, PO5].
- Apply the variants of machine learning model to solve the real-time problems [PO4, PO5].

CO-PO Matrix :

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X			X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Develop a deep understanding of the fundamental mathematical and statistical concepts used in machine learning models	PO1, PO12 / PSO1	U	F, C
2	CO2: Develop the systematic and deep understanding of the popular machine learning models	PO4, PO5 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Apply the variants of machine learning model to solve the real-time problems	PO4, PO5 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on machine learning.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in machine learning.
Focus on entrepreneurship	Yes	Machine Learning offers enormous scope for entrepreneurship.

HM116 Principles of Economics (3-0-0-3)

Course Objective: This course provides students an understanding of what is Economics, the problems of Economic Organization, what, how and for whom to produce.

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

- Understand the functioning of different types of markets including Monopoly, Monopolistic competition, Oligopoly, and Perfect Competition and the corresponding equilibrium conditions in each market [PO1, PO6, PO12].
- Analyze market efficiencies, consumer surplus, producer surplus and social welfare in economic markets [PO6, PO7].
- Understand theory of labour markets and associated equilibrium wages, employment and unemployment rates with applications in the ICT industry [PO6, PO7].
- Apply macroeconomics principles to estimate the welfare of countries including

the determination of GDP, standard of living and unemployment rates [PO6, PO7 PO12].

POs COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
					X	X					X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the functioning of different types of markets including Monopoly, Monopolistic competition, Oligopoly, and Perfect Competition and the corresponding equilibrium conditions in each market	PO1, PO6, PO12 / PSO1	U	F, C
2	CO2: Analyze market efficiencies, consumer surplus, producer surplus and social welfare in economic markets	PO6, PO7 / PSO1, PSO2	U, An	F, C, P
3	CO3: Understand theory of labour markets and associated equilibrium wages, employment and unemployment rates with applications in the ICT industry	PO6, PO7 / PSO1	U	F, C
4	CO4: Apply macroeconomics principles to estimate the welfare of countries including the determination of GDP, standard of living and unemployment rates	PO6, PO7, PO12 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowedge Domain [F: Facual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	No	-
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in economics that helps students taking related elective courses.
Focus on entrepreneurship	No	-

Executive Registrar
DA-IICT, Gandhinag.

Dhirubhai Ambani
Institute of Information and Communication Technology

DA-IICT Road, Gandhinagar, Gujarat, India 382007.
Tel.: +91 79 6826 1700 I Fax: +91 79 6826 1710 I Web: www.daiict.ac.in

NAAC Accredited
Recipient of Centre of Excellence Award by the Government of Gujarat
Recipient of '5 Star' in GSIRF Ranking by Government of Gujarat

ENGINEERS WITH
SOCIAL RESPONSIBILITY

PROGRAM: MASTER OF TECHNOLOGY, M.TECH

PO No.	Program Outcomes
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO No.	Program Specific Outcomes (PSOs)
PSO1	To apply the theoretical concepts of computer engineering and practical knowledge in analysis, design and development of computing systems and interdisciplinary applications.
PSO2	To work as a socially responsible professional by applying ICT principles in real-world problems.

Course Outcomes (COs) – Program Outcomes (POs) · Program Specific Outcomes (PSOs)

PC512 Technical Writing and Communication Skills (2-0-0-2)

Course Objectives. In this course first-year M.Tech. students are introduced to the basics of technical writing and communication skills that are essential in their professional life. A set of guidelines on several important aspects of technical writing and presentations are discussed. Several technical writing exercises and technical presentations would be carried out using public-domain (free) software packages (esp. LaTeX and Beamer) for practical training of the students.

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

- Start reading technical literature and collecting material for their research projects [PO2, PO12].
- Present the research progress seminars, defend their thesis, and make technical presentations with confidence [PO8, PO9, PO10].
- Become familiar with writing memorandums, minutes, etc, in the corporate world [PO5, PO6].
- Work in small groups for presentation and discussions [PO11, PO12].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
	X			X	X		X	X	X	X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Start reading technical literature and collecting material for their research projects	PO2, PO12 / PSO1	U	F, C

| 2	CO2: Present the research progress seminars, defend their thesis, and make technical presentations with confidence	PO8, PO9, PO10 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Become familiar with writing memorandums, minutes, etc, in the corporate world	PO5, PO6 / PSO1	U	F, C, P
4	CO4: Work in small groups for presentation and discussions	PO11, PO12 / PSO1	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	Communication skills and language proficiency helps students in employment.
Focus on Skill development	Yes	The students develop necessary skills for communicative english, writing and presentation skills
Focus on entrepreneurship	No	-

PC503 Programming Lab (3-0-0-3)

This course aims to provide hands-on practice in software tools and technologies to MTech (ICT) and MTech (EC) students. The broad coverage of this course is as follows: Familiarity in Linux; Shell Programming; Programming tools (Make files, version control, debugger, GitHub). Problem solving and programming using Python, Introduction to Circuit Modelling and Analysis; System Design, Lab on Sampling and Quantization.
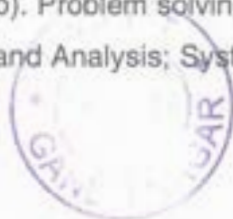
Course Outcomes:

- This course will give an opportunity to the MTech- CT (SS, ML, VLSI & ES) and MTech(EC) students to gain skills in Python, MATLAB, familiarity in programming and EDA tools Database and Web Development, Data Science, AI/ML, Web Scraping and GUI development [PO1, PO12].
- Students will learn SQL, HTML5, CSS3; Flask and Django for web application. Pandas, NumPy, and Matplotlib for DS (Data Science), Scikit-learn for ML (Machine Learning), Soup, Scrapy Spiders and tkinter for GUI (Graphical User Interfaces) [PO9].
- Students will acquire skills to deploy the code in prototype systems to solve real-world problems [PO5].
- This course will provide a platform to develop skills for which companies are interested in hiring professionals [PO6].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X			X	X			X	X	X	

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: This course will give an opportunity to the MTech-ICT (SS, ML, VLSI & ES) and MTech(EC) students to gain skills in Python, MATLAB, familiarity in programming and EDA tools, Database and Web Development, Data Science, AI/ML, Web Scraping and GUI development	PO1, PO12 / PSO1	U	F, C

2	CO2: Students will learn SQL, HTML5, CSS3; Flask and Django for web application, Pandas, NumPy, and Matplotlib for DS (Data Science), Scikit-learn for ML (Machine Learning), Soup, Scrapy Spiders and tkinter for GUI	PO9 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Students will acquire skills to deploy the code in prototype systems to solve real-world problems	PO5 / PSO1, PSO2	U, An	F, C, P
4	CO4: This course will provide a platform to develop skills for which companies are interested in hiring professionals	PO6 / PSO2	Ap, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on coding and web development.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in programming.
Focus on entrepreneurship	No	-

IT580 Advanced Algorithm (3-1-0-4)

This is an algorithms course with an emphasis on teaching techniques for the design and analysis of efficient algorithms, emphasizing methods of application. Topics include divide-and-conquer, randomization, dynamic programming, greedy algorithms, approximation algorithms, complexity theory etc.

Course Outcomes Students who complete the course should have the ability to do the following:

- Understand the correctness of algorithms using inductive proofs and invariants [PO1].
- Analyze worst-case running times of algorithms using asymptotic analysis. Describe the divide and conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms and analyze them [PO2].
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Synthesize dynamic programming algorithms, and analyze them [PO2,PO3].
- Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Synthesize greedy algorithms, and analyze them [PO2,PO3, PO4, PO12].

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X	X	X								X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the correctness of algorithms using inductive proofs and invariants	PO1 / PSO1	U	F, C
2	CO2: Analyze worst-case running times of algorithms using asymptotic analysis. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms and analyze them	PO2 / PSO1, PSO2	U, An	F, C, P

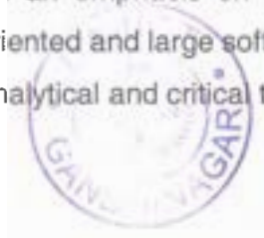| 3	CO3: Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Synthesize dynamic programming algorithms, and analyze tnem	PO2, PO3 / PSO1, PSO2	U An	F C P
4	CO4: Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Synthesize greedy algorithms, and analyze them	PO2, PO3, PO4, PO11 / PSO2	Ap, An, E	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software development, coding and computing.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in Algorithms that become prerequisite for other subsequent courses.
Focus on entrepreneurship	Yes	Algorithms is a foundational course that helps in exploring startups, entrepreneurship.

IT561 Advanced Software Engineering (3-0-2-4)

Course Objectives: The course focuses on tools and techniques for the development of software systems, with an emphasis on the construction and management of internet-oriented, agent-oriented and large software systems. The course is equipped with essential research, analytical and critical thinking skills.

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

- Understand software engineering principles and existing software process models [PO1, PO12].
- Develop software requirement specification documents for a given project using software requirement engineering principles [PO5, PO6].
- Implement software project management including project scheduling, software size metrics and cost estimation methods [PO11].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
X				X	X					X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand software engineering principles and existing software process models	PO1, PO12 / PSO1	U	F, C
2	CO2: Develop software requirement specification documents for a given project using software requirement engineering principles	PO5, PO6 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Implement software project management including project scheduling, software size metrics and cost estimation methods	PO11 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on Software Engineering.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in software engineering.
Focus on entrepreneurship	Yes	Software Engineering is an essential course for start-ups and entrepreneurship.

IT486 Blockchain and Cryptocurrencies (3-0-0-3)

Course Objective: Basics of blockchains and cryptocurrencies such as Bitcoin and their applications.

Course Outcomes: Upon completion of the course:

- Students should be able to understand properties of blockchains and their applications [PO1, PO2].
- Students should be able to understand the fundamental principles and algorithms underlying bitcoin [PO2, PO3, PO8].
- Students should be able to understand the limitations of cryptocurrencies such as bitcoin [PO5, PO8].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X		X			X				

Course Outcomes and Competencies

| Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Students should be able to understand properties of blockchains and their applications	PO1, PO2 / PSO1	U	F. C
2	CO2: Students should be able to understand the fundamental principles and algorithms underlying bitcoin	PO2, PO3, PO8 / PSO1, PSO2	U, Ap	F. C. P
3	CO3: Students should be able to understand the limitations of cryptocurrencies such as bitcoin	PO5, PO8 / PSO1, PSO2	U, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap. Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on blockchains.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in blockchains and its applications.
Focus on entrepreneurship	Yes	Blockchains found enormous scope in start-ups and entrepreneurship.

IT544 Modern Cryptography (3-0-2-4)

Course Objectives: Cryptography is concerned with the mathematical, algorithmic, and implementation aspects of information and network security.
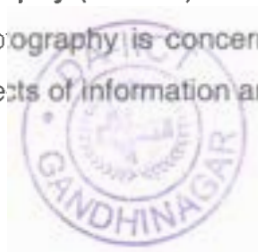
Course Outcomes: After completion of this course, students will be able to understand:

- Notion and Assumptions of security primitives [PO1, PO2, PO12].
- Design principles of security primitives and applications [PO3, PO4].
- Students will display a breadth of knowledge in applied cryptography and be able to build secure systems for real world problems. [PO3, PO5].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X	X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Notion and Assumptions of security primitives	PO1, PO2, PO12 / PSO1	U	F, C
2	CO2: Design principles of security primitives and applications	PO3, PO4 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Students will display a breadth of knowledge in applied cryptography and be able to build secure systems for real-world problems	PO3, PO5 / PSO1, PSO2	U, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on security engineering.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in cryptography and information security.
Focus on entrepreneurship	No	-

IT582 Foundations of Machine Learning (3-0-2-4)

Course Outcomes: After completion of this course, students will develop the deep understanding of the fundamental mathematical and statistical concepts used in machine learning models.

- Develop the systematic and deep understanding of the popular machine learning models [PO1, PO12].
- Learn to implement the machine learning models from scratch [PO4, PO5].
- Will be able to apply the variants of machine learning models to solve real-time problems [PO4, PO5].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X			X	X							

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Develop the systematic and deep understanding of the popular machine learning models	PO1, PO12 / PSO1	U	F, C

2	CO2: Learn to implement the machine learning models from scratch	PO4, PO5 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Will be able to apply the variants of machine learning models to solve real-time problems	PO4, PO5 / PSO1, PSO2	U, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on machine learning, data science.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in machine learning.
Focus on entrepreneurship	Yes	Machine Learning is an emerging area for start-ups and entrepreneurship.

IT585 Advanced Machine Learning (3-0-2-4)

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

- Understand some of the ML techniques in details [PO1, PO12].
- Read and Understand research papers in the domain of ML [PO2, PO3, PO10].
- Develop an ML model, implement it , deploy it, evaluate it and report about it for a given project [PO3, PO6, PO11].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X			X				X	X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand some of the ML techniques in details	PO1. PO12 / PSO1	U	F, C
2	CO2: Read and Understand research papers in the domain of ML	PO2, PO3. PO10 / PSO1, PSO2	U Ap	F, C, P
3	CO3: Develop an ML model, implement it , deploy it, evaluate it and report about it for a given project	PO3, PO6, PO11 / PSO1, PSO2	U, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply: An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on machine learning, data science.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in machine learning.
Focus on entrepreneurship	Yes	Machine Learning is an emerging area for start-ups and entrepreneurship.

IT524 Computer Vision (3-0-2-4)

Course Objective: This course will cover classical computer vision algorithms like shape from shading, stereovision, depth from defocus, optical flow and the mathematics behind them, as well as high level applications such as classification, detection and segmentation.

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

- Developing computer vision algorithms [PO1, PO12].
- Understanding, formulating and solving research problems in computer vision [PO2, PO3].
- Applying deep learning based solutions for real-world applications [PO4, PO5, PO9].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X	X	X				X			X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Developing computer vision algorithms	PO1, PO12 / PSO1	U	F, C
2	CO2: Understanding, formulating and solving research problems in computer vision	PO2, PO3 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Applying deep learning based solutions for real-world applications	PO4, PO5, PO9 / PSO1, PSO2	U, An	F, C, P

CL. Cognitive Process Domain [R Remember, U Understand Ap. Apply An: Analyze: E: Evaluate. C. Crete]

KC Knowledge Domain [F: Factual: C. Conceptual: P Procedural: M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on computer vision, image processing.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in computer vision.
Focus on entrepreneurship	Yes	Computer Vision is an emerging area for start-ups and entrepreneurship.

VLSI System Design (3-0-2-4)

The course aims to impart basics of VLSI circuit and system designs. This will be covered by incorporating various practical examples. Different combinational and sequential circuit designs and their co-integration for system implementation will be taught.

Course Outcomes: After successful completion of this course, students should be able to:

- Understand the concept of MOS transistors, circuit design, their applications in the field of VLSI and semiconductor technology [PO1, PO2, PO3, PO4].
- The students shall be able to design different circuits with optimization with respect to different parameters such as speed, power and area [PO3, PO4, PO12].
- Use of EDA tools and their efficient execution to implement the system design [PO5].

POs COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X	X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the concept of MOS transistors, circuit design, their applications in the field of VLSI and semiconductor technology	PO1, PO2, PO3, PO4 / PSO1	U	F, C
2	CO2: The students shall be able to design different circuits with optimization with respect to different parameters such as speed, power and area	PO3, PO4, PO12 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Use of EDA tools and their efficient execution to implement the system design	PO5 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on VLSI.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in basic electronics, VLSI.
Focus on entrepreneurship	No	-

EL504 Selected Topics in VLSI (3-0-2-4)

Course Outcomes: Learn about the various ASIC architectures, ASIC design flow, issues in ASIC design and verification and its fix. The following are the highlights:

        Describe architecture based on application specifications. Identify circuit topology. [PO1, PO4, PO6, PO12]

        Derive, design and define circuit parameters. [PO3, PO4]

·   Perform synthesis, process design flow, CTS, routing etc. [PO1 PO5]

        Verifying and validating the integrated circuit at various stages of design. [PO5]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
X		X	X	X	X		X	X	X	X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Describe architecture based on application specifications. Identify circuit topology	PO1, PO4, PO6, PO12 / PSO1	U	F, C
2	CO2: Derive, design and define circuit parameters	PO3, PO4 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Perform synthesis, process design flow, CTS, routing etc	PO1- PO5 / PSO1, PSO2	U, An	F, C, P
4	CO4: Verifying and validating the integrated circuit at various stages of design	PO5 / PSO2	Ap, An, E	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]
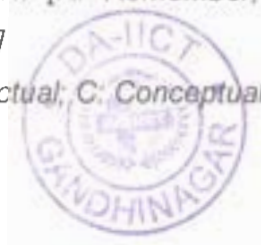
Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on VLSI.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in basic electronics, VLSI.
Focus on entrepreneurship	No	-

IT 584 Approximation Algorithms (3-1-0-4)

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

- Understand the notion of hard problems and need of approximation algorithms [PO1, PO12]
- Understand techniques to design approximation algorithms for various problems [PO2, PO4, PO11]
- Analyze approximation algorithms for different problems [PO2, PO4, PO10, PO11]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X		X						X	X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the notion of hard problems and need of approximation algorithms	PO1, PO12 / PSO1	U	F, C

2	CO2: Understand techniques to design approximation algorithms for various problems	PO2, PO4, PO11 / PSO1. PSO2	U Ap	F. C. P
3	CO3: Analyze approximation algorithms for different problems	PO2, PO4, PO10, PO11 / PSO1, PSO2	U. An	F. C. P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software development and computing.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in Algorithms that become prerequisite for other subsequent courses.
Focus on entrepreneurship	No	-

CT546 Introduction to Wireless Communication Systems (3-0-2-4)

The course CT546 introduces the student to the principles and the engineering practices that drive today's wireless communication systems.

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

- The course introduces the students to the engineering knowledge of the mathematics and engineering fundamentals of the next generation wireless

communication systems [PO1 PO12].

- The students engage in the analysis and design of the basic modules of a communication system [PO2, PO3].
- Through the Lab and the Project works that are team-based and require a formal presentation by the students, they acquire the team-work and the technical communication skills [PO9, PO10].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X	X	X				X	X		

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: The course introduces the students to the engineering knowledge of the mathematics and engineering fundamentals of the next generation wireless communication systems	PO1, PO12 / PSO1	U	F, C
2	CO2: The students engage in the analysis and design of the basic modules of a communication system	PO2, PO3 / PSO1, PSO2	U, An	F, C, P
3	CO3: Through the Lab and the Project works that are team-based and require a formal presentation by the students, they acquire the team-work and the technical communication skills	PO9, PO10 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication engineering.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in wireless communication..
Focus on entrepreneurship	No	-

CT 516 Advanced Digital Communication (3-0-2-4)

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

- Understand the mathematical concepts required for modeling and study of digital communication systems [PO1, PO12].
- Study the effect of noise on the communication systems [PO3].
- Quantify information and decide on the resource required to transmit and receive data [PO3].
- Simulate communication systems and do a performance study [PO3].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X		X									X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the mathematical concepts required for modeling and study of digital communication systems	PO1, PO12 / PSO1	U	F, C

2	CO2: Study the effect of noise on the communication systems	PO3 / PSO1, PSO2	U	F, C
3	CO3: Quantify information and decide on the resource required to transmit and receive data	PO3 / PSO1, PSO2	U, An	F, C, P
4	CO4: Simulate communication systems and do a performance study	PO3 / PSO2	Ap, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication engineering.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in digital communication..
Focus on entrepreneurship	No	-

SC532 Linear Algebra, Random Variables and Random Processes (3-0-0-3)

Course Objective: This course is designed to revise the knowledge of linear algebra and probability, random variables, and random processes to the incoming M.Tech. students.

Course Outcomes: After completing this course, a student

- Should be able to understand the basic concepts of linear algebra, probability, random variables, stochastic processes, and a few of their applications in various scientific, technological, and societal applications [PO1, PO12].

- Should have the capability to analyze, comprehend, design & develop engineering processes and systems for a variety of applications and thus demonstrating professional ethics & concern for societal wellbeing [PO2, PO3, PO4, PO11].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X	X							X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Should be able to understand the basic concepts of linear algebra, probability, random variables, stochastic processes, and a few of their applications in various scientific, technological, and societal applications	PO1, PO12 / PSO1	U	F, C
2	CO2: Should have the capability to analyze, comprehend, design & develop engineering processes and systems for a variety of applications and thus demonstrating professional ethics & concern for societal wellbeing	PO2, PO3, PO4, PO11 / PSO1, PSO2	U, Ap, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on machine learning, data science.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in linear algebra and random processes.
Focus on entrepreneurship	No	-

CT505 Detection and Estimation Theory (3-0-0-3)

Course Objectives: Different problems in signal processing and communication involve detection and processing of the signals to make inference. In a practical scenario, the signals could be noisy. The objective of this course is to provide fundamental and theoretical concepts to develop frameworks such that the inference problem can be addressed in those areas.

Course Outcomes: After completion of this course, students should be able to:
- Understand the methods of estimating parameters of observed signals. [PO1, PO12]
- Formulate models for signal estimation and detection. [PO2]
- Analyze the existing detection and estimation methods for further improvements. [PO2, PO3, PO4, PO5]
- Work in a group for a project, and present their work to the engineering community [PO9, PO10].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X	X	X				X	X		X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the methods of estimating parameters of observed signals.	PO1, PO12 / PSO1	U	F, C
2	CO2: Formulate models for signal estimation and detection.	PO2 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Analyze the existing detection and estimation methods for further improvements	PO2, PO3, PO4, PO5 / PSO1, PSO2	U, An	F, C, P
4	CO4: Work in a group for a project, and present their work to the engineering community	PO9, PO10 / PSO2	Ap, An, E	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication engineering.
Focus on Skill development	Yes	The students develop necessary skills to

		develop knowledge in detection and estimation theory and its applications.
Focus on entrepreneurship	No	-

PC 874 Research Methodology (3-0-0-3)

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

- Start reading technical literature and collecting material for their research projects [PO1, PO2, PO3, PO12].
- Present the research progress seminars, defend their thesis, and make technical presentations with confidence [PO4, PO5, PO6]
- Write papers, proposals, and technical reports [PO8, PO9, PO10, PO11].
- Work in small groups for presentation and discussions [PO8, PO9, PO10, PO11].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X	X	X	X		X	X	X	X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Start reading technical literature and collecting material for their research projects	PO1, PO2, PO3, PO12 / PSO1	U	F, C
2	CO2: Present the research progress seminars, defend their thesis, and make technical presentations with confidence	PO4, PO5, PO6 / PSO1, PSO2	U, Ap	F, C, P

| 3 | CO3: Write papers, proposals, and technical reports | PO8-PO11 / PSO1, PSO2 | U, An | F, C, P |
| 4 | CO4: Work in small groups for presentation and discussions | PO8-PO11 / PSO2 | Ap, An, E | F, C, P |

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	No	-
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in writing and presentation.
Focus on entrepreneurship	No	-

Executive Registrar
DA-IICT, Gandhinagar

Dhirubhai Ambani
Institute of Information and Communication Technology

DA-IICT Road, Gandhinagar, Gujarat, India 382007.
Tel.: +91 79 6826 1700 I Fax: +91 79 6826 1710 I Web: www.daiict.ac.in

NAAC Accredited
Recipient of Centre of Excellence Award by the Government of Gujarat
Recipient of '5 Star' in GSIRF Ranking by Government of Gujarat

ENGINEERS WITH
SOCIAL RESPONSIBILITY

PROGRAM: MASTER OF SCIENCE IN INFORMATION TECHNOLOGY, M.SC (IT)

PO No.	Program Outcomes
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO No.	Program Specific Outcomes (PSOs)
PSO1	To apply the theoretical concepts of information technology and practical knowledge in analysis, design and development of computing systems and interdisciplinary applications.
PSO2	To work as a socially responsible professional by applying IT principles in real-world problems.

Course Outcomes (COs) Program Outcomes (POs) - Program Specific
Outcomes (PSOs)

SC612 Discrete Mathematics 3-1-0-4

Course objective: Students are expected to learn logical reasoning to solve a variety
of problems to learn different proof methods, algorithms to solve problems. and to
learn discrete probability and number theory to solve problems.

Course Outcomes: After completion of the course, the students should acquire:

- A basic overview of discrete mathematics [PO1, PO12]
- Understand how the concepts are used in various applications [PO3, PO4, PO5].
- Apply skills learned in the course for problem solving [PO2, PO3, PO5]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
X	X	X	X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: A basic overview of discrete mathematics	PO1, PO12 / PSO1	U	F, C
2	CO2: Understand how the concepts are used in various applications	PO3, PO4, PO5 / PSO1, PSO2	U	F, C, P
3	CO3: Apply skills learned in the course for problem solving	PO2, PO3, PO5 / PSO1, PSO2	U, Ap	F, C, P

*CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An:
Analyze; E: Evaluate; C: Crete]*

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software development.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in discrete mathematics that become prerequisite for other subsequent courses.
Focus on entrepreneurship	No	-

IT603 C Programming 3-0-2-4

Course objective: This course aims to introduce problem solving techniques using C programming to help the students to develop analytical and logical skills. The course starts with basic concepts of computer programming and follows in building up knowledge in program development, deployment and testing to solve computational problems. The course also provides visualization of memory and time requirements for solving problems using C programming language. The coverage of this course includes problem solving techniques, flow charts, algorithms development, pseudo codes, and implementation of algorithms using C programming.

Course Outcomes: After completion of this course, students should be able to:
- Understand the basic programming skills in C. [PO1, PO12]
- Understand the syntax and semantics of flow-chart, data types and structured programming. [PO1, PO4]
- Apply skills in problem solving techniques. [PO2, PO3, PO4]

POs and COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X		X								X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the basic programming skills in C	PO1, PO12 / PSO1	U	F. C
2	CO2: Understand the syntax and semantics of flow-chart, data types and structured programming	PO1, PO4 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Apply skills in problem solving techniques.	PO1, PO3, PO4 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the Programming course can be employed in industries focusing on coding, web development.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in basic programming skills that become prerequisite for other subsequent courses..

Focus on entrepreneurship	Yes	The students apply their coding skills in entrepreneurship, start-up.

IT616 Algorithms and Data Structures 3-1-0-4

Course objective: The course aims to introduce the concept of data structures, and their indispensability in implementing algorithms and also how they aid in improving performance. An extensive coverage of the well-known and important data structures and routines/algorithms associated with them will be covered.

Course Outcomes: After completion of this course, students should be able to:
- Understand basic and abstract data types [PO1, PO12].
- Analyze complexity of various data structures [PO2, PO3, PO4].
- Apply skills for solving problems [PO2, PO3, PO4]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
X	X	X	X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand basic and abstract data types	PO1, PO12 / PSO1	U	F, C
2	CO2: Analyze complexity of various data structures	PO2, PO3, PO4 / PSO1, PSO2	U, An	F, C, P
3	CO3: Apply skills for solving problems	PO2, PO3, PO4 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software development, coding and computing.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in data structures that become prerequisite for other subsequent courses.
Focus on entrepreneurship	Yes	Data structure is a foundational course that helps in exploring startups, entrepreneurship.

IT615 Database Management Systems 3-0-2-4

Course objective: This course covers all essential topics in database management, in particular, relational databases. The exposure obtained by the students in this course serve as a required prerequisite to several elective courses in the areas of Software Engineering.

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

• Understand the principles of relational algebra and entity-relationship diagrams [PO1, PO2, PO4].

• Understand and apply the concepts of database design and implementation [PO2, PO4, PO5, PO12]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X		X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the principles of relational algebra and entity-relationship diagrams	PO1, PO2, PO4 / PSO1	U	F, C
2	CO2: Understand and apply the concepts of database design and implementation	PO2, PO4, PO5, PO12 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking DBMS course can be employed to industries focusing on database and software development.
Focus on Skill development	Yes	The students develop necessary skills to work with real use cases using databases.
Focus on entrepreneurship	Yes	The students can work on real time projects focusing on development of small, medium and large enterprises through entrepreneurship/self-employability and start-ups.

PC613 Communication Skills 3-0-2-4

Course Objectives: The course trains students with communication skills that are essential in their professional life.

Course Outcomes. After completion of this course, students should be able to:

- Upskills their English proficiency [PO6, PO8, PO12]
- Work in group discussion and presentations [PO7, PO8, PO11, POP12]

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
					X	X	X		X	X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Upskills their english proficiency	PO6, PO8, PO12 / PSO1	U	F, C
4	CO2: Work in group discussion and presentations	PO7, PO8, PO11, PO12 / PSO2	Ap, An, E	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	Communication skills and language proficiency helps students in employment.
Focus on Skill development	Yes	The students develop necessary skills for communicative english, writing and presentation skills
Focus on entrepreneurship	No	-

IT602 Object Oriented Programming 3-0-2-4

Course Objective: This course introduces basic concepts of object-oriented programming principles, design techniques, and analysis tools.

Course Outcomes: After successful completion of the course, the student will have the ability to:

- Understand and apply the core concepts of object-oriented programming efficiently [PO1, PO12].
- Use Java-based tools/libraries and develop basic software applications [PO3, PO5].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X		X		X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand and apply the core concepts of object-oriented programming efficiently	PO1, PO12 / PSO1	U	F, C
2	CO2: Use Java-based tools/libraries and develop basic software applications	PO3, PO5 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the Programming course can be employed in industries focusing on coding, web development.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in OOPs and OODs.
Focus on entrepreneurship	Yes	The students apply their coding skills in entrepreneurship, start-up.

IT632 Software Engineering 3-0-2-4

Course objective: The Software Engineering course introduces the basic principles, practices, tools and techniques required to engineer large complex software systems.

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

- Understand software engineering principles and existing software process models [PO1, PO12].
- Develop software requirement specification documents for a given project using software requirement engineering principles [PO5, PO6].
- Implement software project management including project scheduling, software size metrics and cost estimation methods [PO11].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X				X	X					X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand software engineering principles and existing software process models	PO1, PO12 / PSO1	U	F, C
2	CO2: Develop software requirement specification documents for a given project using software requirement engineering principles	PO5, PO6 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Implement software project management including project scheduling, software size metrics and cost estimation methods	PO11 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on Software Engineering.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in software engineering.
Focus on entrepreneurship	Yes	Software Engineering is an essential course for start-ups and entrepreneurship.

IT628 Systems Programming 3-0-2-4

Course Outcomes:

- Understand the importance of system programming, kernel subsystems, types of kernel, embedded and real time systems [PO1, PO2, PO12].
- Implement process scheduling policy and signaling mechanisms for real time and non-real time processes [PO2, PO5].
- Understand and implement I/O features device drivers [PO1, PO12].

POs-COs Matrix:

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
X	X			X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the importance of system programming, kernel subsystems, types of kernel, embedded and real time systems	PO1, PO2, PO12 / PSO1	U	F, C
2	CO2: Implement process scheduling policy and signaling mechanisms for real time and non-real time processes	PO2, PO5 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Understand and implement I/O features device drivers	PO1, PO12 / PSO1, PSO2	U, Ap, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software engineering, developer.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in systems programming.
Focus on entrepreneurship	No	-

IT694 Computer Networks 3-0-2-4

Course Outcomes:

- Understand digital information flow from source to destination over OSI and TCP stack [PO1, PO12].
- Understand the network protocol stacks in the Internet [PO1, PO3].
- Determine and implement appropriate medium access control protocol to avoid collision of packets during transmission in a given medium [PO3, PO4].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
X		X	X								X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand digital information flow from source to destination over OSI and TCP stack	PO1, PO12 / PSO1	U	F, C

| 2 | CO2: Understand the network protocol stacks in the Internet | PO1, PO3 / PSO1, PSO2 | U | F, C, P |
| 3 | CO3: Determine and implement appropriate medium access control protocol to avoid collision of packets during transmission in a given medium | PO3, PO4 / PSO1, PSO2 | U, Ap | F, C, P |

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on Software Engineering, Network Administrator.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in computer networks
Focus on entrepreneurship	No	-

IT629 Web Programming 3-0-2-4

Course Objective: The objective of this course is to provide an overview of the building blocks of a functional webpage and to understand the frontend and backend technologies that power the modern websites. Students will learn to develop dynamic web pages and make use of the web services through Javascript-enabled frontend framework, ReactJS and backend of NodeJS.

Course Outcomes: After completion of the course, students should be able to:
● Understand the basic principles of web development [PO1, PO4, PO12].

- Learn Javascripts, backend and frontend technologies [PO4, PO7, PO11].
- Develop web applications [PO1, PO11].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X	X		X			X				X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the basic principles of web development	PO1, PO4, PO12 / PSO1	U	F, C
2	CO2: Learn Javascripts, backend and frontend technologies	PO4, PO7, PO11 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Develop web applications	PO1, PO11 / PSO1, PSO2	U, Ap, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software developer, web developer.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in web development

Focus on entrepreneurship	Yes	The students taking this course will be equipped with the required exposure for initiating start-ups, entrepreneurship

IT619 Design of Software Systems 3-0-2-4

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

- Understand and apply object-oriented design techniques [PO1, PO12].
- Understand design principles of software systems [PO5, PO6].
- Select and use appropriate software design patterns [PO2, PO6, PO12].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X				X	X						X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand and apply object-oriented design techniques	PO1, PO12 / PSO1	U	F, C
2	CO2: Understand design principles of software systems	PO5, PO6 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Select and use appropriate software design patterns	PO2, PO6, PO12 / PSO1, PSO2	U, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software developer, web developer.
Focus on . Skill development	Yes	The students develop necessary skills to develop knowledge in web development
Focus on entrepreneurship	No	-

IT618 Enterprise Computing 3-0-2-4

Course Objective: This course aims to teach J2EE technologies for building scalable enterprise applications.

Course Outcomes: After completion of the course, students should be able to:
- Understand the basic principles of web development [PO1, PO4, PO12].
- Learn J2EE technologies [PO4, PO7, PO11].
- Develop components of enterprise applications [PO1, PO11].

POs-COs Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X	X		X			X				X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the basic principles of web development	PO1, PO4, PO12 / PSO1	U	F, C
2	CO2: Learn J2EE technologies	PO4, PO7, PO11 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Develop components of enterprise applications	PO1, PO11 / PSO1, PSO2	U, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software developer, web developer.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in enterprise applications.
Focus on entrepreneurship	Yes	The students taking this course will be equipped with the required exposure for initiating start-ups, entrepreneurship.

Executive Registrar
DA-IICT, Gandhinagar

Dhirubhai Ambani
Institute of Information and Communication Technology

DA-IICT Road, Gandhinagar, Gujarat, India 382007.
Tel.: +91 79 6826 1700 I Fax: +91 79 6826 1710 I Web: www.daiict.ac.in

NAAC Accredited
Recipient of Centre of Excellence Award by the Government of Gujarat
Recipient of '5 Star' in GSIRF Ranking by Government of Gujarat

ENGINEERS WITH
SOCIAL RESPONSIBILITY

PROGRAM: MASTER OF SCIENCE IN DATA SCIENCE, M.SC (DS)

PO No.	Program Outcomes
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs) – Program Outcomes (POs) – Program Specific Outcomes (PSOs)

PSO No.	Programme Specific Outcomes (PSOs)
PSO1	To model computational problems by applying mathematical concepts and solving real-world problems using algorithmic techniques.
PSO2	To apply the mathematical and statistical approaches for analyzing, designing and development of computing systems in interdisciplinary applications.
PSO3	To work as a socially responsible professional by drawing statistical inference using software tools in real-world problems.

SC613 Mathematical Foundation for Data Science (3-1-0-4)

Course Objective: To provide a strong foundation of the important mathematical concepts for modern data sciences, to be covered in two modules:

- Probability and Random Variables and

- Linear Algebra

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

- Course forms the foundation of most methods used in data science and machine learning [PO1, PO12].

- To help develop a better intuition for machine learning algorithms and not treat them as black boxes [PO2, PO4].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X	X		X								X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Course forms the foundation of most methods used in data science and machine learning	PO1, PO12 / PSO1	U	F, C
2	CO2: To help develop a better intuition for machine learning algorithms and not treat them as black boxes	PO2, PO4 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on data science, machine learning.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in data science and linear algebra.
Focus on entrepreneurship	No	-

IT605 Data Structures and Algorithms (Lab:Python) (3-0-2-4)

Course Objective :

- Learn different data structures such as arrays, linked list, queue, stack, trees, graphetc.
- Learn algorithms implementation to perform a specific task using these data structures.
- Learn how to measure the execution time of some of these algorithms using asymptotic notation.

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

- Understand basic and abstract data types [PO1, PO12].
- Analyze complexity of various data structures [PO2, PO3, PO4].
- Apply skills for solving problems [PO2, PO3, PO4]

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X	X	X	X							X

Course Outcomes and Competencies

Sr. No	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand basic and abstract data types	PO1, PO12 / PSO1	U	F, C
2	CO2: Analyze complexity of various data structures	PO2, PO3, PO4 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Apply skills for solving problems	PO2, PO3, PO4 / PSO1, PSO2	U, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C. Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on software development, coding and computing.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in data structures that become prerequisite for other subsequent courses.
Focus on entrepreneurship	Yes	Data structure is a foundational course that helps in exploring startups, entrepreneurship.

SC614 Statistical Methods (Lab:R) (3-0-2-4)

Course Objective: The objective of this course is to cover the basic methods of Statistical decision making. Initial lectures are devoted to strengthening the statistical foundation of students. Thereafter, different statistical decision making methods have been briefly introduced.

Course Outcomes: After completion of this course, students will

- Learn the fundamental concepts and the basic tools of statistics used in Data Science [PO1. PO12].
- Learn to use R/Python for implementation of the statistical tools [PO1 PO2. PO11].
- Acquire the skill to analyze data in a systematic and logical manner to answer important research questions arising in different disciplines [PO2. PO4].
- Know how to measure and attach a measure of uncertainty to the inference drawn from data [PO4, PO5].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X	X		X	X							

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Learn the fundamental concepts and the basic tools of statistics used in Data Science	PO1, PO12 / PSO1	U	F, C
2	CO2: Learn to use R/Python for implementation of the statistical tools	PO1, PO2, PO11 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Acquire the skill to analyze data in a systematic and logical manner to answer important research questions arising in different disciplines	PO2, PO4 / PSO1, PSO2	U, An	F, C, P

4	CO4: Know how to measure and attach a measure of uncertainty to the inference drawn from data	PO4, PO5 / PSO2	Ap, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on data science.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in statistical methods.
Focus on entrepreneurship	No	-

IT606 Programming Lab (0-0-4-2)

Course Objective: This course focuses on the core syntax and semantics of the Python programming language. The course also helps in working with structuring the data using lists, dictionaries, tuples and sets. This course provides the ability to the students to analyze and criticize the data using Python.

Course Outcomes: After completion of this course, students should be able to:
- Understand Python programming basics. [PO1, PO12]
- Represent compound data using Python lists, tuples, and dictionaries. [PO4, PO5]
- Develop ML models and perform the analysis of data using NumPy, pandas and matplotlib [PO3, PO4, PO12]

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
X		X	X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand Python programming basics	PO1, PO12 / PSO1	U	F, C
2	CO2: Represent compound data using Python lists, tuples, and dictionaries	PO4, PO5 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Develop ML models and perform the analysis of data using NumPy, pandas and matplotlib	PO3, PO4, PO12 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on coding, software development.

Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in Python programming.
Focus on entrepreneurship	No	-

IT607 Database Management Systems (3-0-2-4)

Course objective: This course covers all essential topics in database management, in particular, relational databases. The exposure obtained by the students in this course serve as a required prerequisite to several elective courses in the areas of Software Engineering.

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

• Understand the principles of relational algebra and entity-relationship diagrams [PO1, PO2, PO4].

• Understand and apply the concepts of database design and implementation [PO2, PO4, PO5, PO12].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X		X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the principles of relational algebra and entity-relationship diagrams	PO1, PO2, PO4 / PSO1	U	F, C

2	CO2: Understand and apply the concepts of database design and implementation	PO2, PO4, PO5, PO12 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking DBMS course can be employed to industries focusing on database and software development.
Focus on Skill development	Yes	The students develop necessary skills to work with real use cases using databases.
Focus on entrepreneurship	Yes	The students can work on real time projects focusing on development of small, medium and large enterprises through entrepreneurship/self-employability and start-ups.

IT608 Machine Learning (3-0-2-4)

Course Objective: The course starts with linear regression and then discusses supervised and unsupervised learning.

Course Outcomes: After completion of this course, students will

- Develop a deep understanding of the fundamental mathematical and statistical concepts used in machine learning models [PO1, PO12].
- Develop the systematic and deep understanding of the popular machine learning models [PO4, PO5].
- Apply the variants of machine learning model to solve the real-time problems [PO4, PO5].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X			X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Develop a deep understanding of the fundamental mathematical and statistical concepts used in machine learning models	PO1, PO12 / PSO1	U	F, C
2	CO2: Develop the systematic and deep understanding of the popular machine learning models	PO4, PO5 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Apply the variants of machine learning model to solve the real-time problems	PO4, PO5 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on machine learning.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in machine learning.

Focus on entrepreneurship	Yes	Machine Learning offers enormous scope for entrepreneurship.

SC602 Numerical Methods for Data Science (3-0-2-4)

Course Objective: The course discusses the role of numerical methods for data analysis problems.

Course Outcomes: After completion of this course, students should be able to:
- Understand the depth understanding of the fundamental numerical and mathematical concepts used in data science methods [PO1, PO12].
- Ability to understand the precision issues that arise when applying iterative numerical methods to solve optimization problems [PO4, PO5].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X			X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the depth understanding of the fundamental numerical and mathematical concepts used in data science methods	PO1, PO12 / PSO1	U	F, C
2	CO2: Ability to understand the precision issues that arise when applying iterative numerical methods to solve optimization problems	PO4, PO5 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on data science.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in Numerical methods for data science.
Focus on entrepreneurship	No	-

IT609 Big-Data Processing (2-0-2-3)

Course Objective: The course discusses Big-data processing and storage techniques using industry relevant tools and techniques.

Course Outcomes: After completion of this course, students should be able to
- Explain why traditional data processing techniques do not work on big data problems [PO1, PO4].
- Work on some of popular large data processing frameworks like hadoop, spark, and some of no-sql databases [PO1, PO4, PO5].
- Appreciate techniques for iterative data access for data mining tasks [PO1, PO12].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X			X	X							X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Explain why traditional data processing techniques do not work on big data problems	PO1, PO4 / PSO1	U	F, C
2	CO2: Work on some of popular large data processing frameworks like hadoop, spark, and some of no-sql databases	PO1, PO4, PO5 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Appreciate techniques for iterative data access for data mining tasks	PO1, PO12 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on Big-Data, Analytics.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in big-data processing.
Focus on entrepreneurship	Yes	Big-Data, Data Analytics provide enough opportunities for entrepreneurship.

SC601 Optimization (2-0-2-3)

Course Objective: The main purpose of this course is to provide the students working knowledge of optimization methods in a few selected areas.

Course Outcomes: After successful completion of the course the student will have the ability to:

- Understand and analyze complicated engineering and real-world situations by physical reasoning in terms of simple fundamental physical laws [PO1, PO12].
- Formulate mathematical models by applying abstract concepts to complex problems and solving the model using approximations if necessary [PO2, PO3, PO4]

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X	X	X	X								X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand and analyze complicated engineering and real-world situations by physical reasoning in terms of simple fundamental physical laws	PO1, PO12 / PSO1	U	F, C
2	CO2: Formulate mathematical models by applying abstract concepts to complex problems and solving the model using approximations if necessary	PO2, PO3, PO4 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitual]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on data science.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in optimization.
Focus on entrepreneurship	No	-

IT641 Deep Learning (3-0-2-4)

Course Outcomes:

- Students will obtain conceptual or physical and mathematical knowledge sufficiently in-depth such that students will be able to understand and solve various data mining problems using deep learning techniques. The student will work effectively and efficiently as an individual or with the team in various multi-disciplinary data analysis projects [PO1, PO2, PO12].

- Students will be able to understand the complex data mining problem and then identify or develop optimal deep learning techniques to solve the problem. They will be able to review the technical or research literature, may identify new data mining problems that can be better solved using deep learning techniques and possibly the advancement or development of better deep learning techniques [PO2, PO3, PO4, PO5].

- Students will explore projects in data mining, artificial intelligence and machine learning expertise or go for higher education and research in the related domain [PO4, PO6].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X	X	X	X	X	X						X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1. Students will obtain conceptual or physical and mathematical knowledge sufficiently in-depth such that students will be able to understand and solve various data mining problems using deep learning techniques. The student will work effectively and efficiently as an individual or with the team in various multi-disciplinary data analysis projects	PO1, PO2, PO12 / PSO1	U	F, C
2	CO2: Students will be able to understand the complex data mining problem and then identify or develop optimal deep learning techniques to solve the problem. They will be able to review the technical or research literature, may identify new data mining problems that can be better solved using deep learning techniques and possibly the advancement or development of better deep learning techniques	PO2-PO5 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Students will explore projects in data mining, artificial intelligence and machine learning expertise or go for higher education and research in the related domain	PO4, PO6 / PSO1, PSO2	U, Ap, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on machine learning.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in machine learning.
Focus on entrepreneurship	Yes	Machine Learning offers enormous scope for entrepreneurship.

IT642 Interactive Data Visualization (3-0-2-4)

Course Objective: In this course, students will learn the foundations of information visualization and design.

Course Outcomes:

- Understand the fundamental design principles and different types of data visualization [PO1, PO12].
- Demonstrate the best practice that presents a story in the process of creating data visualization [PO2, PO3, PO4].
- Practice the core principles using Tableau (widely used interactive data visualization software) [PO2, PO4, PO5].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X	X		X	X				X	X		X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the fundamental design principles and different types of data visualization	PO1, PO12 / PSO1	U	F, C
2	CO2: Demonstrate the best practice that presents a story in the process of creating data visualization	PO2, PO3, PO4 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Practice the core principles using Tableau (widely used interactive data visualization software)	PO2, PO4, PO5 / PSO1, PSO2	U, Ap, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on computer vision, data analytics.
Focus on Skill development	Yes	The students develop necessary skills to develop knowledge in data visualization.
Focus on entrepreneurship	No	-

Executive Registrar
DA-IICT, Gandhinagar

Dhirubhai Ambani
Institute of Information and Communication Technology

DA-IICT Road, Gandhinagar, Gujarat, India 382007.
Tel.: +91 79 6826 1700 I Fax: +91 79 6826 1710 I Web: www.daiict.ac.in

NAAC Accredited
Recipient of Centre of Excellence Award by the Government of Gujarat
Recipient of '5 Star' in GSIRF Ranking by Government of Gujarat

ENGINEERS WITH
SOCIAL RESPONSIBILITY

PROGRAM: MASTER OF DESIGN IN COMMUNICATION DESIGN, M.DES (CD)

PO No.	Programme Outcomes
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO No.	Program Specific Outcomes (PSOs)
PSO1	To apply the theoretical concepts of information technology and practical knowledge in analysis, design and development of computing systems and interdisciplinary applications.
PSO2	To work as a socially responsible professional by applying visual communication principles in real-world problems.

Course Outcomes (COs) - Program Outcomes (POs, Program Specific Outcomes (PSOs)

PC748 Design History (1-0-2-2)

Course Objectives: This course will introduce students to a brief history of Design practice and pedagogy as it evolved in the context of the industrial Revolution and the onset of the age of mass production in the late 19th and early 20th century. The objective of this course is to enrich students' understanding of Design not merely as practice but as a vast intellectual field spanning several disciplines.

Course Outcomes: After completion of the course, students will be able to:
- Understand the economic, political, cultural and technological contexts within which Design Schools, Design movements and Design Styles took shape in Europe, the United States and later India [PO1, PO11, PO12].
- Understand how Design practice and pedagogy was closely linked to modern consumerism and nationalism on the one hand and on social, political, and environmental movements on the other [PO6, PO7].
- Visualize specific movements as the Art and Crafts Movement of the late 19th century, Art Noveau, Bauhaus and the Modernist Era, along with Alternative Design movements, such as appropriate design, universal design, and socially responsible design etc [PO6. PO8, PO10].
- Make connections between what they learn in class and the larger economic, social and cultural context in which they would work [PO11].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X					X	X	X		X	X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1. Understand the economic, political, cultural and technological contexts within which Design Schools, Design movements and Design Styles took shape in Europe, the United States and later india	PO1, PO11, PO12 / PSO1	U	F, C
2	CO2: Understand how Design practice and pedagogy was closely linked to modern consumerism and nationalism on the one hand and on social, political, and environmental movements on the other	PO6, PO7 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Visualize specific movements as the Art and Crafts Movement of the late 19th century, Art Noveau, Bauhaus and the Modernist Era, along with Alternative Design movements, such as appropriate design, universal design, and socially responsible design etc	PO6, PO8, PO10 / PSO1, PSO2	U, Ap	F, C, P
4	CO4: Make connections between what they learn in class and the larger economic, social and cultural context in which they would work	PO11 / PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication design.

Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in design history.
Focus on entrepreneurship	No	-

PC721 Approaches to Culture and Communication (3-0-0-3)

Course Objectives: The course aims to explore the ways in technology mediates and transforms cultural meanings in practices of social communication. The primary focus of this course would be on identifying specific fields of social communication, and understanding the kinds of design problems and solutions these can generate.

Course Outcomes: After completion of the course, students will be able to:
- Understand a range of analytical frameworks derived from studies of both aesthetics and semiotics [PO1, PO6, PO12].
- Understand that an appreciation of the intent of communication is a significant factor in the process of effective communication design and that it is important to develop the ability to decode 'point of view' and 'perspective' in relation to meanings [PO6, PO7, PO8].
- Learn the essential foundations for them to undertake their individual projects in the second year when they would be oriented to develop a more in-depth understanding of the principles of communication through either Visual Design or Interaction Design [PO10, PO11, PO12].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X					X	X	X		X	X	X

Course Outcomes and Competencies

Sr. No	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand a range of analytical frameworks derived from studies of both aesthetics and semiotics	PO1, PO6. PO12 PSO1	U	F, C
2	CO2: Understand that an appreciation of the intent of communication is a significant factor in the process of effective communication design and that it is important to develop the ability to decode 'point of view' and 'perspective' in relation to meanings	PO6, PO7. PO8 PSO1, PSO2	U. Ap	F, C, P
3	CO3: Learn the essential foundations for them to undertake their individual projects in the second year when they would be oriented to develop a more in-depth understanding of the principles of communication through either Visual Design or Interaction Design	PO10, PO11, PO12 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication design.
Focus on Skill development	Yes	The students develop necessary skills to

		develop foundational knowledge in culture and communication.
Focus on entrepreneurship	No	-

PC722 Fundamentals of Design - I (3-0-4-5)

Course Objectives: The Fundamentals of Design course is an attempt to sensitize students to this complex, dynamic and multidimensional scenario. The course would emphasize the latitude and value of individual thinking and the students' ability to observe and see which would enable them to apply themselves creatively in solving problems.

Course Outcomes: After completion of the course, students will be able to:
- Understand the basics of design principles [PO1. PO12].
- Apply the design principles in visual communication [PO2, PO6, PO7].
- Learn and visualize communication design [PO6, PO10].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X				X	X			X		X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the basics of design principles	PO1, PO12 / PSO1	U	F, C
2	CO2: Apply the design principles in visual communication	PO2, PO6, PO7 / PSO1, PSO2	U, Ap	F, C, P

3	CO3: Learn and visualize communication design	PO6 PO10 PSO1. PSO2	U, Ap	F C, P

CL. Cognitive Process Domain [R Remember: U: Understand; Ap Apply An. Analyze, E: Evaluate; C: Crete]

KC. Knowledge Domain [F: Factual, C Conceptual, P Procedural. M. Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on visual communication.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in design principles.
Focus on entrepreneurship	No	-

PC746 Information Design (3-0-4-5)

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

- Understand Information Systems and Architecture to establish and understand types of information systems and the role of such systems and their technological foundations. [PO1, PO12].
- Learn the methods and frameworks used in conceptualizing, designing and implementing information systems, through Information Architecture would also be considered [PO5, PO6, PO10].
- Transforms complex, unorganized, or unstructured data into useful, usable information both with efficiency and effectiveness [PO2, PO3, PO4].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X	X	X	X	X	X				X		X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand Information Systems and Architecture to establish and understand types of information systems and the role of such systems and their technological foundations.	PO1, PO12 / PSO1	U	F, C
2	CO2: Learn the methods and frameworks used in conceptualizing, designing and implementing information systems, through Information Architecture would also be considered	PO5, PO6, PO10 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Transforms complex, unorganized, or unstructured data into useful, usable information both with efficiency and effectiveness.	PO2, PO3, PO4 / PSO1, PSO2	U, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on information design.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in information design.
Focus on entrepreneurship	No	-

PC749 Image Text Sound (3-0-4-5)

Course Objective: This course aims at exploring now words, images and sounds are put together for a range of communication events and forms.

Course Outcomes: After completing this course students should be able to:
- Read and explore ideas from design aesthetics and semiotics to understand compositional styles and aesthetic choices in traditional as well as contemporary forms of communication media in which visual, verbal and aural elements are combined to make effective communication events [PO1, PO12].
- Apply diverse technologies of communication in rural or urban India or in local or global media platforms and explore how image, text and sounds are combined to generate context specific meanings in specific contexts [PO7, PO8].
- Research, document and compose presentations deploying multi-media [PO7, PO11, PO12].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X					X	X				X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Read and explore ideas from design aesthetics and semiotics to understand compositional styles and aesthetic choices in traditional as well as contemporary forms of communication media in which visual, verbal and aural elements are combined to make effective communication events	PO1, PO12 / PSO1	U	F, C

2	CO2: Apply diverse technologies of communication in rural or urban india or in local or global media platforms and explore how image, text and sounds are combined to generate context specific meanings in specific contexts	PO7, PO8, PSO1, PSO2	U, Ap	F, C, P
3	CO3: Research, document and compose presentations deploying multi-media	PO7, PO11, PO12, PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication design.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in visual communication.
Focus on entrepreneurship	No	-

PC731 Research Methodologies - Ethnography and its Applications (3-0-0-3)

Course Objective: The course introduces the foundations and basic methods of ethnography derived from the fields of visual anthropology and cognitive anthropology. It will look at several applications of these disciplines to current communication practices. The objective of the course is to provide the student the intellectual tools to develop research capacity for the final design projects they would have to undertake.

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

- Understand social activity through immersive exposure. seems particularly appropriate to study communication design [PO1, PO12].
- Undertake fieldwork assignments and related applied activities such as collection of empirical data qualitative data, contextual inquiry and usability testing that provides the foundations for user-centered interaction and visual design [PO6, PO7, PO9].

CO-PO Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
	X		X	X				X	X		X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand social activity through immersive exposure, seems particularly appropriate to study communication design	PO1, PO12 / PSO1	U	F, C
2	CO2: Undertake fieldwork assignments and related applied activities such as collection of empirical data, qualitative data, contextual inquiry and usability testing that provides the foundations for user-centered interaction and visual design	PO6, PO7, PO9 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication design.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in ethics, research methodology.
Focus on entrepreneurship	No	-

PC732 Fundamentals of Design - II (3-0-4-5)

Course Objectives: The Fundamentals of Design course is an attempt to sensitize students to this complex, dynamic and multidimensional scenario. The course would emphasize the latitude and value of individual thinking and the students' ability to observe and see which would enable them to apply themselves creatively in solving problems.

Course Outcomes: After completion of the course, students will be able to:
- Understand advanced topics in design [PO1. PO12].
- Deals with the advanced aspects of color, composition, virtual 3D spaces, Typography as image, Illustration for information design, and Digital Photography as means of explore, visualize and communicate complex ideas with high levels of data density [PO2, PO6, PO9].
- Acquire from the field of 'Design History' the understanding of visual language that is applied for range of visualization essential for practice of sketching, photography, film and animation [PO6, PO7, PO8].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X	X				X	X	X	X	X		X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand advanced topics in design	PO1, PO12 / PSO1	U	F, C
2	CO2: Deals with the advanced aspects of color, composition, virtual 3D spaces, Typography as image, Illustration for information design, and Digital Photography as means of explore, visualize and communicate complex ideas with high levels of data density	PO2, PO6, PO9 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Acquire from the field of 'Design History' the understanding of visual language that is applied for range of visualization essential for practice of sketching, photography, film and animation	PO6, PO7, PO8 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on visual communication.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in design principles.
Focus on entrepreneurship	Yes	The students will find opportunities for start-ups, entrepreneurship.

PC725 Introduction to Narratology (3-0-2-4)

Course Objective: This course will introduce students to the critical place of narratives in communication practices. The theoretical starting point of this course will be an understanding that narratives are found and communicated through a range of media such as verbal and written language, gestures, music, visual art and film.

Course Outcomes: After completion of the course, students will be able to:
- Develop a deep understanding of both the thematic and modal aspects of story-telling [PO1, PO7, PO12].
- Prepare students for a subsequent course on the construction and translation of narratives in different media [PO6, PO7, PO11].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X					X	X				X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Develop a deep understanding of both the thematic and modal aspects of story-telling	PO1, PO7, PO12 PSO1	U	F, C
2	CO2: Prepare students for a subsequent course on the construction and translation of narratives in different media	PO6, PO7, PO10 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication design.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in narratology.
Focus on entrepreneurship	No	-

PC750 Photography (1.5-0-2-2.5)

Course Objective: This course aims to introduce students to the application and use of photography in design through a creative use of the camera, its controls and techniques. It aims to generate an understanding of the symbiotic relationship between the photographic image and other design skills and develop an understanding of digital practice.

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

- Understand the technical aspects of resolution, colour, contrast, light and the manipulation of these aspects in images through theory and practice [PO1, PO7, PO12].
- Demonstrate the best practice that presents an art of photography [PO7, PO8, PO9].

CO-PO Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X						X	X	X			X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand the technical aspects of resolution, colour, contrast, light and the manipulation of these aspects in images through theory and practice	PO1, PO7, PO12 / PSO1	U	F, C
2	CO2: Demonstrate the best practice that presents an art of photography	PO7, PO8, PO9 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication design.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in photography.
Focus on entrepreneurship	No	-

PC751 Video (1.5-0-2-2.5)

Course Objective: The aim of the course is to establish an understanding in students about the elements of documentary filmmaking through a practical approach; to establish an understanding of the complexities of this medium through critical analysis and study of acclaimed documentaries and documentary filmmakers.

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

- Learn a brief history of documentary filmmaking to examine the narratives of historically important films and filmmakers and how they have affected society - biopics, video essays, craft documentaries etc. and compare it to current trends in documentary filmmaking. [PO1, PO7, PO12].
- Understand audiences - shaping films according to the audience - how geography, history, culture, language and understanding affect a film. [PO7, PO8, PO9].
- Illustrate sound as an integral part of film making – both the aesthetic and practical aspects of sound leveling, mixing, foley recording, voice over, music would be covered in theory and practice, and finally subtitling, graphics, motion graphics, end and opening credits, title of the film, data intermediate etc. to conclude the process [PO1, PO10, PO11].

CO-PO Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X						X	X	X	X	X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Learn a brief history of documentary filmmaking to examine the narratives of historically important films and filmmakers and how they have affected society - biopics, video essays, craft documentaries etc. and compare it to current trends in documentary filmmaking.	PO1, PO7, PO12 / PSO1	U	F, C
2	CO2: Understand audiences - shaping films according to the audience - how geography, history, culture, language and understanding affect a film.	PO7, PO8, PO9 / PSO1, PSO2	U, Ap	F, C, P
3	CO3:Illustrate sound as an integral part of film making – both the aesthetic and practical aspects of sound leveling, mixing, foley recording, voice over, music would be covered in theory and practice, and finally subtitling, graphics, motion graphics, end and opening credits, title of the film, data intermediate etc. to conclude the process	PO1, PO10, PO11/PSO1	Ap, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication design.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in Video.
Focus on entrepreneurship	No	-

PC752 Interaction Design (1-0-4-3)

Course Objective: Interaction Design involves designing for meaningful interactions between humans and their artifacts and this idea is easily extended to include interactions between humans with the help of their artifacts. This course is designed to cover the breadth of the field and to enable the students to be adept and competent in grasping and dealing effectively with design issues involving interaction with a range of devices, services and users.

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

- Perform empirical studies with design implications and extensive work on lab and field based exercises [PO1, PO7, PO12].
- Investigate a specific area or a context in depth and develop understandings and design implications in order to deliver an innovative proposal and prototype [PO7, PO8, PO9, PO10].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X						X	X	X	X		X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Perform empirical studies with design implications and extensive work on lab and field based exercises.	PO1, PO7, PO12 / PSO1	U	F, C
2	CO2: Investigate a specific area or a context in depth and develop understandings and design implications in order to deliver an innovative proposal and prototype.	PO7, PO8, PO9, PO10 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication design.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in interaction design.
Focus on entrepreneurship	Yes	Interaction design opens up business opportunities and entrepreneurship.

PC741 Animation (3-0-2-4)

Course Objective: The aim is to sensitize students to the structure, nature, systems, and communication potential of the medium of animation.

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

- Understand fundamentals (principles and dynamics) of motion and movement in animation – both theory and practice [PO1, PO6, PO12].
- Learn the basic concepts, methods/means and language to conceptualize and visualize simple ideas through animated sequences/films. Storytelling, Storyboarding Animatics. Setting a stage, and kinetics would be the main areas to explore the limits of the medium [PO6, PO7, PO8].
- Explore ways to communicate complex ideas and hidden worlds effectively using the language of animation, from entertainment -films and gaming to Instructional material [PO8, PO9].
- Apply the art of developing and visualizing characters for animated films [PO9, PO10].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
X					X	X	X	X	X		X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Understand fundamentals (principles and dynamics) of motion and movement in animation – both theory and practice	PO1, PO6, PO12 / PSO1	U	F, C
2	CO2: Learn the basic concepts, methods/means and language to conceptualize and visualize simple ideas through animated sequences/films. Storytelling, Storyboarding, Animatics, Setting a stage, and kinetics would be the	PO6, PO7, PO8 / PSO1, PSO2	U, Ap	F, C, P

	main areas to explore the limits of the medium			
3	CO3: Apply the art of developing and visualizing characters for animated films	PO9, PO10 / PSO1	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication design.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in animation.
Focus on entrepreneurship	Yes	Animation offers scopes for start-ups, entrepreneurship.

PC733 Web Design: Applications, Interconnectability (3-0-2-4)

Course Objective: This course will consider the concepts, technical requirements and production processes needed for web site development and construction. Primary objective is to present and explore concepts and tools for interactivity in multimedia.

Course Outcomes: After completion of the course, students will be able to:
- Learn to combine various software that are available and that must be utilized to create multimedia content [PO1, PO7, PO12].
- Develop knowledge in product design, concept development and collaborative techniques as used in professional multimedia prototyping [PO8, PO9, PO10].

- Learn about a variety of hardware and software options including, but not limited to, image editing, digital video and input/output concerns [PO6. PO10. PO11].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X					X	X	X	X	X	X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Learn to combine various software that are available and that must be utilized to create multimedia content	PO1, PO7, PO12 / PSO1	U	F, C
2	CO2: Develop knowledge in product design, concept development and collaborative techniques as used in professional multimedia prototyping	PO8, PO9, PO10 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Learn about a variety of hardware and software options including, but not limited to, image editing, digital video and input/output concerns	PO6, PO10, PO11 / PSO1, PSO2	U, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication design.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in multimedia.
Focus on entrepreneurship	No	-

PC743 Thematic Seminar/Workshop or a Reading/Research Course (3-0-0-3)

Course Objective: The course aims to provide an interaction form to students where faculty would deliver thematic seminars.

Course Outcomes: After completion of the course, students will be able to:
- Explore research opportunities in communication design, visual communication [PO1, PO12].
- Participate in presentation, understanding ethical practice and projects [PO7, PO8, PO11].

CO-PO Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X						X	X			X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Explore research opportunities in communication design, visual communication	PO1, PO12 PSO1	U	F, C
2	CO2: Participate in presentation, understanding ethical practice and projects	PO7, PO8, PO11 / PSO1, PSO2	U, Ap	F, C P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication design.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in technical writing, presentation and communication.
Focus on entrepreneurship	No	-

PC745 Research Application: Constructing Narratives (3-0-2-4)

Course Objective: This course is meant to encourage students to apply the theoretical insights drawn from the earlier course on narratives and develop their own narrative form around a particular idea or message they wish to communicate.

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

- Develop a deep understanding of both the thematic and modal aspects of story-telling [PO1, PO7, PO12].

- Prepare students for a subsequent course on the construction and translation of narratives in different media [PO6, PO7, PO11].
- Implement a group project wherein students will be tested on their capacities to work together and develop a product that reflects coordinated team work [PO9, PO10, PO11].

CO-PO Matrix :

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X					X	X		X	X	X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Develop a deep understanding of both the thematic and modal aspects of story-telling	PO1, PO7, PO12 / PSO1	U	F, C
2	CO2: Prepare students for a subsequent course on the construction and translation of narratives in different media	PO6, PO7, PO10 / PSO1, PSO2	U, Ap	F, C, P
3	CO3: Implement a group project wherein students will be tested on their capacities to work together and develop a product that reflects coordinated team work	PO9, PO10, PO11 / PSO1	Ap, An	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication design.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in narratology.
Focus on entrepreneurship	No	

PC740 Research Proposal Seminar: Rationale, Process, Outcome (1-0-4-3)

Course Objective: The course aims to provide an interaction form to students where faculty would deliver thematic seminars, which will motivate students to do projects in their area of interest.

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

- Explore research opportunities in communication design, visual communication [PO1, PO12].
- Participate in presentation, understanding ethical practice and projects [PO7, PO8, PO11].

CO-PO Matrix:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
X						X	X			X	X

Course Outcomes and Competencies

Sr. No.	Course Outcome	PO/PSO	CPD	KD
1	CO1: Explore research opportunities in communication design, visual communication	PO1, PO12 / PSO1	U	F, C
2	CO2: Participate in presentation, understanding ethical practice and projects	PO7, PO8, PO11 / PSO1, PSO2	U, Ap	F, C, P

CL: Cognitive Process Domain [R: Remember; U: Understand; Ap: Apply; An: Analyze; E: Evaluate; C: Crete]

KC: Knowledge Domain [F: Factual; C: Conceptual; P: Procedural; M: Metacognitive]

Focus Area	Yes/No	Details
Focus on Employability	Yes	The students taking the course can be employed in industries focusing on communication design.
Focus on Skill development	Yes	The students develop necessary skills to develop foundational knowledge in technical writing, presentation and communication.
Focus on entrepreneurship	No	-

Executive Registrar
DA-IICT, Gandhinagar