ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::RAJAMPET
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

R23

III YEAR COURSE STRUCTURE

II Semester							
S.No.	**Category**	**Code**	**Title**	**L**	**T**	**P**	**Credits**
1	PC	23A0461T	Microwave and Optical Communications	3	0	0	3
2	PC	23A0462T	VLSI Design	3	0	0	3
3	PC	23A0463T	Digital Signal Processing	3	0	0	3
4	PE	23A046AT	Electronic Measurements and Instrumentation	3	0	0	3
		23A046BT	Embedded systems & IOT				
		23A046CT	Speech Processing				
5	PE	23A046DT	Digital Image Processing	3	0	0	3
		23A046ET	Artificial Intelligence & Machine learning				
		23A046FT	Satellite Communications				
6	OE		**Open Elective-II**	3	0	0	3
7	PC	23A0461L	Microwave and Optical Communications Lab	0	0	3	1.5
8	PC	23A0462L	VLSI Design Lab	0	0	3	1.5
9	SEC	23A0463L	Machine Learning and DSP	0	1	2	2
10	MC	23AHS67T	Technical Paper Writing & IPR	2	0	0	-
			Total	**20**	**1**	**8**	**23**
Mandatory Industry Internship of 08 weeks duration during summer vacation							

Open Elective – II

S.No.	Code	Title	Offered by the Dept
1	23A016GT	Disaster Management	CIVIL
2	23A016HT	Sustainability In Civil Engineering Practices	
3	23A026IT	Renewable Energy Sources	EEE
4	23A036KT	Automation and Robotics	ME
5	23A056IT	Operating Systems	CSE& Allied/IT
6	23A056JT	Machine Learning	
7	23AHS61T	Optimization Techniques	Mathematics
8	23AHS62T	Physics Of Electronic Materials and Devices	Physics
9	23AHS63T	Chemistry Of Polymers and Applications	Chemistry
10	23AHS64T	Academic Writing and Public Speaking	Humanities

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, RAJAMPET
(An Autonomous Institution)

R23

Title of the Course: Microwave and Optical Communications
Category: PC
Couse Code: 23A0461T
Branch/es: ECE
Year III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1.To analyse different modes of operation in rectangular wave guides, circular wave guides and resonators.
2 To study and analyse various microwave components and microwave sources.
3. To gain knowledge on different microwave semiconductor devices and microwave measurements procedures.
4. To analyse different optical fiber modes and to study different types of distortions and losses in optical communication.
5. To study various optical sources, optical detectors and to analyze various optical links.

Course Outcomes:

At the end of the course, the student will be able to

1. Analyze different modes of operation in rectangular wave guides, circular wave guides and resonators.
2. Understand and analyze various microwave components and microwave sources.
3. Gain knowledge on different microwave semiconductor devices and microwave measurements procedures.
4. Analyze different optical fiber modes and to study different types of distortions and losses in optical communication.
5. Understand study various optical sources, optical detectors and to analyze various optical links.

Unit 1 Waveguides **13**

Introduction, Rectangular wave guides, Field expressions for TE and TM modes, Wave propagation in the guide, Phase and group velocities, Power transmission and attenuation, Wave guide current and mode excitation, Circular wave guide – TE and TM modes(**Qualitative treatment only**), Wave propagation, Cavity resonators (**Qualitative treatment only**).

Unit 2 Passive Microwave Devices Microwave Amplifiers and Oscillators: **15**

Introduction to scattering parameters and their properties, Terminations, Variable short circuit, Attenuators, Phase shifters, Hybrid Tees (H-plane, E-plane, Magic Tees), Directional Couplers – Bethe hole and Two hole Couplers, Deriving Scattering matrix for Microwave passive devices. Microwave propagation in Ferrites, Gyrator, Isolator, Circulator.Microwave Tubes: Linear Beam Tubes – Two cavity Klystron amplifier -velocity modulation, bunching process, output power, Reflex Klystron oscillator, power output and efficiency, Travelling Wave Tube (TWT) – Bunching process and amplification process (**Qualitative treatment only**). Crossed Field Tubes – Magnetron oscillator, pi-mode operation, power output and efficiency, Hartree Condition.

Unit 3 Microwave Semiconductor Devices Microwave Measurements **12**

Gunn Oscillator – Principle of operation, Characteristics, Two valley model, IMPATT, TRAPATT diodes.Description of Microwave bench-different blocks and their features, errors and precautions,

Microwave power measurements, Measurement of attenuation, frequency, VSWR (low, medium, high), Measurement of _Q' of a cavity, Impedance measurements.

Unit 4 Introduction to Optical Fibers and Transmission Characteristics 10

The propagation of light in optical waveguides – Classification of optical fibers – Numerical aperture, Step index and Graded index fiber – Modes in cylindrical fiber – Linearly polarized modes, Attenuation: Absorption, Scattering, Bending losses. Modal dispersion and chromatic dispersion – Single mode fiber - waveguide dispersion– MFD – PMD

Unit 5 Optical Transmitters and Receivers Optical Link Design 10

Optical Sources: - Light source materials – LED homo and hetero structures – surface and edge emitters – Quantum efficiency – Injection Laser Diode – Modes and threshold condition –Structures and Radiation Pattern. Optical detectors: – Physical principles – PIN and APD diodes – Photo detector noise. Point- to-point links – System considerations – Link Power budget – Rise time budget.

Prescribed Textbooks:

1. David M. Pozar,‖ Microwave Engineering‖ John Wiley & Sons, Inc. 4th edition, 2012
2. . Samuel Y. Liao, ―Microwave Devices and Circuits‖, PHI publications, Third Edition, 1997.
3. Gerd Keiser, ―Optical Fiber Communications‖, McGraw Hill, Third Edition, 2000.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Ethics	Individual and team work	Communication	Project management and	Life-long learning	PSO1	PSO2
23A0461T.1	3	2	-	2	2	-	-	-	-	-	2	3	-
23A0461T.2	3	3	2	2	2	-	-	-	-	-	2	3	-
23A0461T.3	3	2	2	3	3	-	-	-	-	-	2	3	-
23A0461T.4	3	2	2	2	2	-	-	-	-	-	2	3	-
23A0461T.5	3	2	2	2	3	-	-	-	-	-	2	3	2

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Title of the Course: VLSI Design
Category: PC
Couse Code: 23A0462T
Branch/es: ECE
Year III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To understand the steps involved in fabrication of ICs using MOS transistor technology.
2. To learn about the VLSI design processes, Stick diagrams and Layouts.
3. To gain knowledge on the Gate Level Design concepts.
4. To learn the design of various subsystems with different VLSI Design styles.
5. To get familiar with CMOS testing techniques.

Course Outcomes:

At the end of the course, the student will be able to

1. Understand the steps involved in fabrication of ICs using MOS transistor technology.
2. Learn about the VLSI design processes, Stick diagrams and Layouts.
3. Gain knowledge on the Gate Level Design concepts.
4. Learn the design of various subsystems with different VLSI Design styles.

5 . Familiar with CMOS testing techniques.

Unit 1 Introduction **10**

Introduction, Brief Introduction to IC technology MOS, PMOS, NMOS, CMOS & BiCMOS Technologies. Basic Electrical Properties of MOS and Bi CMOS Circuits: I_{DS} - V_{DS} relationships, MOS transistor Threshold Voltage, figure of merit, Transconductance, Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

Unit 2 VLSI Circuit Design Processes **13**

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Lambda(λ)-based design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

Unit 3 Gate level Design **14**

Gate level Design: Logic gates and other complex gates, Switch logic, Alternate gate circuits. Basic Circuit Concepts: Sheet Resistance Rs and its concepts to MOS, Area Capacitances calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out

Unit 4 **Subsystem Design** **10**

Subsystem Design: Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Counters. VLSI Design styles: Full-custom, Standard Cells, Gate-arrays, FPGAs, CPLDs and Design Approach for Full-custom and Semi-custom devices, parameters influencing low power design.

Unit 5 **CMOS Testing** **12**

CMOS Testing: Need for testing, Design for testability - built in self-test (BIST) – testing combinational logic –testing sequential logic – practical design for test guide lines – scan design techniques.

Prescribed Textbooks:

1 Essentials of VLSI Circuits and Systems, Kamran Eshraghian, EshraghianDougles,
A. Pucknell, 2005, PHI

2.Modern VLSI Design – Wayne Wolf, 3 Ed., 1997, Pearson Education.

Reference Books:

1 CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson,2009.

2.BehzadRazavi , ―Design of Analog CMOS Integrated Circuits‖, McGraw Hill, 2003.

3. an M. Rabaey, ―Digital Integrated Circuits‖, AnanthaChandrakasan and Borivoje Nikolic, Prentice-Hall of India Pvt.Ltd, 2nd edition, 2009

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Ethics	Individual and team work	Communication	Project management and	Life-long learning	PSO1	PSO2
23A0462T.1	3	3	-	1	-	2	-	-	-	-	1	2	1
23A0462T.2	3	2	1	1	-	2	-	1	-	-	-	2	-
23A0462T.3	3	3	3	2	-	-	-	1	-	-	-	3	-
23A0462T.4	3	3	3	2	-	-	-	1	-	-	-	3	-
23A0462T.5	3	1	1	1	1	1	2	-	-	-	1	2	2

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R23

Title of the Course: Digital Signal Processing
Category: PC
Couse Code: 23A0463T
Branch/es: ECE
Year: III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To get familiar with the properties of discrete time signals, systems and z-transform.
2. To learn the importance of FFT algorithm for computation of Discrete Fourier Transform and Fast Fourier Transform with decimations.
3. To understand the implementations of digital filter structures.
4. To analyze the FIR filter design using Fourier series and windowing methods.
5. To gain the knowledge on Programmable DSP Devices.

Course Outcomes:

At the end of the course, the student will be able to

1. Familiar with the properties of discrete time signals, systems and z-transform.
2. Learn the importance of FFT algorithm for computation of Discrete Fourier Transform and
3. Fast Fourier Transform with decimations.
4. Understand the implementations of digital filter structures.
5. Analyze the FIR filter design using Fourier series and windowing methods.
6. Gain the knowledge on Programmable DSP Devices.

Unit 1 Introduction to discrete time signals and systems & Z–Transform 16

Introduction to digital signal processing, Review of discrete-time signals and systems, Analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems. Z–Transform: Definition, ROC, Properties, Poles and Zeros in Z-plane, the inverse Z-Transform, System analysis, Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions, Illustrative Problems, analysis of linear time-invariant systems in the z-domain, pole-zero stability.

Unit 2 Discrete Fourier Transform & Fast Fourier Transform 12

DFT: Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT, sampling, Quantization effects. FFT: Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).

Unit 3 IIR Filters 12

Introduction to digital filters, Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods, Frequency transformations, Basic structures of IIR Filters - Direct form-I, Direct form-II, Cascade form and Parallel form realizations.

Unit 4 FIR Filters **12**

Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using Fourier series and windowing methods (Rectangular, Triangular, Raised Cosine, Hanging, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters – Direct form, Cascade form, Linear phase realizations.

Unit 5 Multirate Digital Signal Processing and Programmable DSP Device **10**

Introduction, Down sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion, Applications of Multi Rate Signal Processing.

Programmable DSP Devices: Introduction and Architecture of TMS320C5X, Central Arithmetic Logic Unit, ALU.

Prescribed Textbooks:

1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education, 2007..
2. A.V.Oppenheim and R.W. Schaffer, Discrete Time Signal Processing ,PHI..

Reference Books:

1. S.K.Mitra, Digital Signal Processing – A practical approach , 2nd Edition, Pearson Education, New Delhi, 2004
2. MH Hayes, Digital Signal Processing, Schaum's Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using MATLAB, Thomson, 2007.i.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Ethics	Individual and team work	Communication	Project management and	Life-long learning	**PSO1**	**PSO2**
23A0463T.1	3	2	2	2	2	-	-	-	-	-	2	3	-
23A0463T.2	3	3	2	2	3	-	-	-	-	-	2	3	-
23A0463T.3	3	2	3	2	3	-	-	2	1	1	2	3	-
23A0463T.4	3	3	3	2	2	-	-	1	1	-	2	3	-
23A0463T.5	3	2	2	1	3	1	1	1	1	2	3	2	2

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Title of the Course: ELECTRONIC MEASUREMENTS AND INSTRUMENTATION
Category: PE
Couse Code: 23A046AT
Branch/es: ECE
Year: III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To know about the performance characteristics of instruments and measurement of electrical quantities.
2. To understand the construction, working and applications of different types of CRO‘s.
3. To analyze the working of different types of bridges.
4. To study the working of signal & function generators and analyzers.
5. To analyze the working of sensors and transducers in measuring physical parameters.

Course Outcomes:

At the end of the course, the student will be able to

1. Learn about the performance characteristics of instruments and measurement of electrical quantities.
2. Understand the construction, working and applications of different types of CRO‘s.
3. Compare the working of different types of bridges.
4. Know the working of signal & function generators and analyzers.
5. Grasp the working of sensors and transducers in measuring physical parameters.

Unit 1 **15**

Performance characteristics of Instruments: Static characteristics, Accuracy, Precision, Resolution, Sensitivity, static and dynamic calibration, Errors in Measurement, and their statistical analysis, dynamic characteristics-speed of Response, fidelity, Lag and dynamic error. DC ammeters, DC voltmeters-multirange, range extension/solid state and differential voltmeters, AC voltmeters–multirange, range extension. Thermocouple type RF ammeter, ohm meters, series type, shunt type, multimeter for voltage, current and resistance measurements.

Unit 2 **12**

Oscilloscopes: Introduction, Basic Principle, Standard specifications of CRO, CRT features, vertical and horizontal amplifiers, horizontal and vertical deflection systems, sweep trigger pulse, delay line, sync selector circuits, probes for CRO – active, passive, and attenuator type, triggered sweep CRO, and Delayed sweep, dual trace/beam CRO, Measurement of amplitude, frequency and phase (Lissajous method). Principles of sampling oscilloscope, storage oscilloscope, and digital storage oscilloscope, Digital frequency counters, time & Period measurements.

Unit 3 **12**

Bridges: DC Bridges for Measurement of resistance: Wheat stone bridge, Kelvin‘s Bridge, AC Bridges for Measurement of inductance- Maxwell‘s bridge, Hay‘s Bridge, Anderson bridge. Measurement of capacitance- Schearing Bridge, Wien Bridge. Errors and precautions in using bridges.

Unit 4 **12**

Signal Generators: Signal generator-fixed and variable, AF oscillators, function generators, pulse, random noise, sweep, and arbitrary waveform generators, their standards, specifications and principles of working (Block diagram approach). Wave analyzers, Harmonic distortion analyzers, Spectrum analyzers, and Logic analyzers.

Unit 5 **10**

Sensors and Transducers - Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.

Prescribed Textbooks:

1. A.D. Helfrick and W.D. Cooper, ―Modern Electronic Instrumentation and Measurement Techniques, 5th Edition, PHI, 2002..
2. H.S.Kalsi, ―Electronic Instrumentation‖, 2nd edition, Tata McGraw Hill, 2004.

Reference Books:

1. David A. Bell, ―Electronic Instrumentation & Measurements‖, 2nd Edition, PHI, 2003.
2. K. Lal Kishore, ―Electronic Measurements & Instrumentations‖, Pearson Education, 2009.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Ethics	Individual and team work	Communication	Project management and	Life-long learning	PSO1	PSO2
23A046AT. 1	3	3	3	3	-	-	-	-	-	-	-	2	-
23A046AT. 2	3	3	3	3	-	-	-	-	-	-	-	2	-
23A046AT. 3	3	3	3	3	-	-	-	-	-	-	-	2	-
23A046AT. 4	3	3	3	3	-	-	-	-	-	-	-	2	-
23A046AT. 5	3	3	3	3	-	-	-	-	-	-	-	2	-

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Title of the Course: Embedded systems & IOT
Category: PE
Couse Code: 23A046BT
Branch/es: ECE
Year III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1.Understand the Architecture, Development & Design of Embedded Systems
2 Understand the Architecture and features of ARM, ARDUINO
3.Know the terminology, technology and its applications of IoT.
4.Understand the concepts of M2M Network, IoT Platforms & Cloud platforms
5.Learn the concepts of python programming language.

Course Outcomes:

At the end of the course, the student will be able to
1.Understand the Architecture, Development & Design of Embedded Systems.
2.Understand the Architecture and features of ARM, ARDUINO.
3.Understand the terminology, technology and its applications of IoT.
4. Identify the difference between of M2M & IoT and understand IoT Platforms & Cloud platforms.
5.develop the IoT experiments with the help of Python programs.

Unit 1 **Introduction to Embedded Systems** **9**

Introduction, Definition Types of Embedded systems, Applications of embedded systems, Hardware & Software Architecture of Embedded Systems, Embedded Systems Development process

Unit 2 **Advanced Microcontrollers** **10**

The ARM Architecture, Pin Diagram, Register Set, ARM7, ARM9 Features and applications of ARM. ARDUINO: Block diagram, Architecture, Pin functions, overview of main features such as I/O Ports, Timers, interrupts serial port, PWM, ADC.

Unit 3 **Introduction to Internet of Things (IoT)** **10**

Introduction to Internet of Things, History of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels & Deployment Templates, Applications of IoT.

Unit 4 **M2M Network, IoT Platforms & Cloud platforms** **11**

Introduction, M2M, Difference between IoT and M2M, SDN (Software Defined Networking) & NFV (Network Function Virtualization) for IoT, IoT Platform Architecture -IBM Internet of Things & Watson Platforms, Cloud platform-Think Speak

Unit 5 **Fundamentals of Python Programming** **12**

Introduction, Installing Python, Python Data Types and Data Structures, Control Flow, Functions, Modules, Packages and File Handling.

Prescribed Textbooks:

1 ArsheepBahga , Vijay Madisetti , —Internet of Things: A Hands-On Approach‖, 1st Edition, VPT, 2014.
1. K.V.K.K.Prasad, —Embedded Real Time Systems: Concepts, Design and Programming‖, 1st Edition, Dreamtech Publication, 2014
2. Massimo Banzi and Michael Shiloh -Make: Getting Started with Arduino, 3e: The Open Source Electronics Prototyping Platform ,3rd edition

Reference Books:

1 Rene Beuchat , Andrea Guerrieri & Sahand Kashani —Fundamentals of System-on-Chip Design on Arm Cortex-M Microcontrollers‖ Paperback, 2 August 2021.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, —The Internet of Things: Key applications and Protocols‖, 2nd Edition, Wiley Publications, 2012.
3. Adrian McEwen, Hakim Cassimally, —Designing the Internet of Things‖, Wiley Publications, 2013

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Ethics	Individual and team work	Communication	Project management and	Life-long learning	**PSO1**	**PSO2**
23A046BT. 1	3	3	3	3	__	__	__	__	__	__	3	2	__
23A046BT. 2	3	3	3	3	__	__	__	__	__	__	3	2	__
23A046BT. 3	3	3	3	3	__	__	__	__	__	__	3	2	__
23A046BT. 4	3	3	3	3	__	__	__	__	__	__	3	2	__
23A046BT. 5	3	3	3	3	__	__	__	__	__	__	3	2	__

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Title of the Course: Speech processing
Category: PE
Couse Code: 23A046CT
Branch/es: ECE
Year III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To impart knowledge on anatomy and physiology of speech organs and the process of Speech Production.
2. To understand the methods for extracting of speech using Time domain parameters.
3. To learn the Frequency Domain Methods for Speech Processing
4. To interpret and analyze LPC Parameters for Speech Processing.
5. To introduce the concepts of homomorphic Speech Processing.

Course Outcomes:

At the end of the course, the student will be able to

1. Gain knowledge on anatomy and physiology of speech organs and the process of Speech Production.
2. Understand the methods for extracting of speech using Time domain parameters
3. Learn the Frequency Domain Methods for Speech Processing.
4. Interpret and analyze LPC Parametersfor Speech Processing.
5. Grasp the concepts of homomorphic Speech Processing

Unit 1 Fundamentals of Digital Speech Processing: 10

Anatomy & Physiology of Speech Organs, The process of Speech Production, The Acoustic Theory of Speech Production – Uniform lossless tube model, effect of losses in vocal tract and radiation at lips, Digital models for speech signals.

Unit 2 Time Domain Methods for Speech Processing: 6

Time domain parameters of speech, methods for extracting the parameters: Zero crossings, Auto-correlation function, pitch estimation.

Unit 3 Frequency Domain Methods for Speech Processing 9

Short time Fourier analysis, Filter bank analysis, Spectrographic analysis, Formant extraction, Pitch extraction.

Unit 4 Linear predictive Coding (LPC) for Speech: 12

Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains, Method of Solution of the LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.

Unit 5 Homomorphic Speech Processing: 15

Introduction Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, pitch Detection and Formant Estimation; Applications of speech processing – Speech Enhancement, Speech recognition, Speech synthesis and Speaker Verification.

Prescribed Textbooks:

1.L.R. Rabiner and S. W. Schafer, Digital Processing of Speech Signals, Pearson Education.

2.Douglas O‘ Shaughnessy, Speech Communications: Human &Machine, 2nd Ed., Wiley-IEEE Press.

Reference Books:

1.Thomas F. Quatieri, Discrete Time Speech Signal Processing: Principles and Practice, 1st Ed., Pearson Education.

2.Ben Gold & Nelson Morgan, Speech and Audio Signal Processing: Processing and Perception of Speech and Music ,1st Ed., Wiley.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Ethics	Individual and team work	Communication	Project management and	Life-long learning	PSO1	PSO2
23A046CT. 1	3	3	2	3	2	2			3			3	2
23A046CT. 2	3	2	2	3	2	2			2			3	2
23A046CT. 3	3	2	1	2	2	2			1			3	2
23A046CT. 4	3	3	2	2	2	2			2			2	1
23A046CT. 5	3	3	1	1	2	2			2			3	1

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R23

Title of the Course: Digital image Processing
Category: PE
Couse Code: 23A046DT
Branch/es: ECE
Year III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To learn the fundamentals of Image Processing with different Transforms.
2. To understand functions of Intensity Transformations and working fundamentals of Spatial Filters
3. To implement various models of Restoring and Reconstruction of Images from filtering projections.
4. To acquire basic knowledge on color image processing
5. To analyze various Image compression and segmentation methods

Course Outcomes:

At the end of the course, the student will be able to

1 .Learn the fundamentals of Image Processing with different Transforms.
2.Understand the functions of Intensity Transformations and working fundamentals of Spatial Filters
3.Implement various models of Restoring and Reconstruction of Images from filtering projections
4.Describe the images in different formats such as binary, grey shade and Color with respect to different areas
5.Differentiate the methods related to image compression and segmentation with respect to the required applications

Unit 1 DIGITAL IMAGE FUNDAMENTALS 14

Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing. Image Transforms: Need for image transforms, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform

Unit 2 IMAGE ENHANCEMENT 12

Intensity Transformations and Spatial Filtering: Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters , sharpening spatial filters, Filtering in the Frequency Domain: Preliminary concepts, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters

Unit 3 IMAGE RESTORATION 12

Image Restoration and Reconstruction: A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering.

Unit 4 COLOR IMAGE PROCESSING 10

Color image processing: color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations

Unit 5 IMAGE COMPRESSION & SEGMENTATION 14

Image compression: Fundamentals, Coding Redundancy, Spatial and temporal Redundancy, Image Compression Models, Image segmentation: Fundamentals, Point, Line and Edge Detection, Thresholding – Global and Optimum Global, Region based segmentation.

Prescribed Textbooks:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2.R. C. Gonzalez and R. E. Woods, Digital Image Processing, 2nd edition, Prentice Hall, 2002.

Reference Books:

1.Jayaraman, S. Esakkirajan, and T. Veerakumar, Digital Image Processing, Tata McGraw-Hill Education, 2011..
2. Anil K.Jain, —Fundamentals of Digital Image Processing, Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
3.B.Chanda, D.DuttaMajumder, —Digital Image Processing and Analysis, PHI, 2009
4. Digital Image processing using MAT LAB – Rafael C. Gonzalez, Richard E Woods and Steven L. Edition, PEA, 2004.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Ethics	Individual and team work	Communication	Project management and	Life-long learning	PSO1	PSO2
23A046DT. 1	3	3	3	2	1	1	-	-	3	-	3	3	3
23A046DT. 2	3	3	3	3	2	2	-	-	3	-	3	3	3
23A046DT. 3	3	3	3	3	2	2	-	-	2	-	3	3	3
23A046DT. 4	3	3	3	3	2	2	-	-	2	-	3	3	3
23A046DT. 5	3	3	3	3	3	3	-	-	2	-	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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R23

Title of the Course: Artificial Intelligence & Machine learning
Category: PE
Couse Code: 23A046ET
Branch/es: ECE
Year III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To learn the basics and problems of Artificial Intelligence with rationality and structure of agents.
2. To describe the search for solutions using various search strategies & algorithms for optimization.
3. To evaluate the representation of Agents with Propositional Logic in Shopping World.
4. To understand the concepts of Machine Learning with different Perspectives.
5. To analyze Decision Tree Representation with different problems & issues.

Course Outcomes:

At the end of the course, the student will be able to

1 To learn the basics and problems of Artificial Intelligence with rationality and structure of agents.
2.To describe the search for solutions using various search strategies & algorithms for optimization.
3. Evaluate the representation of Agents with Propositional Logic in Shopping World
4.Understand the concepts of Machine Learning with different Perspectives.
5.Analyze Decision Tree Representation with different problems & issues.

Unit 1 **Introduction:** **14**

What Is AI, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Unit 2 **Problem Solving:** **12**

Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, informed (Heuristic) Search Strategies, Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions.

Unit 3 **Knowledge Representation:** 12

Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, The Internet Shopping World.

Unit 4 **Introduction to Machine Learning:** **10**

Well-Posed Learning Problem, Designing a Learning system, Perspectives and Issues in Machine Learning.

Unit 5 Decision Tree Learning: **12**

Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning Algorithm, Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning.

Prescribed Textbooks:

1.Stuart Russell and Peter Norvig —Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson.
2.Tom M. Mitchell, *Machine Learning,* McGraw Hill Edition, 2013

Reference Books:

1.Saroj Kaushik —Artificial Intelligence, Cengage Learning India, 2011
2. Elaine Rich and Kevin Knight —Artificial Intelligence Tata McGraw Hill.
3.B.Chanda, D.David Poole and Alan Mackworth —Artificial Intelligence: Foundations for Computational Agents, Cambridge University Press 2010.
4. Trivedi, M.C., —A Classical Approach to Artificial Intelligence, Khanna Publishing House, Delhi.
5.Christopher Bishop, Pattern Recognition and Machine Learning (PRML), Springer, 2007.
6. Shai Shalev- Shwartz and Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms (UML) , Cambridge University Press, 2014.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Ethics	Individual and team work	Communication	Project management and	Life-long learning	PSO1	PSO2
23A046ET. 1	2	2	-	-	-	-	1	1	2	1	2	2	2
23A046ET. 2	1	2	2	3	3	3	-	-	-	-	2	2	-
23A046ET. 3	-	3	3	-	-	-	-	-	-	-	2	-	2
23A046ET. 4	-	-	-	-	3	3	1	1	2	-	2	-	2
23A046ET. 5	2	2	-	-	-	3	2	-	-	-	2	-	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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R23

Title of the Course: Satellite Communications
Category: PE
Couse Code: 23A046FT
Branch/es: ECE
Year III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To learn the basic concepts of satellite communication, principles of orbital mechanics& satellite launch system with performance parameters.
2. To describe the elements of satellite subsystem, reliability.
3. To know the working concepts of various multiple access techniques and Onboard processing.
4. To analyze the satellite links design with communication links.
5. To understand the components and operations of earth stations, GPS positioning principles.

Course Outcomes:

At the end of the course, the student will be able to

1. Describe basic concepts of satellite communication, orbital mechanics, and launch systems.
2. Identify satellite subsystems and assess their reliability.
3. Understand multiple access techniques and onboard processing.
4. Analyze and design satellite communication links.
5. Illustrate earth station components and apply GPS positioning principles.

Unit 1 Introduction & Orbital Mechanics **14**

Introduction: Background and History of satellite communications, Basic concepts of satellite communications, frequency allocations for satellite services, applications, and future trends.Orbital Mechanics*:* Kepler's Laws, Orbital elements, orbit determination, Orbital effects in communication systems performance, Launch vehicles.

Unit 2 Satellite Subsystems **12**

Spacecraft subsystem, Telemetry, Tracking, Command and Monitoring (TTC&M), Power Systems, Communication subsystems, Satellite Antenna, Equipment Reliability and Space Qualification.

Unit 3 Multiple Access Techniques **10**

Multiple access techniques:FDMA, TDMA,CDMA, Demand Assignment Multiple Access (DAMA)
Satellite onboard processing.

Unit 4 Satellite Link Design **10**

Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design of Downlinks, Uplink Design, Propagation Effects and their impact on Links.

Unit 5 Earth Station Technology & GPS **10**

Earth station design-transmitters, receivers, Antennas, tracking systems, primary power test methods, GPS position location principles

Prescribed Textbooks:

1.Satellite communications, Timothi Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley publications, 3rd Edition,2020.
2 D. Roddy, Satellite Communication (4/e), McGraw- Hill, 2009.

Reference Books:

1.B.N. Agrawal, Design of Geosynchrons Spacecraft, Prentice- Hall,1986.
2. Satellite communications- Satellite communications systems: systems, Techniques and Technology- Gerard Maral, Michel Bousquet, Zhili Sun, Wiley Publications, 6th Edition, 2020.
3.Satellite communications Engineering-Wilbur L. Prichard, Robert A. Nelson & Henry G. Suyderhoud, 2nd Edition, Pearson Publications, 2003

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Ethics	Individual and team work	Communication	Project management and	Life-long learning	**PSO1**	**PSO2**
23A046FT. 1	3	3	-	1	-	2	-	-	-	-	1	2	1
23A046FT. 2	3	2	1	1	-	2	-	1	-	-	-	2	-
23A046FT. 3	3	3	3	2	-	-	-	1	-	-	-	3	-
23A046FT. 4	3	3	3	2	-	-	-	1	-	-	-	3	-
23A046FT. 5	3	1	1	1	1	1	2	-	-	-	1	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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R23

Title of the Course: Microwave and Optical Communications Lab
Category: PC
Couse Code: 23A0461L
Branch/es: ECE
Year: III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:

1. To understand the working of microwave bench set up and characteristics of microwave
2. To verify the characteristics of various microwave components and to draw the radiation pattern of antennas
3. To verify the characteristics of optical sources & detectors and to study about losses in optical fiber

Course Outcomes:

At the end of the course, the student will be able to

1.Understand the working of microwave bench set up and characteristics of microwave sources.
2.Verify the characteristics of various microwave components and to draw the radiation pattern of antennas.
3.Verify the characteristics of optical sources & detectors and to study about losses in optical fiber.

LIST OF EXPERIMENTS: (At least 8 Linear and 4 Digital IC experiments shall be performed)

PART-A: Microwave Lab - Any Seven (7) Experiments

1. Reflex Klystron Characteristics
2. Gunn Diode Characteristics
3. Attenuation Measurement
4. Directional Coupler Characteristics
5. VSWR Measurement
6. Impedance Measurements
7. Frequency and Wavelength measurement
8. Scattering Parameters of Directional coupler
9. Scattering Parameters of Magic TEE
10. Radiation pattern measurement of a Antenna
11. Antenna gain measurement

Part B: Optical Fiber Lab - Any five (5) Experiments

1. Characterization of LED
2. Characterization of Laser Diode
3. Intensity Modulation of Laser output through Optical fiber
4. Measurement of data rate for digital Optical link
5. Measurement of Numerical Aperture.
6. Measurement of Losses for Analog optical link

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Ethics	Individual and team work	Communication	Project management and	Life-long learning	**PSO1**	**PSO2**
23A0461L. 1	3	2	2	2	3	-	-	2	2	-	2	3	-
23A0461L. 2	3	2	3	2	3	-	-	2	2	-	2	3	-
23A0461L. 3	3	2	3	2	3	-	-	2	2	-	2	3	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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R23

Title of the Course: VLSI Design Lab
Category: PC
Couse Code: 23A0462L
Branch/es: ECE
Year: III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:

1. To design a logic circuit using CMOS transistor using 180 nm technology in terms of schematic, symbol, test bench, DC and AC analysis.
2. To evaluate different schematics & output responses for AOI logic by using different Software tools
3. To design CMOS circuits using Full & Semi custom IC designs for analyzation
4. To design different layouts using different software tools for analog circuits.

Course Outcomes:

At the end of the course, the student will be able to

1. Design a logic circuit using CMOS transistor using 180 nm technology in terms of schematic, symbol, test bench, DC and AC analysis.
2. Evaluate different schematics & output responses for AOI logic by using different software tools.
3. Design CMOS circuits using Full & Semi custom IC designs for analyzation
4. Design different layouts using different software tools for analog circuits.

List of Experiments: (Any TEN of the experiments are to be conducted)

EXP 1	**Design and analysis of CMOS Inverter**
a) Implement CMOS inverter schematic using 180 nm technology and design its symbol. b) Implement test bench for CMOS Inverter and check its output response c) . Perform DC and AC analysis for CMOS inverter. d) Check the performance of CMOS inverter using parametric sweep.	

EXP 2	**Design and analysis of NAND and NOR Logic gates**
a) Implement NAND/NOR schematic using 180 nm technology and design its symbol b) Implement test bench for NAND/NOR and check its output response. c) Perform DC and AC analysis for NAND/NOR. d) Check the performance of NAND/NOR using parametric sweep.	

EXP 3	**Design and analysis of XOR and XNOR Logic gates**
a) Implement XOR/XNOR schematic using 180 nm technology and design its symbol b) Implement test bench for XOR/XNOR and check its output response. c) Perform DC and AC analysis for XOR/XNOR. d) Check the performance of XOR/XNOR using parametric sweep	
EXP 4	**Design of AOI logic**
a) Design Schematic for AB+C_D and check its output response. b) Design Schematic for AB_+C_D and check its output response. c) Design Schematic for (A+B_)(C+D) and check its output response. d) Design Schematic for (A+B_)(C_+D) and check its output response.	

EXP 5	Design and analysis of Full adder
a) Design full adder using Full custom IC design. b) Design full adder using Semi custom IC design.	
EXP 6	**Analysis of NMOS and PMOS characteristics**
a) implement test bench for NMOS/PMOS transistor. b) Perform DC and AC analysis for NMOS/PMOS transistor c) Check the performance of NMOS/PMOS transistor using parametric sweep.	

EXP 7	Design and analysis of Multiplexers
a) Implement Multiplexers schematic using 180 nm technology and design its symbol. b) Implement test bench for Multiplexers and check its output response. c) Perform DC and AC analysis for Multiplexers. d) Check the performance of Multiplexers using parametric sweep. .	

EXP 8	Design and analysis of Demultiplexers
a) Implement Demultiplexers schematic using 180 nm technology and design its symbol. b) Implement test bench for Demultiplexers and check its output response. c) Perform DC and AC analysis for Demultiplexers. d) Check the performance of Demultiplexers using parametric sweep.	

EXP 9	Design and analysis of Encoders
a) Design Encoders schematic using 180 nm technology and its symbol. b) Implement test bench for Encoders and check its output response c) Perform DC and AC analysis for Encoders. d) Check the performance of Encoders using parametric sweep	

EXP 10	Design and analysis of Decoders
a) Design Decoders schematic using 180 nm technology and its symbol. b) Implement test bench for Decoders and check its output response. c) Perform DC and AC analysis for Decoders. d) Check the performance of Decoders using parametric sweep.	

EXP 11	Design of Inverter Layout
a) Design and implement inverter schematic. b) Design the layout for inverter using 180 nm tech file. c) Perform LVS for schematic and layout d) Check and remove all DRC violations. e) Extract parasitic R and C in layout.	

EXP 12	Design of NAND/NOR Layout
a) Design and implement NAND/NOR schematic. b) Design the layout for inverter using 180 nm tech file. c) Perform LVS for schematic and layout d) Check and remove all DRC violations e) Extract parasitic R and C in layout	

The students are required to design the schematic diagrams using CMOS logic and to draw the layout diagrams to perform the experiments with the Industry standard EDA Tools. Software Required:
i. Mentor Graphics/ Synopsis/ Cadence / Equivalent Industry Standard Software.
ii. . Personal computer system with necessary software to run the programs and to implement

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Ethics	Individual and team work	Communication	Project management and	Life-long learning	**PSO1**	**PSO2**
23A0462L. 1	2	1	1	1	-	-	1	2	-	-	1	1	-
23A0462L. 2	3	3	3	3	-	-	1	2	-	-	1	2	-
23A0462L. 3	3	2	1	1	3	-	1	2	2	-	1	2	-

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R23

Title of the Course: Machine Learning and DSP
Category: SEC
Couse Code: 23A0463L
Branch/es: ECE
Year III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	1	2	2

Course Objectives:
The main objectives of the course are to

1. To understand the modules and dependencies for machine learning corresponding to different applications.
2. To understand a range of machine learning regression techniques & clustering along with their datasets
3. Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

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

1. Understand the basic concepts of Python, including data types, control flow statements, and basic operations.
2. Apply functions and manipulate strings and lists in Python through defined operations and built-in methods.
3. Utilize dictionaries, tuples, and sets for data storage and manipulation in Python programs. (L3)
4. Implement file handling techniques and object-oriented programming concepts in Python applications.
5. Analyze and manipulate data using NumPy and Pandas, integrating functional programming concepts in Python.

Unit 1

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators iii) Assignment Operatorsiv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

Unit 2

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the substring is present in a given string or not.
11. Write a program to perform the given operations on a list:
    i. Addition ii. Insertion iii. slicing
12. Write a program to perform any 5 built-in functions by taking any list.

Unit 3

Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

13. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
14. Write a program to count the number of vowels in a string (No control flow allowed).
15. Write a program to check if a given key exists in a dictionary or not.
16. Write a program to add a new key-value pair to an existing dictionary.
17. Write a program to sum all the items in a given dictionary.

Unit 4

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Poly morphism.

Sample Experiments:

18. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square

Unit 5

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

24. Python program to check whether a JSON string contains complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.
28. Python program to find min, max, sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a) Apply head () function to the pandas data frame
    b) Perform various data selection operations on Data Frame
30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Reference Books:

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Ethics	Individual and team work	Communication	Project management and	Life-long learning	PSO1	PSO2
23A0463L. 1	3	3	2	1	2	-	-	1	1	1	2	2	-
23A0463L. 2	3	3	3	2	3	-	-	1	1	1	2	3	-
23A0463L. 3	3	3	3	3	3	-	-	2	1	2	3	2	-
23A0463L. 4	3	3	3	3	3	2	-	2	1	2	3	3	-
23A0463L. 5	3	3	3	3	3	2	-	2	2	2	3	3	3

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R23

Title of the Course: TECHNICAL PAPER WRITING AND IPR
Category: MC
Course Code: 23AHS67T
Branch/es: Common to all branches
Year III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
2	-	-	-

Course Objectives:

The objectives of this course are to make the student :

1. To enable the students to practice the basic skills of research paper writing.
2. To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
3. To practice the basic skills of performing quality literature review.
4. To help them in knowing the significance of real life practice and procedure of Patents.
5. To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks.

Course Outcomes:

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

1. Identify key secondary literature related to their proposed technical paper writing.
2. Explain various principles and styles in technical writing.
3. Use the acquired knowledge in writing a research/technical paper.
4. Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark etc..
5. Evaluate different forms of IPR available at national & international level.
6. Develop skill of making search of various forms of IPR by using modern tools and techniques.

Unit 1

Principles of Technical Writing: styles in technical writing; clarity, precision, coherence andlogical sequence in writing-avoiding ambiguity- repetition, and vague language -highlighting your findings-discussing your limitations -hedging and criticizing -plagiarism and paraphrasing.

Unit 2

Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature- Problems and Framing Research Questions- Synopsis.

Unit 3

Process of research: publication mechanism: types of journals- indexing-seminars- conferences- proof reading –plagiarism style; seminar & conference paper writing; Methodology-discussion-results- citation rules.

Unit 4

Introduction to Intellectual property: Introduction, types of intellectual property, International organizations, agencies and treaties, importance of intellectual property rights Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

Unit 5

Law of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer. Patent law, intellectual property audits.

Prescribed Textbooks:

1. Deborah. E. Bouchoux, Intellectual Property Rights, Cengage Learning India, 2013.
2. Meenakshi Raman, Sangeeta Sharma. Technical Communication:Principles and practices.Oxford.

Reference Books:

1. R.Myneni, Law of Intellectual Property, 9th Ed, Asia law House, 2019.
2. Prabuddha Ganguli,Intellectual Property Rights Tata Mcgraw Hill, 2001
3. P.Naryan,Intellectual Property Law, 3rd Ed ,Eastern Law House, 2007.
4. Adrian Wallwork. English for Writing Research PapersSecond Edition. Springer Cham Heidelberg New York ,2016
5. Dan Jones, Sam Dragga, Technical Writing Style

Online Learning Resources:

1. https://theconceptwriters.com.pk/principles-of-technical-writing/
2. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html
3. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html
4. https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paperjournal/
5. https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf
6. https://lawbhoomi.com/intellectual-property-rights-notes/
7. https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf

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R23

Title of the Course: Disaster Management
Category: OE
Course Code: 23A016GT
Branch/es: CSE/ECE/ME/EEE
Year III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

The objectives of this course are to make the student :

1. To understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
2. To analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
3. To apply wind engineering principles and computational techniques in designing wind-resistant structures.
4. To evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.
5. To assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

Course Outcomes:

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

1. Understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
2. Analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
3. Apply wind engineering principles and computational techniques in designing wind- resistant structures.
4. Evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.
5. Assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

Unit 1 Natural Disasters **8**

SENDAI Frame Work, Types of Natural Disasters, Disasters in Different Climatic and Geographical Regions, Hazard Maps (Earthquake and Cyclone) (World and India), Regulations for Disaster Risk Reduction, Post-Disaster Recovery and Rehabilitation (Socio-economic Consequences).

Unit 2 Cyclones **8**

Cyclones and Their Impact– Climate Change and Its Impact on Tropical Cyclones, Nature of Cyclonic Wind, Velocities and Pressure, Cyclone Effects, Storm Surges, Floods, and Landslides. Behavior of Structures in Past Cyclones and Windstorms, Case Studies. Cyclonic Retrofitting, Strengthening of Structures, and Adaptive Sustainable Reconstruction. Life-Line Structures Such as Temporary Cyclone Shelters.

Unit 3 Wind Effects **10**

Structural Response and Wind Loads– Basic Wind Engineering, Aerodynamics of Bluff Bodies, Vortex Shedding, and Associated Unsteadiness Along and Across Wind forces. Demo on Wind Tunnel Testing and Its Salient Features. Introduction to Computational Fluid Dynamics (CFD). General Planning and Design Considerations Under Windstorms and Cyclones. Wind Effects On Buildings, towers, Glass Panels, Etc., and Wind-Resistant Features in Design. Codal Provisions, Design Wind Speed, Pressure Coefficients. Coastal Zoning Regulations for Construction and Reconstruction in Coastal Areas. Innovative Construction Materials and Techniques, Traditional Construction Techniques in Coastal Areas.

Unit 4 Seismic Risk Assessment **10**

Seismology and Earthquake Effects– Causes of Earthquakes, Plate Tectonics, Faults, Seismic Waves; Magnitude, Intensity, Epicenter, Energy Release, and Ground Motions. Earthquake Effects– On Ground, Soil Rupture, Liquefaction, Landslides. Performance of Ground and Buildings in Past Earthquakes– Behavior of Various Types of Buildings and Structures,

Collapse Patterns; Behavior of Non-Structural Elements Such as Services, Fixtures, and Mountings – Case Studies. Seismic Retrofitting– Weakness in Existing Buildings, Aging, Concepts in Repair, Restoration, and Seismic Strengthening

Unit 5 Seismic Safety **10**

General Planning and Design Considerations; Building forms, Horizontal and Vertical Eccentricities, Mass and Stiffness Distribution, Soft Storey Effects, Seismic Effect of Building Configuration. Plan and Vertical Irregularities, Redundancy, and Setbacks. Construction Detailing of Various members, Innovative Construction Materials and Techniques. Local Practices– Traditional Regional Responses.

Prescribed Textbooks:

1. David Alexander, Natural Disasters, 1st Edition, CRC Press, 2017.
2. Edward A. Keller and Duane E. DeVecchio, Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes, 5th Edition, Routledge, 2019.

Reference Books:

1. Ben Wisner, J.C. Gaillard, and Ilan Kelman (Editors), Handbook of Hazards and Disaster Risk Reduction and Management, 2nd Edition, Routledge, 2012.
2. Damon P. Coppola, Introduction to International Disaster Management, 4th Edition, Butterworth-Heinemann, 2020.
3. Bimal Kanti Paul, Environmental Hazards and Disasters: Contexts, Perspectives and Management, 2nd Edition, Wiley-Blackwell, 2020.

Online Learning Resources:

1. https://nptel.ac.in/courses/124107010 2.
2. https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A016GT.1	3	-	-	-	-	2	-	2	2	-	-	-	3	3
23A016GT.2	-	3	-	-	2	-	-	-	-	-	-	2	3	-
23A016GT.3	3	-	-	3	-	-	3	-	-	2	-	-	-	3
23A016GT.4	-	-	3	-	3	-	-	2	-	-	-	-	3	-
23A016GT.5	-	-	-	3	-	3	3	3	2	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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R23

Title of the Course: Sustainability in Civil Engineering Practices
Category: OE
Couse Code: 23A016HT
Branch/es: CSE/ECE/ME/EEE
Year III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
2. To analyze sustainable construction materials, their durability, and life cycle assessment.
3. To apply energy calculationsin construction materials and assess their embodied energy.
4. To evaluate green building standards, energy codes, and performance ratings.
5. To assess the environmental effects of energy use, climate change, and global warming.

Course Outcomes:

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

1. Understand the fundamentals of sustainability, the carbon cycle and the environmental impact of construction materials.
2. Analyze sustainable construction materials, their durability, and life cycle assessment.
3. Apply energy calculations in construction materials and assess their embodied energy.
4. Evaluate green building standards, energy codes, and performance ratings.
5. Assess the environmental effects of energy use, climate change, and global warming.

Unit 1 Introduction **8**

Introduction and Definition of Sustainability - Carbon Cycle - Role of Construction Material: Concrete and Steel, Etc. - CO_2 Contribution From Cement and Other Construction Materials.

Unit 2 Materials for Sustainable Construction **8**

Construction Materials and Indoor Air Quality - No/Low Cement Concrete - Recycled and Manufactured Aggregate - Role of QC and Durability - Life Cycle and Sustainability.

Unit 3 Energy Estimate **10**

Components of Embodied Energy - Calculation of Embodied Energy for Construction Materials - Energy Concept and Primary Energy - Embodied Energy Via-A-Vis Operational Energy in Conditioned Building - Life Cycle Energy Use

Unit 4 Green Building Regulations **10**

Control of Energy Use in Building - ECBC Code, Codes in Neighboring Tropical Countries - OTTV Concepts and Calculations – Features of LEED and TERI – GRIHA Ratings – Roel of Insulation and Thermal

Properties of Construction Materials - Influence of Moisture Content and Modeling - Performance Ratings of Green Buildings - Zero Energy Building.

Unit 5 Environmental Impact 10

Non-Renewable Sources of Energy and Environmental Impact– Energy Norm, Coal, Oil, Natural Gas - Nuclear Energy - Global Temperature, Green House Effects, Global Warming - Acid Rain: Causes, Effects and Control Methods - Regional Impacts of Temperature Change.

Prescribed Textbooks:

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.

Reference Books:

1. Craig A. Langston & Grace K.C. Ding, Sustainable Practicesin the Built Environment, Butterworth Heinemann Publishers, 2011.
2. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2012.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105157/

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A016HT.1	3	-	-	-	-	2	3	2	-	-	-	-	3	3
23A016HT.2	-	3	-	-	2	-	3	-	-	-	-	2	3	3
23A016HT.3	-	-	3	3	3	-	2	-	-	2	-	-	3	3
23A016HT.4	-	-	3	3	3	-	3	2	-	-	-	-	3	3
23A016HT.5	-	-	-	-	-	3	3	3	-	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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R23

Title of the Course: Renewable Energy Sources

Category: OE
Couse Code: 23A026IT
Branch/es: CSE/ECE/ME/Civil
Year : III
Semester: II

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	--	--	3

Course Objectives:

1. Analyze the working of flat plate and concentrating collectors.
2. Describe the electrical characteristics of solar PV cells/modules and their design considerations.
3. Illustrate the components and types of Wind Energy Conversion Systems (WECS).
4. Examine Emerging Renewable Technologies and their applications.

Course Outcomes: Blooms Level

At the end of the course, the student will be able to…

1. Understand principle operation of various renewable energy sources	L1
2. Identify site selection of various renewable energy sources.	L2
3. Analyze various factors affecting on solar energy measurements, wind energy conversion	L3
4. Design of Solar PV modules and considerations of horizontal and vertical axis Wind energy systems.	L5
5. Apply the concepts of Geo Thermal Energy, Ocean Energy, Bio mass and Fuel Cells for generation of power.	L4

Unit 1 Solar Energy: 8

Solar radiation - beam and diffuse radiation, solar constant, measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. Flat plate collectors (Liquid, air), Concentrating collectors - Compound Parabolic Concentrator, Parabolic Dish Collector, Central Receiver System. Solar water heater, solar industrial heating system.

Unit 2 PV Energy Systems: 10

Advantages and Disadvantages of solar PV system, Electrical characteristics of solar PV cells and modules, Solar cell design considerations, Solar cell, module and array construction, Solar PV cell in series and parallel, Simple numerical problems, Solar power distributed system – off-line, grid connected and hybrid PV systems.

Unit 3 Wind Energy: 8

Factors affecting the distribution of Wind Energy on the Surface of Earth, Nature of winds, Basic block diagram of wind energy conversion systems (WECS), Wind mill components, various types WECS and their constructional features, Site selection considerations, Estimation of wind energy at a place, advantages and disadvantages of wind energy.

Unit 4 Geothermal Energy: 8

Advantages, disadvantages and application of Geothermal Energy, Origin and distribution of Geothermal sources, Geothermal resources - Hydrothermal, Hot dry rock, Magma, Estimation of heat content in the Hot dry rock resource.

Unit 5 Miscellaneous Energy Technologies: 10

Ocean Energy: Ocean Tidal Energy conversion schemes, advantages and limitations.
Wave Energy: Principle of working, energy and power from waves, advantages and limitations.
Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages.
Fuel cell: Principle of working of various types of fuel cells and their working, fuel cell power plant.
Hydrogen Energy: Principle of working of Hydrogen energy and benefits of Hydrogen energy.

Prescribed Text books:

1. G. D. Rai, —Non-Conventional Energy Sources‖, 4th Edition, Khanna Publishers, 2004.
2. B H Khan , — Non-Conventional Energy Resources‖, 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.

Reference Books:

1. G. N. Tiwari and M.K.Ghosal, —Renewable Energy Resource: Basic Principles and Applications‖, Narosa Publishing House, 2004.
2. Stephen Peake, —Renewable Energy Power for a Sustainable Future‖, Oxford International Edition, 2018.

Web Resources:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
1	3	1	-	-	1	1	-	-	-	-	2	1	3
2	3	2	1	1	1	2	-	-	-	1	1	2	3
3	2	3	1	2	2	1	-	-	-	-	1	2	3
4	2	2	3	1	3	-	-	-	1	2	-	3	3
5	1	2	2	1	1	1	2	-	2	-	-	1	3

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R23

Title of the Course: Automation and Robotics
Category: OE
Couse Code: 23A036KT
Branch/es: CSE/ECE/EEE/Civil
Year: III
Semester: II

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- To acquire basic knowledge on automation and hardware components of automation.
- To learn about the automated flow lines, line balancing methods and automated assembly systems.
- To learn about the robotics and fundamentals of robots with their needs in present trend and the sensors, actuators.
- To understand robot kinematics, dynamics and to acquire knowledge on importance of trajectory planning in robots.
- To learn about the robot programming methods and applications of industrial robots.

Course Outcomes:

At the end of the course, the student will be able to

1. Summarize the concepts of an automation and hardware components of automation
2. Analyze the line balancing methods and automated assembly systems, automated flow lines.
3. Summarize the fundamentals of Robots, sensors and actuators.
4. Analyze the Robot kinematics, dynamics and trajectory planning
5. Summarize the concept of robot programming methods and robot applications

Unit 1 Introduction to Automation **12**

Introduction to Automation, Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

Unit 2 Automated Flow Lines and Assembly line balancing **12**

Automated flow lines, Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines. Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

Unit 3 Introduction to Industrial Robotics, actuators and Feedback components **12**

Introduction to Industrial Robotics: Introduction to Industrial Robotics, Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers.

Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

Unit 4 Manipulator Kinematics, Manipulator Dynamics and Trajectory Planning 12

Manipulator Kinematics: Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics.

Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton – Euler formations.

Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

Unit 5 Robot Programming and Robot Application in Manufacturing 10 Hrs

Robot Programming: Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages.

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and In

Textbooks:

1. Automation, Production systems and CIM, M.P.Groover, Pearson Edu 2004. ISBN-10: 9789332572492, ISBN-13: 978-9332572492
2. Introduction to Robotics: Analysis, systems, Applications, Niku Saeed B., PHI New Delhi. ISBN-10: 0130613096

Reference Books:

1. Robotics. Fu KS, McGraw Hill. 2014. ISBN: 9780071822282
2. Introduction to Robtics, Saha, S.K., Second Edition McGraw Hill New Edition 2014. ISBN: 9789332902800.
3. Industrial Robotics, M.P. Groover, TMH 2003. ISBN-10: 007024989X
4. Introduction to Robotics. John J. Craig, Pearson Edu 2017. ISBN: 0133489795

Online Learning Resources:

- https://youtu.be/oxMdDsud5vg
- https://www.youtube.com/watch?v=xrwz9IxpMJg&t=1311

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A036KT.1	3	2	1	1	-	-	-	-	-	-	-	3	1	1
23A036KT.2	3	3	2	2	-	-	-	-	-	-	-	3	2	2
23A036KT.3	3	2	1	1	-	-	-	-	-	-	-	3	1	1
23A036KT.4	3	3	2	2	-	-	-	-	-	-	-	3	2	2
23A036KT.5	3	2	1	1	-	-	-	-	-	-	-	3	1	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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R23

Title of the Course: Operating Systems
Category: OE
Couse Code: 23A056IT
Branch: CE/EEE/ME/ECE
Year: III B. Tech
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1.Understand the fundamental principles of operating systems and their role in managing hardware and software resources.
2.Explore process management techniques, including scheduling algorithms, multithreading and inter process communication mechanisms.
3. Analyze memory management strategies such as paging, segmentation, and virtual memory to optimize system performance.
4.Evaluate deadlock conditions and file system structures, including resource allocation, disk scheduling, and RAID technologies.
5.Implement security and protection mechanisms to safeguard computer systems from threats and unauthorized access.

Course Outcomes:

At the end of the course, the student will be able to
1.Explain core operating system functions such as process, memory, file, and device management.
2.Analyze scheduling algorithms and IPC mechanisms to enhance process efficiency.
3.Apply memory management techniques to improve system performance.
4.Assess deadlock conditions and propose solutions for resource management.
5.Able to design and implement file systems, focusing on file access methods, directory structure, free space management and explore various protection mechanisms,

Unit 1 Operating Systems Overview, System Structures **8**

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot.

Unit 2 Process Concept, Multithreaded Programming, Process Scheduling, Inter-process Communication **10**

Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multithreading models, Thread

libraries, Threading issues, Examples. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples. Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem.

Unit 3 Memory-Management Strategies, Virtual Memory Management 10

Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples

Unit 4 Deadlocks, File Systems 10

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection And recovery, Deadlock avoidance, Deadlock prevention. File Systems: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation

Unit 5 System Protection, System Security 10

System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks, Computer security classification. Case Studies: Linux, Microsoft Windows.

Textbooks:

1. Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2016.
2. Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (Topics: Inter-process Communication and File systems.)

Reference Books:

1. Tanenbaum A S, Woodhull A S, Operating Systems Design and Implementation, 3rd edition, PHI, 2006.
2. Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw Hill, 2012.
3. Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education, 2009
4. Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004

Online Learning Resources:

https://nptel.ac.in/courses/106/106/106106144/
http://peterindia.net/OperatingSystems.html

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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R23

Title of the Course: Machine Learning
Category: OE
Course Code: 23A056JT
Year: III B. Tech
Semester: II Semester
Branch : ECE/EEE/ME/CE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives: This course will be able to
1.Understand the fundamental concepts of machine learning, its types, applications, and data preprocessing techniques.
2. Learn to select, train, evaluate, and improve machine learning models while applying feature engineering techniques.
3. Explore Bayesian methods for concept learning and understand various classification algorithms.
4. Understand regression techniques for predictive modelling and methods to enhance model accuracy.
5. Learn unsupervised learning techniques such as clustering and association rule mining for pattern discovery.

Course Outcomes:
At the end of the course, the student will be able to
1. Explain the significance of machine learning types, applications, and data quality in model building
2. Apply feature engineering methods to improve model performance and interpretability. Implement classification models such as k-NN, Decision Trees, and Random Forest for predictive tasks
3. Implement classification algorithms such as k-NN, Decision Trees, and Random Forests.
4. Analyze regression algorithms and improve model accuracy using optimization techniques.
5. Design clustering models using partitioning and density-based techniques for pattern recognition.

Unit 1 Introduction to Machine Learning & Preparing to Model
Introduction: What is Human Learning? Types of Human Learning, what is Machine Learning? Types of Machine Learning, Problems Not to Be Solved Using Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools in Machine Learning, Issues in Machine Learning
Preparing to Model: Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing

Unit 2 Modeling and Evaluation & Basics of Feature Engineering
Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model Basics of Feature Engineering: Introduction, Feature Transformation, Feature Subset Selection

Unit 3 Bayesian Concept Learning & Supervised Learning: Classification
Introduction, Why Bayesian Methods are Important? Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network.
Supervised Learning: Classification: Introduction, Example of Supervised Learning, Classification Model, Classification Learning Steps, Common Classification Algorithms-k- Nearest Neighbor (kNN), Decision tree, Random forest model, Support vector machines

Unit 4 Supervised Learning: Regression

Introduction, Example of Regression, Common Regression Algorithms-Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.

Unit 5 Unsupervised Learning

Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering – Clustering as a machine learning task, Different types of clustering techniques, Partitioning methods, K-Medoids: a representative object-based technique, Hierarchical clustering, Density-based methods-DBSCAN Finding Pattern using Association Rule- Definition of common terms, Association rule, Theapriori algorithm for association rule learning, Build the a priori principle rules.

Textbooks:

Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

Reference Books:

1. EthernAlpaydin, —Introduction to Machine Learning‖, MIT Press, 2004.
Stephen Marsland, —Machine Learning -An Algorithmic Perspective‖, Second Edition,
Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
2. Andreas C. Müller and Sarah Guido —Introduction to Machine Learning with 3.Python: A Guide for Data Scientists‖, Oreilly.

Online Learning Resources:

1. Andrew Ng, —Machine Learning B.Techning‖ https://www.deeplearning.ai/machine-learning-B.Techning/
2. Shai Shalev-Shwartz , Shai Ben-David, —Understanding Machine Learning: From Theory to Algorithms‖ , Cambridge University Press https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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R23

Title of the Course: Optimization Techniques
Category: OE
Couse Code: 23AHS61T
Branch/es: Common to All Branches
Year III Year
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To formulate and solve optimization problems using various techniques.
2. To apply optimization algorithms to real-world problems.
3. To analyze and interpret the results of optimization models.
4. To use optimization software tools to solve problems.

Course Outcomes:

At the end of the course, the student will be able to

1. Understand the meaning, purpose, tools of Operations Research and linear programming in solving practical problems in industry.
2. Interpret the transportation models' solutions and infer solutions to the real-world problems.
3. Develop mathematical skills to analyze and solve nonlinear programming models arising from a wide range of applications.
4. Apply the concept of non-linear programming for solving the problems involving non-linear constraints and objectives
5. Apply the concept of unconstrained geometric programming for solving the problems involving non-linear constraints and objectives.

Unit 1 Linear programming I **8**

Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Graphical Method for Linear Programming Problems, Basic Definitions in Linear Programming. Simplex Method, Simplex Algorithm and Two phase Simplex Method, Big-M method.

Unit 2 Linear programming II: Duality in Linear Programming **8**

Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method, Transportation Problem and assignment problem, Complementary slackness Theorem

Unit 3 Non-linear programming: Unconstrained optimization techniques **8**

Introduction: Methods of Unconstrained minimization,

Direct Search Methods: Random Search Methods: Descent Method and Fletcher Powell Method, Grid Search Method

Unit 4 Non-linear programming: Constrained optimization techniques **8**

Introduction, Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.

Unit 5 Geometric Programming **8**

Unconstrained Minimization Problems: solution of unconstrained geometric programming using differential calculus and arithmetic-geometric inequality.

Constrained minimization Problems: Solution of a constrained geometric programming problem, primal-dual programming in case of less-than inequalities, geometric programming with mixed inequality constraints.

Prescribed Textbooks:

1. Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.
2. J. C. Panth, Introduction to Optimization Techniques, (7-e) Jain Brothers, New Delhi.

Reference Books:

1. Harvey M. Wagner, Principles of Operation Research, Printice-Hall of India Pvt. Ltd. New Delhi.
2. Peressimi A.L., Sullivan F.E., Vhl, J. J. Mathematics of Non-linear Programming, Springer – Verlag.

Web References:

1. https://onlinecourses.nptel.ac.in/noc24_ee122/preview
2. https://archive.nptel.ac.in/courses/111/105/111105039/
3. https://onlinecourses.nptel.ac.in/noc21_ce60/preview

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23AHS61T.1	3	3	2	2	-	-	-	-	-	-	1	-	-
23AHS61T.2	3	2	2	2	-	-	-	-	-	-	1	-	-
23AHS61T.3	3	2	2	1	-	-	-	-	-	-	1	-	-
23AHS61T.4	2	2	2	1	-	-	-	-	-	-	1	-	-
23AHS61T.5	3	3	2	1	-	-	-	-	-	-	1	-	-

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R23

Title of the Course: Physics of Electronic Materials and Devices
Category: OE
Couse Code: 23AHS62T
Branch/es: Common to all branches
Year III Year
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To make the students to understand the concept of crystal growth, defects in crystals and thin films.
2. To provide insight into various semiconducting materials and their properties.
3. To develop a strong foundation in semiconductor physics and device engineering.
4. To elucidate excitonic and luminescent processes in solid-state materials.
5. To understand the principles, technologies, and applications of modern display systems.

Course Outcomes:

At the end of the course, the student will be able to

1. Understand crystal growth and thin film preparation
2. Summarize the basic concepts of semiconductors
3. Illustrate the working of various semiconductor devices
4. Analyze various luminescent phenomena and the devices based on these concepts
5. Explain the working of different display devices

Unit 1 Fundamentals of Materials Science 9

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. The basic idea of point, line, and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge).

Unit 2 Semiconductors 9

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

Unit 3 Physics of Semiconductor Devices 9

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Heterojunctions, Transistors, MOSFETs.

Unit 4 Excitons and Luminescence 9

Luminescence: Different types of luminescence, basic definitions, Light emission in solids, Inter- band luminescence, Direct and indirect gap materials.

Photoluminescence: General Principles of photoluminescence, Excitation and relaxation, OLED, Quantum-dot.

Electro-luminescence: General Principles of electroluminescence, light emitting diode, diode laser.

Unit 5 Display devices 9

LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS (Micro-Opto-Electro-Mechanical Systems) and MEMS displays.

Prescribed Textbooks:

1. Principles of Electronic Materials and Devices-S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd.,4thedition, 2021.
2. Semiconductor physics & devices: basic principles, 4th Edition, McGraw-Hill, 2012.

Reference Books:

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning,6th edition
2. Electronic Materials Science- Eugene A. Irene, Wiley, 2005
3. Electronic Components and Materials, Grover and Jamwal, DhanpatRai and Co., New Delhi., 2012.

NPTEL course links:

1. **https://nptel.ac.in/courses/113/106/113106062/**
2. **https://onlinecourses.nptel.ac.in/noc20_ph24/preview**

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2	PSO3
23AHS62T.1	3	3	2	2	1	-	-	-	-	-	-	-	-	-	-
23AHS62T.2	3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
23AHS62T.3	3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
23AHS62T.4	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
23AHS62T.5	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

R23

Title of the Course: Chemistry of Polymers and Applications
Category: OE
Couse Code: 23AHS63T
Branch/es: Common to all branches
Year III
Semester: II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To understand the basic principles of polymers
2. To understand natural polymers and their applications.
3. To impart knowledge to the students about synthetic polymers, their preparation and importance.
4. To enumerate the applications of hydrogel polymers
5. To enumerate applications of conducting and degradable polymers in engineering.

Course Outcomes:

At the end of the course, the student will be able to

1. Explain polymerization mechanism and measurement of molecular weight of polymer
2. Describe the physical, chemical properties and applications of natural polymers and modified cellulosics.
3. Explain types of polymerizations, types of polymers and applications.
4. Understand polymer networks, hydrogels, and their applications.
5. Explain classification and mechanism of conducting and degradable polymers.

Unit 1 Polymers-Basics and Characterization 9

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, copolymerization and coordination polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

Unit 2 Natural Polymers & Modified Cellulosics 9

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

Unit 3 Synthetic Polymers 9

Addition and condensation polymerization processes– Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties. Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of

Polymers based on different types of monomers, Olefin polymers (PE, PVC), Butadiene polymers (BUNA-S, BUNA-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins.

Unit 4 Hydrogels of Polymer Networks 9

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.

Unit 5 Conducting and Degradable Polymers 9

Conducting polymers: Introduction, Classification, Mechanism of conduction in Poly Acetylene, Poly Aniline, Poly Thiophene, Doping, Applications.

Degradable polymers: Introduction, Classifications, Examples, Mechanism of degradation, poly lactic acid, PHB (Polyhydroxybutyrate) Nylon-6, Polyesters, applications.

Prescribed Textbooks:

1. Fred W. Billmeyer, Jr. is: Billmeyer F. W. A Textbook of Polymer Science, Textbook of Polymer Science (3rd ed.). Wiley-Interscience,1984.
2. Introduction to polymer chemistry, G.S. Mishra, Wiley Eastern Ltd., New Delhi. Newage publishers
3. Polymer science- V.R Gowrikar, N V Viswanathan, Jayaadev Sreedhar-New age International Publishers.1986

Reference Books:

1. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
2. Advanced Organic Chemistry, B.Miller, Prentice Hall
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning
23AHS63T.1	3	3	2	2	-	-	-	-	-	-	1
23AHS63T.2	2	2	1	1	-	-	-	-	-	-	1
23AHS63T.3	2	2	1	1	-	-	-	-	-	-	1
23AHS63T.4	2	2	1	1	-	-	-	-	-	-	1
23AHS63T.5	2	2	1	1	-	-	-	-	-	-	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

R23

Title of the Course: Academic Writing and Public Speaking
Category: OE
Couse Code: 23AHS64T
Branch/es: Common to all branches
Year: III B.Tech
Semester II Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

6. To encourage all-round development of the students by focusing on writing skills
7. To make the students aware of non-verbal skills
8. To enhance analytical skills in academic writing for deeper knowledge enhancement
9. To cultivate proficiency in delivering clear and engaging public speeches

Course Outcomes:

At the end of the course, the student will be able to

6. Understand various elements of Academic Writing
7. Identify sources and avoid plagiarism
8. Demonstrate the knowledge in writing a Research paper
9. Analyze different types of essays
10. Assess the strengths of other speakers and build confidence in delivering impactful presentations to an audience.

Unit 1 Introduction to Academic Writing 9

Introduction to Academic Writing – Essential Features of Academic Writing – Courtesy – Clarity – Conciseness – Correctness – Coherence – Completeness – Types – Descriptive, Analytical, Persuasive, Critical writing.

Unit 2 Academic Journal Article 9

Art of condensation- summarizing and paraphrasing - Abstract Writing, writing Project Proposal, writing application for internship, Technical/Research/Journal Paper Writing – Conference Paper writing - Editing, Proof Reading - Plagiarism.

Unit 3 Essay & Writing Reviews 9

Compare and Contrast – Argumentative Essay – Exploratory Essay – Features and Analysis of Sample Essays – Writing Book Report, Summarizing, Book/film Review- Sop

Unit 4 Public Speaking 9

Introduction, Nature, characteristics, significance of Public Speaking – Presentation – 4 Ps of Presentation– Stage Dynamics – Answering Strategies –Analysis of Impactful Speeches- Speeches for Academic events

Unit 5 Public Speaking and Non-Verbal Delivery 9

Body Language – Facial Expressions-Kinesics – Proxemics – Haptics – Chronemics -Paralanguage - Signs

Prescribed Textbooks:

4. Critical Thinking, Academic Writing and Presentation Skills: MG University Edition Paperback – 1 January 2010 Pearson Education; First edition (1 January 2010)
5. Pease, Allan & Barbara. The Definitive Book of Body Language, RHUS Publishers, 2016

Reference Books:

4. Alice Savage, Masoud Shafiei Effective Academic Writing,2Ed.,2014 Oxford University Press.
5. Shalini Verma, Body Language, S Chand Publications 2011.
6. Sanjay Kumar and Pushpalata, Communication Skills 2E 2015, Oxford.
7. Sharon Gerson, Steven Gerson, Technical Communication Process and Product, Pearson, New Delhi, 2014
8. Elbow, Peter. Writing with Power. OUP USA, 1998

Online Learning Resources

1 https://youtu.be/NNhTIT81nH8
2 https://www.youtube.com/watch?v=478ccrWKY-A
3 https://www.youtube.com/watch?v=nzGo5ZC1gMw
4 https://www.youtube.com/watch?v=Qve0ZBmJMh4
5 https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12-nonverbal-aspects-of- delivery/
6 https://onlinecourses.nptel.ac.in/noc21_hs76/preview
7 https://archive.nptel.ac.in/courses/109/107/109107172/#
8 https://archive.nptel.ac.in/courses/109/104/10910410

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning
23AHS64T-1	-	-	-		-	-	-	-	-	3	-	3
23AHS64T-2	-	-	-	-	-	-	-	-	-	3	-	3
23AHS64T-3	-	-	-	-	-	-	-	-	-	3	-	3
23AHS64T-4	-	-	-	-	-	-	-	-	-	3	-	3
23AHS64T-5	-	-	-	-	-	-	-	-	-	3	-	3