



**Curriculum for  
S.Y. B.Tech  
(Pattern :2023-NEP)**

**Department of Information Technology**

## Vision and Mission of the Department

- **Vision**

“Nurture IT professionals committed to lifelong learning, integrity and societal contributions.”.

- **Mission**

- To nurture graduates with an all-rounded education and instilling human values, promoting their holistic development and social responsibility.
- To empower graduates with cutting-edge technical, innovative and entrepreneurial skills, enabling them to shape their own learning trajectories.
- To prepare graduates for advanced studies and academic research through multidisciplinary mind-set..

### Program Specific Outcomes (PSOs)

At the end of program, students should be able to

- **PSO a:** An ability to understand, analyze and develop computer programs in the areas related to algorithms, web development and database management
- **PSO b:** An ability to apply knowledge of software engineering principles and practices for multidisciplinary applications to meet the needs of the industry and society

### Program Outcomes (POs)

At the end of program, students should be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, social and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **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.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health,

safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

**S.Y.B.Tech.**

**NEP-2023 Pattern : Syllabus Structure**

## Second Year B. Tech. Information Technology- Semester III (Pattern: NEP 2023)

Course Code	Course Name	Teaching Scheme (Hrs/Wk)			Assessment Scheme (100-mark scale)										CR
		TH	L	T	ISA						ESA			Total	
					HA	TW	SCE	PPT	GD	CIE	ESE	PR	OR		
ITUA21231	COMPUTER GRAPHICS	3	2	-	10	-	20	-	-	10	40	20	-	100	4
ITUA21232	DATA COMMUNICATION AND NETWORKING	3	2	-	10	10	20	-	-	-	40	-	20	100	4
ITUA21233	DISCRETE MATHEMATICS	2	-	1	10	20	20	-	-	10	40	-	-	100	3
MDM20235	QUALITY STANDARDS IN PRACTICE	2	-	-	20	-	20	-	-	20	40	-	-	100	2
EEM21236	DESIGN THINKING	1	-	1	-	30	30	20	-	20	-	-	-	100	2
VEC21237	UNIVERSAL HUMAN VALUES	2	-	-	-	-	-	20	-	10	-	-	20	50	2
CEP21238	COMMUNITY ENGAGEMENT PROJECT	-	4	-	-	50	-	-	-	-	-	-	-	50	2
CSOEUA21239A	BASICS OF UI/UX	2	-	-	20	-	20	-	-	20	40	-	-	100	2
AIOEUA21239B	DATA ETHICS	2	-	-	20	-	20	-	-	20	40	-	-	100	2
ETOEUA21239C	SENSOR TECHNOLOGY	2	-	-	20	--	20	--	--	20	40	-	-	100	2
MEOEUA21239D	RENEWABLE ENERGY	2	-	-	20	-	20	-	-	20	40	-	-	100	2
CVOEUA21239E	CLIMATOGRAPHY	2	-	-	20	-	20	-	-	20	40	-	-	100	2
	Total	15	08	2	70	110	130	40	-	90	200	20	20	700	21

Theory: 1Hr. = 1 Credit, Practical: 2 Hrs. = 1 Credit Tut: 1 hr. = 1 Credit, Audit Course: No Credits



**BoS Chairman**



**Dean Academics**



**Director**



SEM-I

## COMPUTER GRAPHICS: (ITUA21231)

Teaching Scheme	Examination Scheme									
Credits: 4	HA	TW	SCE	PPT	GD	CIE	ESE	PR	OR	TOTAL
Lecture's/Week(L): 3 Hrs/week	10	-	20	-	-	10	40	20	-	100
Practical/Week(P): 2 Hrs/week										
Tutorial/Week(T):										

### Prerequisites:

Data Structures and algorithms, Basic Mathematics, Geometry, linear algebra, vectors and matrices .

### Course Objectives:

1. Gain knowledge about basics of computer graphics and graphics hardware devices.
2. Understanding geometric-to-pixel conversion for displays.
3. Exploring polygon filling and clipping algorithms
4. Understand the two-dimensional graphics and their transformations.
5. Understand the three-dimensional graphics and their transformations.
6. Understanding principles of Segmentation, Animation and Light Illumination.

### Course Outcomes:

After studying this course, students will be able to:

1. Acquire a fundamental understanding of computer graphics principles and various graphics hardware devices.
2. Proficiency in grasping geometric-to-pixel conversion processes for display rendering.
3. Proficient exploration of polygon filling and clipping algorithms in computer graphics.
4. Comprehensive understanding of two-dimensional graphics and their transformations.
5. Comprehensive understanding of three-dimensional graphics and their transformations.
6. Design animation and understand illumination and color models.

### Unit I : Introduction to Computer Graphics

**6 Hrs**

Introduction to Computer Graphics and its Components: Overview of Computer Graphics, its functions & elements; Introduction to GUI, Computer Vision, Augmented Reality and other Applications of Graphics; Popular Graphics Software; Components and Working of Interactive Graphics; Raster Scan and Random Scan systems and Display Processors; Look-up table; Loading the Frame Buffer; Coordinate Systems. Graphics Devices: Display Technologies: Resolution, Aspect Ratio, Refresh CRT, Color CRT, Flat Panel Displays; Interactive Input Devices for Graphics, Image and Video Input Devices.

### Unit II : Scan Conversion

**6 Hrs**

Scan Conversion: Drawing Geometry; Output Primitives; Lines and Pixel Graphics; Antialiasing; Scan Converting Lines: DDA line drawing algorithms, Bresenham's line Algorithm; Scan Converting Circles: Polynomial method for circle drawing, circle drawing using polar coordinates, Bresenham's circle drawing. DDA Circle drawing. Algorithms for Generation of ellipse; Line Styles;

### Unit III – Polygons and Clipping Algorithms

**6 Hrs**

Introduction to polygon, types: convex, concave, and complex. Representation of polygon, Inside test, polygon filling algorithms – flood fill, seed fill, scan line fill and filling with patterns. Windowing and clipping viewing transformations, 2-D clipping: Clipping operations: Point and Line clipping, Cohen-Sutherland line clipping, Mid-Point Subdivision line clipping, Sutherland-Hodgman polygon clipping.

<b>Unit IV: Two-Dimensional Transformations</b>		<b>6 Hrs</b>
Two-Dimensional Transformations: Coordinate and Geometric Transformations; Translation, Rotation, Scaling; Matrix representations and Homogeneous coordinates, Composite transformations, General Pivot Point rotation, General Fixed Point Scaling, Shearing; Reflection; Reflection about an arbitrary line. 2-D Viewing: Viewing pipeline; Window, Viewport, Window-to-Viewport transformation; Zooming, Panning; Pointing and Positioning techniques; Rubber band technique; Dragging.		
<b>Unit V : 3-D Graphics &amp; Modeling</b>		<b>6 Hrs</b>
Three-Dimensional Viewing: Viewing Pipeline; Parallel Projection: Orthographic and Oblique Projection; Perspective Projection. 3-D transformations: introduction, 3-D geometry, primitives, Stages in 3D viewing ,3-D transformations and matrix representation, rotation about an arbitrary axis, 3-D viewing transformations . Parallel (Oblique: Cavalier, Cabinet and orthographic: isometric, diametric, trimetric) and Perspective (Vanishing Points – 1 point, 2 point and 3 point)		
<b>Unit VI : Illumination and Shading</b>		<b>6 Hrs</b>
Segment: Introduction, Segment table, Segment creation, closing, deleting and renaming, Visibility. Animation: Introduction, Design of animation sequences, Animation languages, Keyframe, Morphing . Light sources – basic illumination models – halftone patterns and dithering techniques; Properties of light – Standard primaries and chromaticity diagram;		
<b>Textbooks:</b>		
<ol style="list-style-type: none"> <li>1. S. Harrington, —Computer GraphicsI, 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 – 100472 – 6.</li> <li>2. D. Rogers, —Procedural Elements for Computer GraphicsI, 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.</li> <li>3. Donald D. Hearn, —Computer Graphics with Open GLI, 4th Edition, ISBN13: 9780136053583.</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. J. Foley, V. Dam, S. Feiner, J. Hughes, —Computer Graphics Principles and PracticelI, 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.</li> <li>2. D. Rogers, J. Adams, —Mathematical Elements for Computer GraphicsI, 2nd Edition, Tata McGrawHill Publication, 2002, ISBN 0 – 07 – 048677 – 8</li> </ol>		
<b>List of Assignments</b>		
1	<b>Assignment 1: Basic Graphics Primitives</b> <ol style="list-style-type: none"> <li>1. Implement and display basic Graphics primitives such as points, lines, and polygons.</li> <li>2. Explore various attributes such as color, line width, and point size.</li> </ol>	
2	<b>Assignment 2: DDA Algorithm for Line Drawing</b> <ol style="list-style-type: none"> <li>1. Implement the DDA algorithm to draw lines using mouse input.</li> <li>2. Create a program to draw various shapes or patterns using the DDA algorithm.</li> </ol>	
3	<b>Assignment 3: Midpoint and Bresenham’s Circle Drawing Algorithms</b> <ol style="list-style-type: none"> <li>1. Implement the Midpoint circle drawing algorithm.</li> <li>2. Implement Bresenham’s circle drawing algorithm.</li> <li>3. Compare the two algorithms in terms of efficiency and accuracy.</li> </ol>	
4	<b>Assignment 4: Sutherland-Hodgman Polygon Clipping Algorithm</b> <ol style="list-style-type: none"> <li>1. Implement the Sutherland-Hodgman algorithm to clip a given polygon.</li> <li>2. Allow interactive input of the polygon vertices and clipping pattern.</li> </ol>	



5	<b>Assignment 5: 2D Transformations</b> <ol style="list-style-type: none"> <li>1. Implement 2D transformations including translation, shearing, rotation, reflection, and scaling.</li> <li>2. Apply these transformations to an equilateral triangle or a rhombus and display the results.</li> </ol>
6	<b>Assignment 6: 3D Transformations on a Cube</b> <ol style="list-style-type: none"> <li>1. Implement translation in x, y, and z directions for a 3D cube.</li> <li>2. Implement rotation by 45 degrees about the z-axis and 60 degrees about the y-axis in succession.</li> <li>3. Implement scaling transformations, scaling by a factor of 2 in the x-direction and by a factor of 3 in the y-direction.</li> </ol>
7	<b>Assignment 7: Time Slider Study and Bouncing Ball Animation in Maya</b> <ol style="list-style-type: none"> <li>1. <b>Time Slider Study:</b> <ul style="list-style-type: none"> <li>○ Explore and analyze the functionality of the time slider in Maya, understanding its role in controlling animation playback, keyframe manipulation, and overall timeline management.</li> <li>○ Experiment with different playback speeds, frame rates, and time range settings to grasp their impact on animation workflow and preview.</li> </ul> </li> <li>2. <b>Bouncing Ball Animation:</b> <ul style="list-style-type: none"> <li>○ Implement a classic bouncing ball animation using Maya, focusing on principles of timing, spacing, and squash-and-stretch.</li> <li>○ Start with a simple sphere object and animate it realistically as it bounces, considering gravity, momentum, and energy transfer.</li> </ul> </li> </ol>
8	<b>Assignment 8: Pendulum and Tail Animation in Maya.</b> Design and animate a pendulum motion for a selected animal image using Maya software. Additionally, implement a realistic tail animation that complements the pendulum movement, enhancing the overall dynamics and realism of the animation <ol style="list-style-type: none"> <li>1. <b>Image Selection:</b> <ul style="list-style-type: none"> <li>○ Choose a clear picture of any animal that features a visible tail, preferably with distinct details for realistic animation.</li> </ul> </li> <li>2. <b>Pendulum Animation:</b> <ul style="list-style-type: none"> <li>○ Model and animate a pendulum swinging motion based on the selected animal's body structure.</li> <li>○ Ensure the pendulum motion is smooth and realistic, incorporating appropriate physics principles.</li> </ul> </li> <li>3. <b>Tail Animation:</b> <ul style="list-style-type: none"> <li>○ Rig and animate the tail of the selected animal image to synchronize with the pendulum motion.</li> <li>○ Utilize Maya's animation tools to achieve natural tail movements, considering dynamics and interactions with the pendulum animation.</li> </ul> </li> <li>4. <b>Integration and Presentation:</b> <ul style="list-style-type: none"> <li>○ Integrate the pendulum and tail animations seamlessly into a single Maya scene.</li> <li>○ Render the animation from multiple angles to showcase the dynamics and realism achieved.</li> </ul> </li> </ol>
9	<ul style="list-style-type: none"> <li>○ Project Based Learning- Animation: Implement any Animation scene about 10 minutes.</li> </ul>

## DATA COMMUNICATION AND NETWORKING: (ITUA21232)

Teaching Scheme	Examination Scheme									
Credits: 4	HA	TW	SCE	PPT	GD	CIE	ESE	PR	OR	TOTAL
Lecture's/Week(L): 3 Hrs/week	10	10	20	-	-	-	40	-	20	100
Practical/Week(P): 2 Hrs/week										
Tutorial/Week(T):										

### Prerequisites:

- Hardware and Network Maintenance
- Digital Electronics and Logic Design

### Course Objectives:

1. To understand the concepts of data communication.
2. To Study the modulation and demodulation techniques.
3. To learn the transmission media and its use.
4. To study the functions of TCP/IP and OSI layers.
5. To understand the functionalities of Data link layer
6. To study connecting devices in network

### Course Outcomes:

After studying this course, students will be able to:

1. Differentiate the analog and digital signals and their characteristics.
2. Categories various modulation and multiplexing techniques.
3. Identify and use various transmission media in various network scenarios.
4. Understand OSI layers, TCP/IP protocol stack and describe various network topologies.
5. Exercise data link layer techniques (flow and error control).
6. Understand and configure the connecting device switch.

### Unit I : Analog and Digital Signals

**6 Hrs**

Analog and Digital Data, Analog and Digital Signals, Periodic and Non-periodic Signal, Time and Frequency Domains, Composite Signals, Bandwidth, Digital Signals: Bit Rate, bit Length, Digital Signal as a Composite Analog Signal: Signal properties, Transmission modes: parallel transmission, serial transmission, Transmission Impairment: Attenuation, Distortion, Noise Performance: Bandwidth, Throughput, Latency (delay).  
Data Rate Limits: Noiseless Channel: Nyquist Bit Rate, Noisy Channel: Shannon Capacity.

### Unit II : Modulation and Multiplexing Techniques:

**6 Hrs**

Digital-to-digital Conversion: Line Coding, Line Coding Schemes, Block Coding, Scrambling, Analog to digital Conversion: Pulse Code Modulation (PCM), Delta Modulation (DM), Analog-to-analog Conversion (ADM): Amplitude Modulation, Frequency Modulation, Phase Modulation, Multiplexing: Frequency-Division Multiplexing (FDM), Wavelength Division Multiplexing Synchronous Time-Division Multiplexing, Statistical Time-Division Multiplexing Spread Spectrum: Frequency Hopping

Spread Spectrum (FHSS), Direct Sequence Spread Spectrum.	
<b>Unit III : Transmission Media and Switching</b>	<b>6 Hrs</b>
<b>Guided Media:</b> Twisted-Pair, Coaxial and Fiber-Optic Cable. <b>Unguided Media:</b> Radio Waves, Microwaves, Infrared. (RJ45, RJ11, BNC, SC/ST etc.) <b>Circuit-switched Networks:</b> Three Phases, Packet switching: Datagram networks, Virtual circuit networks.	
<b>Unit IV : Layered Model and Topologies</b>	<b>6 Hrs</b>
<b>The Layered Model:</b> Layered Architecture, peer-to-peer Processes, Encapsulation of Layers in the OSI Model, TCP/IP Protocol Suite, LAN, MAN, WAN, Topologies like star, mesh, bus, hybrid etc. <b>Addressing:</b> Physical, logical, port special Addresses. IP Addressing schema.	
<b>Unit V : Error Control and Data Link Control</b>	<b>6 Hrs</b>
<b>Types of errors:</b> Redundancy, detection versus correction, forward error correction versus retransmission, <b>Block coding:</b> error detection, error correction, CRC, polynomial, checksum, hamming code, hamming Distance, DLC Services: Framing, Flow and error control DLL Protocols: Simple protocol, Stop n wait, Go back to N, Selective repeat <b>Point-to-point Protocol (PPP)</b> : Framing, Transition Phases, Multiplexing, Multilink PPP.	
<b>Unit VI : Connecting devices and Switched Networks</b>	<b>6 Hrs</b>
<b>Connecting devices:</b> Hubs, Repeaters, Active hubs, Bridges, Switches, Routers, Gateways <b>Switching:</b> Switched and Converged Networks, Switching Domains, Switch Configuration and Security, Virtual LANs, Inter-VLAN Routing.	
<b>Textbooks:</b>	
1. Fourauzan B., "Data Communications and Networking", 5th edition, McGraw-Hill Publications 2. Stallings William., "Data and Computer Communications", Sixth Edition, Prentice Hall of India 3. CCNA Module-1 and Module-2	
<b>Reference Books:</b>	
1. Andrew S. Tenenbaum ,”Computer Networks”, Pearson 2. Douglas E. Comer, “Computer Networks and Internets”, Pearson Education	
<b>Data Communication and Networking Laboratory</b>	
<b>List of Assignments:</b>	
1	Network Representation on Network Simulator tool: Example will be provided like IT Department Network
2	Study of DCE, DTE, straight and cross cables: Example will be provided like VIIT campus
3	Identify MAC and IP addresses (physically as well as using packet tracer tool): Study with example like identify IP addressing schema , ranges used in VIIT campus
4	Configuration of initial Switch setting using telnet/SSH: Example will be provided like configure switch for lab C205.
5	Design a network/VLAN using a packet tracer tool: Example will be provided like VLAN for different departments in same campus.

6	Write a program for hamming code error control method.
7	Write a program for Cyclic-Redundancy-Check error control method.
8	Write a program for checksum error control method.
9	Configure or create a small network using star, ring, hybrid, tree and mesh topology.
10	Configure the Cat 5 or Cat 6 cable through the cross and straight cable.

## DISCRETE MATHEMATICS: (ITUA21233)

Teaching Scheme	Examination Scheme									
Credits: 3	HA	TW	SCE	PPT	GD	CIE	ESE	PR	OR	TOTAL
Lecture's/Week(L): 2 Hrs/week	10	20	20	-	-	10	40	-	-	100
Practical/Week(P): Hrs/week										
Tutorial/Week(T): 1 Hrs/week										

### Prerequisites:

- Knowledge of Basic Mathematics concepts is required

### Course Objectives:

- To gain sound knowledge to formulate and solve problems with sets and propositions.
- To recognize types of relation, formulate and solve problems with relations and functions.
- To understand Graph and Tree terminologies and models to be applied in real life problems.
- To understand the various types algebraic structures and its applications.

### Course Outcomes:

After studying this course, students will be able to:

- Formulate formal proof techniques and solve the problems with logical reasoning
- Compare types of relations and functions to provide solutions to computational problems
- Apply the concepts of graph theory to devise mathematical models
- Select appropriate algebraic structure to solve problems

### Unit I : Set theory and Propositions

**4 Hrs**

Mathematics and the Notion of Abstraction, Continuous Mathematics and Discrete Mathematics – Discretization, Significance of Discrete Mathematics in Computer Engineering, Continuous Structures and Discrete Structures

Sets: Sets, Combinations of Sets, Venn Diagram, Finite and Infinite Sets, Countable Sets, Multisets, Cartesian Product, Principle of Inclusion and Exclusion, Mathematical Induction.

Propositions: Propositions, Logical Connectives, Conditional and Bi-conditional. Propositions, Logical Equivalence, Validity of Arguments by using Truth Tables,

### Unit II : Relations and Functions

**6 Hrs**

Relations: Cartesian Product, Relations, Paths and Digraphs Properties of Binary Relations, Closure of Relations, Warshall's Algorithm, Equivalence Relations, Partitions, Partial Ordering Relations, Lattices.

Functions: Functions, Composition of Functions, Invertible Functions, Pigeonhole Principle

**Case Study on :** Applications of Relations – Electronic Circuit Design, n-Ary Relations and their Applications, Databases and Relations and Structured Query Language (SQL),

### Unit III : Graph Theory & Trees

**8 Hrs**

Graphs: Basic Terminologies, Multi-Graphs, Weighted Graphs, Sub Graphs, Isomorphic graphs, Complete Graphs, Regular Graphs, Bipartite Graphs, Operations on Graphs, Paths, Circuits, Hamiltonian and Eulerian graphs, Travelling Salesman Problem, Dijkstra's Algorithm, Planar Graphs,  
 Trees: Trees and Weighted Trees, Spanning Trees and Minimum Spanning Trees, Prim's and Kruskal's Algorithm, Isomorphism of Trees and Sub trees  
**Case Study On:** Usage of graph in real time applications

<b>Unit IV : Elementary Number Theory</b>	<b>6 Hrs</b>
---	--------------

Algebraic Structures: Introduction Semigroup, Monoid, Group, Abelian Group, Permutation Groups, Ring, Integral Domain, Field. Applications of Algebraic Structures

**Textbooks:**

1. Kenneth H. Rosen. Discrete Mathematics and Its Applications, 7th Edition, McGraw Hill, 2012.
2. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", 4th Edition, McGraw-Hill

**Reference Books:**

1. Dr. K. D. Joshi, *Foundations of Discrete Mathematics*, New Age International Limited, Publishers, January 1996
2. Richard Johnsonbaugh, *Discrete Mathematics*, Pearson
3. Bernard Kolman, Robert C. Busby and Sharon Ross, *Discrete Mathematical Structures*, Prentice-Hall of India Private Limited.
4. Alan Doerr and Kenneth Levasseur, *Applied Discrete Structures for Computer Science*, Galgotia Publications Pvt. Ltd

**List of Assignments**

	Part A
1	Solve the problems on Mathematical Induction and discuss about its applicability
2	Applications of Relations – Electronic Circuit Design, n-Ary Relations and their Applications, Databases and Relations and Structured Query Language (SQL)
3	Mathematical representations for any five types of graph
4	Problem solving on Minimum Spanning Trees
	Part B
5	Problem solving on groups and rings.
6	Study of shortest Path algorithm and compare with other shortest Path algorithm
7	Analyze different Tree Traversal Techniques
8	Select the data set and build mathematical model by applying discrete mathematics

NPTEL Course on Discrete mathematics:

Discrete Mathematics

By Prof. Sudarshan Iyengar, Prof. Prabuchandran K.J | IIT Ropar, IIT Dharwad

Link for Course Discrete Mathematics - Course ([nptel.ac.in](https://nptel.ac.in))

## QUALITY STANDARDS IN PRACTICE: (MDM20235)

Teaching Scheme	Examination Scheme									
Credits: 2	HA	TW	SCE	PPT	GD	CIE	ESE	PR	OR	TOTAL
Lecture's/Week(L): 2 Hrs/week	20	-	20	-	-	20	40	-	-	100
Practical/Week(P): Hrs/week										
Tutorial/Week(T):										

### Unit 1: Standards and the Standardization Process

Introduction to standards and standardization, Interoperability of standards, National Standards Body (NSB): Characteristics and governance, introduction to International Organization for Standardization (ISO), The International Electrotechnical Commission (IEC), Codex Alimentarius Commission (CAC), The International Organization of Legal Metrology (OIML), “Private” International Standards.

### Unit 2: Quality Control and Quality Assurance

The evolution of quality concepts, quality control and quality assurance during a product's life cycle, benefits and costs of quality assurance, Costs of quality failure, quality systems, quality manual, quality organizational structure, statistical quality control tools, quality-control charts, sampling methods, investigating the causes of non-conformity, six-sigma approach to quality management, comparison between ISO 9000, and six-sigma

### Unit 3: Quality Management Systems

The evolution of quality management, ISO 9000: Family (Series) of standards and its implementation, elements of ISO 9000, principles of quality management systems, internal audit, external audit, the surveillance or quality audit visit, assessment of quality-management systems, conformity assessment, Conformity Assessment Bodies (CABs).

### Unit 4: Overview of Other Management Systems

ISO 14000, environmental management systems, overview of ISO 22000 standards on food safety management, standards on social responsibility, information security management, risk management, ISO standards on energy management

### Reference books:

1. Standards and Quality by Anwar El-Tawil, World Scientific Publishing Co. Pte. Ltd
2. Quality and Standards in Electronics Raymond L. Tricker, Newnes An imprint of Butterworth-Heinemann Linacre House, Jordan Hill, Oxford OX2 8DP A division of Reed Educational and Professional Publishing Ltd.

## DESIGN THINKING: (EEM21236)

Teaching Scheme	Examination Scheme									
Credits: 2	HA	TW	SCE	PPT	GD	CIE	ESE	PR	OR	TOTAL
Lecture's/Week(L): 1 Hrs/week	-	30	30	20	-	20	-	-	-	100
Practical/Week(P):										
Tutorial/Week(T): 1 Hrs/week										

**Prerequisites:** NIL

### Course Objectives:

- To learn design thinking concepts and principles.
- To learn the different phases of design thinking.

### Course Outcomes:

After studying this course, students will be able to:

- CO1:** Understand(identify) the fundamentals of Design Thinking concepts, process and Principles.  
**CO2:** Identify the methods to empathize and define the problem.  
**CO3:** Apply the ideation techniques for problem solving.  
**CO4:** Construct the prototype to evaluate a design.

### Unit I : Introduction

**3 Hrs**

Introduction to Design Thinking, Design Thinking as a problem solving tool, Principles of Design Thinking, Process of Design Thinking, Tools and techniques for Design Thinking process, Planning a Design Thinking project.

#### #Exemplar/CaseStudies

Design Thinking to enhance urban redevelopment

### Unit II : Empathize and Define

**3 Hrs**

Search field determination, Problem clarification, Understanding of the problem, Problem analysis, Reformulation of the problem, Observation Phase, Empathetic design, Tips for observing, Methods for Empathetic Design, Artifact Analysis, Behavioral Mapping and Tracking, Empathy Map

#### #Exemplar/CaseStudies

IBM: Design Thinking

### Unit III : Idea Generation

**3 Hrs**

Mastering the creative process, opening up sources of new ideas, Understanding the creative principles, factors for increasing creativity, Mind mapping, Generating ideas by brainstorming, Different brainstorming variation, Evaluation of ideas & Storytelling

#### #Exemplar/CaseStudies

Philips: Improving Patient experience

### Unit IV : Prototype

**6 Hrs**

Prototype Phase - Lean Startup Method for Prototype Development, Visualization and presentation techniques, Ideas to presentable concepts, Storyboards, Developing mock-ups, models and prototypes,

#### #Exemplar/Case Studies

Developing Environmental sustainable strategy

**Textbooks:**



- 1." Design Thinking" , Gavin Ambrose, Paul Harris, AVA Publishing
- 2."Handbook of Design Thinking - Tips & Tools for how to design thinking", Christian Mueller-Rotenberg.
- 3."Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation" by TimBrown

#### **Reference Books:**

- 1."Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", Idris Mootee, Wiley.
- 2."Designing for Growth: a design thinking tool kit for managers", Jeanne Liedtka and Tim Ogilvie  
Bryan Lawson, "How designers think: The design process demystified", 2<sup>nd</sup> Edition, Butterworth Architecture

#### **eBooks:**

1. [https://www.researchgate.net/publication/332869635\\_Case\\_Study\\_the\\_Use\\_of\\_IBM\\_Design\\_Thinking\\_Methodology\\_in\\_Designing\\_User-Oriented\\_Learning\\_Environment\\_in\\_hebrew](https://www.researchgate.net/publication/332869635_Case_Study_the_Use_of_IBM_Design_Thinking_Methodology_in_Designing_User-Oriented_Learning_Environment_in_hebrew)
2. <https://www.design-thinking-association.org/explore-design-thinking-topics/design-thinking-case-studies>
3. [https://onlinecourses.nptel.ac.in/noc22\\_mg32/preview](https://onlinecourses.nptel.ac.in/noc22_mg32/preview)

#### **Practice Tasks for Tutorial –**

1. Choose a specific problem or challenge relevant to the students' interests or curriculum.(Apply design thinking principles and techniques to effectively solve a real-world problem or challenge, fostering creativity, empathy, and critical thinking skills.)
2. For a problem statement conduct user research.  
(Conduct interviews, surveys, or observations to gather insights about the problem from different perspectives.)
3. Use DT Techniques (Empathy map) to identify Top 3 problems of the problem selected.  
(Provide a brief overview of what design thinking is and why it's valuable in problem-solving)
4. Do ideation using any one or 2 techniques.( Identify specific user needs and pain points.)
5. Present prototype of the selected problem statement.( Prototypes can be physical models, sketches, wireframes, or digital prototypes depending on the nature of the problem.)

## UNIVERSAL HUMAN VALUES: (VEC21237)

Teaching Scheme	Examination Scheme									
Credits: 2	HA	TW	SCE	PPT	GD	CIE	ESE	PR	OR	TOTAL
Lecture's/Week(L): 2 Hrs/week	-	-	-	20	-	10	-	-	20	50
Practical/Week(P):										

**Prerequisites:** Desirable - Universal Human Values 1 (Student Induction)

### Course Objectives:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature

### Course Outcomes:

After studying this course, students will be able to:

- CO1 :** Recognize the significance of human values and advocate a value-based approach to problem-solving
- CO2:** Commit to lead a life of responsibility by becoming aware of their individual reality
- CO3:** Apply understanding of human-human relationship in family and society to behave ethically and professionally
- CO4:** Demonstrate awareness and sensitivity towards nature/existence leading to ethical and sustainable solution to engineering problem

### Unit I : Introduction to Value Education and Understanding the Human

**8 Hrs**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education.

Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations.

Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self.

#### Sample Practice Tasks -

- 1.Sharing about Oneself
- 2.Exploring Human Consciousness
- 3.Exploring Natural Acceptance
- 4.Exploring the difference of Needs of Self and Body

<b>Unit II : Harmony in the Human Being, Family and Society</b>	<b>8 Hrs</b>
<p>Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.  Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship.  'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship  Understanding Harmony in the Society, Vision for the Universal Human Order.</p> <p><b>Sample Practice Tasks -</b></p> <ol style="list-style-type: none"> <li>1. Exploring Sources of Imagination in the Self</li> <li>2. Exploring Harmony of Self with the Body</li> <li>3. Exploring the Feeling of Trust</li> <li>4. Exploring the Feeling of Respect</li> </ol>	
<b>Unit III : Harmony in Nature/Existence and a Look at Professional Ethics</b>	<b>8 Hrs</b>
<p>Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature  Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence  Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct  A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics</p> <p><b>Sample Practice Tasks -</b></p> <ol style="list-style-type: none"> <li>1. Exploring Systems to fulfill Human Goal</li> <li>2. Exploring the Four Orders of Nature</li> <li>3. Exploring Co-existence in Existence</li> <li>4. Exploring Ethical Human Conduct</li> </ol>	
<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1</li> <li>2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, G P Bagaria, 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53</li> </ol>	
<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.</li> <li>2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.</li> <li>3. The Story of Stuff (Book).</li> <li>4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi</li> <li>5. Small is Beautiful - E. F Schumacher.</li> <li>6. Slow is Beautiful - Cecile Andrews</li> <li>7. Economy of Permanence - J C Kumarappa</li> <li>8. Bharat Mein Angreji Raj – Pandit Sunderlal</li> <li>9. Rediscovering India - by Dharampal</li> <li>10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi</li> <li>11. India Wins Freedom - Maulana Abdul Kalam Azad</li> <li>12. Vivekananda - Romain Rolland (English)</li> </ol>	

**e-Resources:**

1. <https://fdp-si.aicte-india.org/UHVII.php>
2. <https://www.youtube.com/watch?v=NhFBzn5qKIM&list=PLWDeKF97v9SO8vvjC1KyqteziTbTjN1So>

Common Graduate Attributes (GAs) being impacted -

1. Holistic vision of life
2. Socially responsible behaviour
3. Environmentally responsible work
4. Ethical human conduct
5. Having Competence and Capabilities for Maintaining Health and Hygiene
6. Appreciation and aspiration for excellence (merit) and gratitude for all

## BASICS OF UI / UX: (CSOEUA21239A)

Teaching Scheme	Examination Scheme									
Credits: 2	HA	TW	SCE	PPT	GD	CIE	ESE	PR	OR	TOTAL
Lecture's/Week(L): 2 Hrs/week	20	-	20	-	-	20	40	-	-	100
Practical/Week(P):										
Tutorial/Week(T):										

**Prerequisites:** NIL

### Course Objectives:

1. Gain a comprehensive understanding of the foundational principles of UI and UX design and recognize their significance in creating user-friendly digital experiences.
2. Develop the ability to conduct user-centered research, analyze user needs and behaviors, and translate findings into actionable insights that inform the design process.
3. Master fundamental design principles and tools to create visually appealing and user-friendly interfaces that enhance the overall user experience.
4. Understand the iterative nature of the UX design process, and learn how to effectively prototype, test, and iterate designs based on user feedback to optimize usability and functionality.

### Course Outcomes:

After studying this course, students will be able to:

1. Analyze and evaluate existing digital interfaces based on UI/UX principles, identifying areas for improvement, and proposing design solutions to enhance user experience.
2. Gain the skills to plan, conduct, and report on user research activities, demonstrating the ability to gather and analyze qualitative and quantitative data to inform UX design decisions.
3. Produce high-fidelity UI mock-ups and prototypes using industry-standard design tools, showcasing their proficiency in applying design principles to create visually appealing and intuitive user interfaces.
4. Have developed a comprehensive understanding of the UX design process, including prototyping and iterative testing, and will be capable of applying these concepts to improve the usability and effectiveness of digital products and services.

### Unit I : Introduction to UI/UX

**6 Hrs**

- Overview of UI/UX, importance, basic principles,
- Difference between UI and UX, industry applications

### Unit II : User Research and Analysis

**6 Hrs**

- Understanding users, conducting user research, user personas,
- User stories, usability testing

### Unit III : UI Design Principles and Tools

**6 Hrs**

- Fundamental design principles, UI elements and components,
- Introduction to design tools (e.g., Figma)

#### **Unit IV : UX Design Process and Prototyping**

**6 Hrs**

- UX design process, wireframing, prototyping, user testing, iteration

#### **Textbooks:**

1. Don't Make Me Think, by Steve Krug
2. The Design of Everyday Things, by Don Norman

3. Interaction Design: Beyond Human-Computer Interaction, by Jenny Preece, Helen Sharp, and Yvonne Rogers

#### **Reference Books:**

1. Lean UX: Designing Great Products with Agile Teams, by Jeff Gothelf and Josh Seiden
2. 100 Things Every Designer Needs to Know About People, by Susan Weinschenk
3. Designing Interfaces, by Jenifer Tidwell

## DATA ETHICS : (AIOEUA21239B)

Teaching Scheme	Examination Scheme									
Credits: 2	HA	TW	SCE	PPT	GD	CIE	ESE	PR	OR	TOTAL
Lecture's/Week(L) 2 Hrs/week	20	-	20	-	-	20	40	-	-	100
Practical/Week(P):										

<b>Prerequisites:</b>	Basics of Data Science									
<b>Course Objectives:</b>										
•	To understand the fundamental concepts of Data Ethics.									
•	To familiarize students with the concepts of Privacy and Confidentiality in relation with data ethics.									
•	To introduce students with the concepts of Trust, Transparency and Algorithmic bias in relation with data ethics.									
•	To understand how Data Governance is becoming more important.									
<b>Course Outcomes:</b>										
	After completion of the course, student will be able to									
1.	Describe the basic concepts related to Data Ethics.									
2.	Explain Data Privacy in relation to Data Ethics.									
3.	Illustrate Digital Trust, Transparency and Algorithmic bias.									
4.	Determine the importance of Data Governance.									

<b>Unit I</b>	<b>Introduction to Data Ethics</b>	<b>6-Hrs</b>
<p>Definition and Importance of Data Ethics, Oops, we're all public ,Personal data becomes commercially valuable, Data driven business model, Data as payment, Good Data, Data at risk, What customer want, Teens want privacy, Demand for data control, Consumers are beginning to act, Pay for privacy,</p> <p>Principles of data ethics, Ethically significant harms and benefits of data ethics, Common ethical challenges for data practitioners and users.</p> <p><b>Case Study:</b> Aadhaar Data Breach</p> <p><a href="https://www.linkedin.com/pulse/aadhaar-data-breach-in-depth-analysis-one-indias-most-pervasive-iywzc/">https://www.linkedin.com/pulse/aadhaar-data-breach-in-depth-analysis-one-indias-most-pervasive-iywzc/</a></p>		
<b>Unit II:</b>	<b>Data Privacy</b>	<b>6-Hrs</b>
<p>Privacy charlatans, A new market for privacy tech, Privacy Embedded in Innovation, Privacy products are not new, Privacy by Design ,Privacy by Default, Differential privacy, Techniques of Data Anonymization</p>		

and De-identification, Why is access important?, Providing access, Statistical disclosure control techniques, Non-tabular data, New challenges, Privacy Enhancing Technologies (PETs)

**Case Study:** COVID 19 Data breach

<https://pib.gov.in/PressReleasePage.aspx?PRID=1931691>

<b>Unit III:</b>	<b>Trust , Transparency and Algorithmic bias</b>	<b>6-Hrs</b>
------------------	--	--------------

What is digital trust? Why is digital trust important? , How to build digital trust? , Snowden effect, Trust is achieved in various ways, Privacy branding, Data Transparency: Importance, benefit and challenges.

**Algorithmic Fairness and Bias:** Introduction, Sources of bias, Sample bias, Label bias, Machine learning pipeline bias, Dealing with Bias, Choosing bias metrics, Mitigating Bias

**Case Study:** Marriott International Data Breach

<https://hoteltechreport.com/news/marriott-data-breach>

<b>Unit IV:</b>	<b>Data Governance</b>	<b>6-Hrs</b>
-----------------	------------------------	--------------

What is data Governance?, What Data Governance Involves? Classification and Access Control, Why Data Governance is becoming more important, The Size of Data Is Growing, Examples of Data Governance in action, Use of data to make better decisions, New Regulations and Laws Around the Treatment of Data, Why Data Governance Is Easier in the Public Cloud, Ingredients of Data Governance.

**Privacy Regulations & Laws:** GDPR, DPDPA, COPPA, HIPPA, CCPA, PIPEDA, LGPD, POPI, PCI-DSS

**Case Study:** How Airbnb used data literacy to promote data-driven decision-making

<https://atlan.com/data-governance-examples/>

#### **Text Books:**

1	Gry Hasselbalch, Pernille Tranberg Data Ethics - The New Competitive Advantage, PubliShare ,2016, 9788771920185, 8771920188
2	Christoph Stückelberger and Pavan Duggal (Eds.) Data Ethics: Building Trust How Digital Technologies Can Serve Humanity, Globethics, 2023, 9782889315246, 288931524X
3	Evren Eryurek, Uri Gilad, Valliappa Lakshmanan, Anita Kibunguchy, Jessi Ashdown Data Governance: The Definitive Guide: People, Processes, and Tools to Operationalize Data Trustworthiness, O'Reilly Media, Incorporated, 2021, 9781492063483, 1492063487

#### **Reference Books:**

1	Frauke Kreuter, Ian Foster, Julia Lane, Rayid Ghani, Ron S. Jarmin Big Data and Social Science Data Science Methods and Tools for Research and Practice CRC Press,2020, 9781000208634, 100020863X
---	--



**Online Resources:**

	1	Introduction to Data Ethics <a href="https://www.scu.edu/media/ethics-center/technology-ethics/IntroToDataEthics.pdf">https://www.scu.edu/media/ethics-center/technology-ethics/IntroToDataEthics.pdf</a>
	2	Why digital trust matters? <a href="https://www.mckinsey.com/capabilities/quantumblack/our-insights/why-digital-trust-truly-matters">https://www.mckinsey.com/capabilities/quantumblack/our-insights/why-digital-trust-truly-matters</a>
	3	Data ethics Tools- <a href="https://dataethics.ewtools/">https://dataethics.ewtools/</a>
	4	Privacy by Design The 7 Foundational Principles- <a href="https://privacy.ucsc.edu/resources/privacy-by-design---foundational-principles.pdf">https://privacy.ucsc.edu/resources/privacy-by-design---foundational-principles.pdf</a>

## SENSORS TECHNOLOGY: (ETOEUA21239C)

Teaching Scheme	Examination Scheme									
Credits: 2	HA	TW	SCE	PPT	GD	CIE	ESE	PR	OR	TOTAL
Lecture's/Week(L) 2 Hrs/week	20	-	20	-	-	20	40	-	-	100
Practical/Week(P):										

### Prerequisite:

- Basic knowledge of electronics components and sensor
- Fundamental of Programming language

### Course Objectives:

- To provide in depth knowledge in basic principles applied in sensors
- To Learn about different types of sensors and their applications in various fields. (like automotive, healthcare, environmental monitoring, industrial automation, and consumer electronics)
- To understand data acquisition systems and the integration of sensors into larger systems and networks
- To explore innovations such as IoT (Internet of Things) sensors, wearable sensors, and advanced MEMS (Micro-Electro-Mechanical Systems).

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

1. Choose an appropriate sensor comparing different standards and guidelines to make sensitive measurements of physical parameters. (Understand level)
2. Use of microcontrollers with various sensors/wireless sensor network and actuators for design of application. (Apply level)
3. Select IoT protocols, Node MCUs and software (Analyze level)
4. Use of Senores and IoT in various Industrial and other applications (Apply level)

### Course contents:

- Sensor fundamentals and characteristics: Sensor Classification, Performance and Types, Error Analysis characteristics, Type of Sensors: Optical Sources and Detectors, Strain, Force, Torque and Pressure sensors, Velocity and Acceleration sensors, Flow, Temperature and Acoustic sensors, Display Sensors.
- Smart Sensors/ IoT-Enabled Sensors: Sensors with integrated processing capabilities to perform complex functions and communicate autonomously. characteristics of wireless sensor nodes,
- IoT Protocols and standards, IoT protocol architecture, wireless technologies related to IoT, Role of microcontroller as gateway to interfacing sensors/ wireless sensors and actuators, Controlling Hardware, Controllers and Network Devices, Development Boards like Arduino, Raspberry Pi, Beagle Bone and various system software IOT platform.
- Case studies using sensors and IoT node MCUs: Industry, Smart Cities, Agriculture, Health and Lifestyle, Home Automation

**Text Books:**

1. Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 2015, 3rd edition, Springer, New York.
2. Jon. S. Wilson, "Sensor Technology Hand Book", 2011, 1st edition, Elsevier, Netherland.
3. Arshdeep Bahga, Vijay Madiseti, "Internet of Things – A hands-on approach", Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515.
4. Jeeva Jose, "Internet of Things", ISBN-10 : 938617359X, Khanna Book Publishing, 2018.
5. Raj Kamal, Internet of Things: Architecture and Design Principle", ISBN-13: 978-93-5260-522-4, McGraw Hill Education (India) 2017

**Reference Books:**

1. John G Webster, "Measurement, Instrumentation and sensor Handbook", 2017, 2nd edition, CRC Press, Florida.
2. Hakima Chouchi, "The Internet of Things Connecting Objects to the Web", ISBN 078 -1-84821-140-7, Wiley Publications.
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning

**Relevant MOOCs Course**

1. NPTEL - [Introduction to internet of things - Course \(nptel.ac.in\)](https://nptel.ac.in/courses/2019Fall/106101001/)
2. Coursera - [An Introduction to Programming the Internet of Things \(IOT\) | Coursera](https://www.coursera.org/learn/internet-of-things)

**List of Assignments:**

**(Students are instructed to use hardware and software online platforms for simulation and programming to implementing the following assignment)**

**Mode of Evaluation: CAT (Classroom Assessment Techniques), Digital Assignments, Quiz, Online course, Paper publication, Projects, Hackathon/Makeathon.**

1. Study of different sensors: - temperature sensor, bio-sensor, IR sensor, chemical sensor (PH), gauge sensor, ultrasonic sensor etc.
2. Study of Raspberry Pi 4, Arduino board and Operating systems for the same. Understand the process of OS installation on the Raspberry Pi.
3. Understand the connection and configuration of GPIO and its use in programming. Write an application of the use of push switch and LEDs.
4. Write an application using Raspberry Pi/Arduino for traffic signal monitoring and control system.
5. Write an application using Raspberry Pi/Arduino for smart health monitoring system which records heart beat rate and temperature and also sends sms alerts if readings are beyond critical values.
6. Implement a weather monitoring system using humidity, temperature and raindrop sensor and Raspberry Pi/Arduino board.
7. Create a simple web interface for Raspberry-Pi/Beagle board to control the connected LEDs remotely through the interface.
8. Internet of things enabled real time water quality monitoring system
9. Implement smart home automation system. The system automates home appliances and control them over internet from anywhere.
10. Develop a Real time application like a smart home security. **Description:** When anyone comes at door the camera module automatically captures his image and sends a notification to the owner of the house on his mobile phone using GSM modem.

## RENEWABLE ENERGY: (MEOEUA21239D)

Teaching scheme	Examination Scheme									
Credits: 2 Lectures (L): 2 hrs./week Tutorial (T): Practical (P):	ISA						ESA			Total
	HA	TW	SCE	PPT	GD	CIE	ESE	PR	OR	
	20		20			20	40			100

**Prerequisite:** Engineering Chemistry, Engineering Physics, Engineering Mathematics, Engineering Mechanics

**Course objectives:**

- To introduce renewable energy resources availability, potential and suitability as a substitute for conventional energy resources in future energy demand.

**Course Outcomes:**

Upon completion of the course, students will be able to

- Understand energy generation, its consumption and opportunities to generate clean energy.
- Comprehend the fundamental of solar energy conversion, operation and its applications.
- Explain basic principles and operational features of wind turbine.
- Illustrate the emerging green technologies – fuel cell and hydrogen energy systems.

**Unit I– Introduction to Renewable energy**

Fundamentals of Energy, Environmental aspects of energy, energy and sustainable development, Carbon footprint, Energy Audit for home

Renewable Energy Scenario in India, prospects, perspectives and advantages of various renewable energy sources, Issues and Challenges for Growth of Renewable Energy in India

**Unit II – Solar Energy**

Solar Radiation Spectrum; Components of solar radiation -Beam, diffuse and global radiation, Solar radiation Measurements - Pyrhemometers, Pyrometer, Sunshine Recorder.

Classification of Solar Thermal systems, Concentrated solar power (CSP) systems- parabolic collectors, parabolic dish collector, Solar tower, Domestic water heating system

Solar PV cell types, operation and applications of solar photovoltaic system, Photovoltaic system for electric power generation, Solar park

**Unit III – Wind Energy**

Wind energy potential and installation in India, Wind mechanism, Principle of wind energy conversion, wind data and site selection considerations, Wind velocity and power from wind, Lift and drag force

Basic components of wind energy conversion systems, Small and large wind turbines; Horizontal and Vertical axis; Upwind and Downwind, One, Two and Three blades.

On-shore and off-shore wind power, issues occur while integrating wind energy with power grids.

**Unit IV- Fuel cell and Hydrogen energy**

Principle and operation of fuel cells, classification and types of fuel cells, potential applications, Fuel cell power plant, Present status and environmental effects

Hydrogen energy, Benefits of hydrogen energy, hydrogen production technologies

Hydrogen energy storage and delivery, applications of hydrogen energy, challenges associated with hydrogen energy, current status

**Text Books:**

1. G. D. Rai, 'Non-Conventional Energy Sources', Khanna Publisher
2. Tiwari G. N. 'Solar Energy: Fundamentals, design, modelling and Applications', Narosa, 2002
3. D P Kothari, K C Singal & Rakesh Ranjan, 'Renewable Energy Sources & Emerging Technologies', Prentice Hall India

**Reference Books:**

1. Kreith And Kreider, Solar Energy Handbook, McGraw Hill
2. Robert Gasch, 'Wind Power Plant Fundamentals, Design, Construction And Operations', Springer
3. Gary L Johnson, ' Wind Energy Systems', Prentice-Hall Inc., New Jersey
4. Mukund R Patel, ' Wind And Solar Power Systems: Design, Analysis and Operation, Second Edition', CRC Press
5. Goswami D. Y., Kreith F, Kreider J F, 'Principles of Solar Engineering', Taylor & Francis

## CLIMATOLOGY: (CVOEUA21239E)

Teaching scheme	Examination Scheme									
Credits: 2 Lectures (L): 2 hrs./week Tutorial (T): Practical (P):	ISA						ESA			Total
	HA	TW	SCE	PPT	GD	CIE	ESE	PR	OR	
	20	-	20	-	-	20	40	-	-	100

Atmospheric structure and composition, Solar radiation and global energy budget, External and internal forcing, Climate feedbacks, Account of past climate, Environmental indicators and instrumental records, Human footprints on global warming, Predicting future climate, Temperature regimes, Extreme climate events, Impact of climate change on agriculture, Impact of climate change on Livestock, Impact of climate change on biodiversity, Impact of climate change on water resources, Impact of climate change on livelihood, Impact of climate change on human health, Climate change vulnerability assessment, Life Cycle Assessment, Geoinformatics in Climate Change Studies, Concept of mitigation and adaptation, Climate smart agriculture, Soil carbon sequestration, Biofuels, Climate Refugees, Climate Justice, Climate Change and Gender, International Initiatives, National Level Action Plan, State Level

### Text Books:

1. Global Warming and Climate Change by Agarwal S. K., First Edition, A P H Publishing Corporation, 2004
2. Foundations of Climatology by E.T. Stringer, Surjeet Publications, Delhi, 1989
3. Impact of climate change on water resources Climate by Raju, K. Srinivasa, and D. Nagesh Kumar, 2018

### Reference Books:

1. The rough guide to climate change by Robert Henson, London, New York , 2008. 2nd edition
2. Primer on Climate Change and Sustainable Development by Mohan Munasinghe and Rob Swart, Cambridge University Press, 2005
3. Barry RG and Chorley RJ. (2010). Atmosphere, weather and climate. 8th Edition. Routledge, New York. pp.421
4. Burroughs WJ (2007) Climate Change: A multidisciplinary approach. 2nd Edition. Cambridge University Press. Pp.390. ISBN: 978-0-521-69033-1
5. Dessler A (2016) Introduction to Modern Climate Change. 2nd Edition. Cambridge University Press. ISBN: 978-521-17315-5

### e-Resources

1. <https://www.ipcc.ch/assessment-report/ar5/>
2. <https://www.coursera.org/specializations/climatechangeandsustainableinvesting>
3. <https://moef.gov.in/moef/about-the-ministry/index.html>