University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus

Institute of Engineering & Management, New Town Campus

University of Engineering & Management, Jaipur

4th Semester Syllabus for B.Tech ECE Admission Batch 2023

Index:

Syllabus Structure:

Sl. No.	Type	Subject Code	Subject Name	L	T	P	Total	Credit
1.	CC	PCCECE401	Analog & Digital Communication	3	0	0	3	3
2.	CC	PCCECE402	Digital Electronics	3	0	0	3	3
3.	CC	PCCECE403	Introduction to Artificial Intelligence and Machine Learning	3	0	0	3	3
4.	MC	MCC401	Sustainability & Environmental Science	1	0	0	1	2
5.	BSC	BSM401	Mathematics-IV	3	0	0	3	3
6.	GSC	ESP402	Essential Studies for Professionals IV	2	0	0	2	0.5
7.	CC	PCCECE491	Analog & Digital Communication Laboratory	0	0	2	2	2
8.	CC	PCCECE492	Digital Electronic Laboratory	0	0	2	2	2
9	CC	PCCECE493	Artificial Intelligence and Machine Learning Laboratory	0	0	2	2	2
10.	Sessional	OEC481	Object Oriented Programming using JAVA	1	0	2	3	2
11.	GSC	SDP482	Skill Development for Professionals-IV	0	0	2	2	0.5
12.	ECP	PRJECE481	Mini Project	-	-	-	1	1
13.	Mandatory Course	MAR481	Mandatory Additional Requirement (MAR)	0	0	0	0	0
14.		IFC	Industry and Foreign Certification	0	0	0	0	0
15.		MOOCS						
							Total Credit Points =	**23**

University of Engineering and Management, Kolkata
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus for B.Tech (Admission Batch 2023)

Subject Name: Analog and Digital Communication **Credit: 3** **Lecture Hours: 36**

Subject Code: PCCECE401

Pre-requisite: Signals and Systems, Mathematics.

Coursera link: https://www.coursera.org/learn/wireless-communications?
Linked link: https://www.linkedin.com/learning/iot-foundations-low-power-wireless-networking
NPTEL link: https://onlinecourses.nptel.ac.in/noc22_ee05/preview

COURSE OBJECTIVE:

1. To learn about Analog Modulation
2. To learn about Digital Modulation
3. To learn impact of Noise in communication
4. To learn about Waveform Coding Techniques
5. To learn about Superheterodyne Receiver

COURSE OUTCOMES:

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth.
2. Understand the behavior of a communication system at receiver in presence of noise.

3. Investigate pulsed modulation system, baseband transmission and analyze their system performance.
4. Analyze different digital modulation schemes and can compute the bit error performance trade off issues, equalization, carrier recovery

Module number	Topic	Sub-Topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Books/ Study Material
1	**Analog modulation**	Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB, Angle Modulation and Demodulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals. AI in Signal Detection and Classification: Application: Use of machine learning (ML) algorithms like convolutional neural networks (CNNs) and recurrent neural networks (RNNs) for the detection, classification, and identification of AM and FM signals in noisy environments.	***International Academia:***(https://web.stanford.edu/class/ee179/) ***AICTE-prescribed syllabus:***(https://www.aicteindia.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** MATLAB/ Simulink applications designs and real time implementation.	8	1. Design, Simulation and implementation of amplitude modulation and demodulation using MATLAB. 2. Design, Simulation and implementation of frequency modulation and demodulation using MATLAB. 3. Measurement of Modulation Index of An Amplitude Modulated Signal using Transistor/ IC. 4. Study of Modulation and Demodulation of Single Side Band Suppressed Carrier (SSB-SC) using IC. 5. Study of Modulation and Demodulation of Frequency Modulation	Ref: B.P.Lathi, Zhi Ding "Modern Digital and Analog Communication ", 4th edition, Oxford university pub: Chapter 3 and 4 Study Material: https://drive.google.com/file/d/1UbrF2Ckbb_YYPpNbMqsrhJzqnznKChYq/view?usp=sharing

					using IC.	
2	**Noise**	Noise Introduction, Sources of Noise, Classification of Noise, Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De- emphasis, Threshold effect in angle modulation. Application of AI technique for minimization of noise in communication system.	***International Standards*:**(https://web.stanford.edu/class/ee179/) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** MATLAB/ Simulink applications designs and real time implementation.	6	1. Study of SNR calculation using MATLAB. 2. SNR measurement for audio frequency using IC.	B.P.Lathi, Zhi Ding "Modern Digital and Analog Communication", 4th edition, Oxford university pub. Chapter: 7. Study Material: https://drive.google.com/file/d/1BPKkBqsLIdGMlsh6y8LCD-3i61dY1-KG/view?usp=sharing
3	**Waveform Coding Techniques**	Pulse modulation, Sampling process, Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation, Delta modulation, Noise considerations in PCM, Time Division multiplexing, AI based orthogonal multiple access technique, Digital Multiplexers.	***International Standards:*** (https://web.stanford.edu/class/ee179/) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf)	6	1. Design, Simulation and implementation of PCM. 2. Design, Simulation and implementation of DPCM. 3. Design, Simulation and implementation of DM. 4. Design, Simulation and implementation of ADM. 5. Study of Modulation	B.P.Lathi, Zhi Ding "Modern Digital and Analog Communication", 4th edition, Oxford university pub. Chapter: 5.

			Industry Mapping: MATLAB/Simulink applications designs and real time implementation.		and Demodulation of Pulse Amplitude Modulation (PAM) using Transistor. 6. Study of Pulse code Modulation using IC. 7. Study of Delta Modulation using IC.	Study Material: https://drive.google.com/file/d/1BPKkBqsLIdGMlsh6y8LCD-3i61dY1-KG/view?usp=sharing
4	**Digital Modulation Techniques**	Pass-band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying. AI-Enabled Digital Carrier Modulation and optimization of those techniques for error minimization. Application of AI-enabled modulation techniques.	***International Standards:*** (https://web.stanford.edu/class/ee179/) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** MATLAB/Simulink applications designs and real time implementation.	8	1. Study of Modulation and Demodulation of Amplitude Shift Keying (ASK) using MATLAB. 2. Study of Modulation and Demodulation of Phase Shift Keying (PSK) using MATLAB. 3. Study of Modulation and Demodulation of Frequency Shift Keying (FSK) using MATLAB. 4. Study of Modulation and Demodulation of Amplitude Shift Keying (ASK) using Transistor. 5. Study of Modulation and Demodulation of	Simon Haykin, "Communication Systems", 4th edition. Chapter:6. Study Material: https://drive.google.com/file/d/1lfqmRuxRmTG8AJHXdNvDs2MiwX39NBMH/view?usp=sharing

					Phase Shift Keying (PSK) using IC. 6. Study of Modulation and Demodulation of Frequency Shift Keying (FSK) using IC.	
5	**Radio Transmitters and Radio Receivers**	Overview of Radio Transmitter and Radio Receivers. Super heterodyne receivers: Super heterodyning principle, Intermediate frequency, Local oscillator frequency, Image frequency. Overview of Amplifier, Mixer, Local Oscillator, LNA, Filter.	**International Standards:**(https://web.stanford.edu/class/ee179/) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** MATLAB/Simulink applications designs for	8	1. Detailed study of intermediate frequency, radio frequency and audio frequency response of super-heterodyne receiver using IC. 2. Frequency Division Multiplexing and Demultiplexing Through Optical Fiber Cable. 3. Analog Communication through Optical Fiber Cable. 4. Study of Satellite	B.P.Lathi, Zhi Ding "Modern Digital and Analog Communication", 4th edition, Oxford university pub. Chapter: 4. Study Material: https://drive.google.com/file/d/1_p22-2oW6PYdPARG

			transmitter and receivers.		Communication.	gAR6RjF2AczmPHwj/view?usp=sharing

Text Books:

1. B.P.Lathi, Zhi Ding, “Modern Digital and Analog Communication”, 4th ed., Oxford university pub.
2. Haykin S., "Communications Systems", John Wiley and Sons

Reference Books:

1. Taub, Schilling, “Principles of Communication Systems”, 2nd ed., Mc-Graw Hill.
2. Proakis J. G., Salehi M., "Communication Systems Engineering", Pearson Education.

Syllabus for B.Tech Admission Batch 2022

Subject Name: Digital Electronics **Credit: 3** **Lecture Hours: 36**
Subject Code: PCCECE402
Pre-requisite: Mathematics, Basic Electronics

Course Objective:

1. To introduce basic postulates of Boolean algebra and to introduce the methods for simplifying Boolean expressions.
2. To study formal procedures for the analysis and design of combinational and sequential circuits.
3. To introduce the concept of logic families, semiconductor memories and implementation of digital circuits using programmable logic devices.
4. To illustrate the concept of synchronous and asynchronous sequential circuits.

Course Outcome:

CO 1: Students will have a thorough knowledge of number system and different codes and also they will be able to apply those knowledge while required.
CO 2: After completing this course, the students will be able to design and analyze combinational logic circuits. They will also learn how to use GEN AI for Combinational Logic Circuits.
CO 3: Students will acquire a knowledge about sequential logic circuits and solid states memory devices. They will also learn how to use GEN AI for Sequential Logic Circuits.
O 4: They will be able to design ADC and DAC and also will acquire knowledge on logic families.

Relevant Links:

1. Link for Study Material:

https://docs.google.com/document/d/1O4bOy7MkdqVMfc3S1RRUsRwiViZ7A67P/edit?usp=sharing&ouid=116508199826018918971&rtpof=true&sd=true.

2. Link for NPTEL Course:

https://onlinecourses.nptel.ac.in/noc25_ee11/preview

3. Link for Coursera Course:

https://www.coursera.org/specializations/fpga-design

4. Link for LinkedIn Learning Course:

i) https://www.linkedin.com/learning/learning-pcb-design-with-orcad?trk=learning-topics_learning-search-card_search-card&upsellOrderOrigin=sem-ga_campid.16725959274_asid.137912488311_crid.590520008629_kw.linkedin%2Blearning%2Bpro_d.c_tid.kwd-1646634661878_n.g_mt.p_geo.9061848

ii) https://www.linkedin.com/learning/learning-arduino-foundations-2i)

iii) https://www.linkedin.com/learning/raspberry-pi-weekly

iv) https://www.linkedin.com/pulse/teaching-digital-logic-design-online-junaid-ahmed-memon/

v) https://www.linkedin.com/learning/learning-fpga-development

vi) https://www.onlinetutorials.org/teaching-academics/basics-of-digital-electronics/

5. Link for Infosys Springboard Course:

i) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013843229080535040338 37_shared/overview

Detailed Syllabus:

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Number System and Logic Families** **Text Books: Anand Kumar (Chapter 2, 3, 4)**	Introduction to number systems, Binary, Octal and Hexadecimal representation and their conversions; BCD, ASCII, gray codes and their conversions, thermometric codes, Signed binary number representation with 1's and 2's complement methods ,basic logic functions Standard forms of logic expressions, and simplification of logic expressions using K Map. Review of TTL and CMOS families, their operations and specifications. Overview of Verilog	***International Academia:*** (https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** SPICE software, Verilog	5	1. Simulation of MOS Inverter with different loads using SPICE software. 2. Simulation of CMOS Inverter for different parameters Kn, Kp as a design variable in SPICE software. 3. Introduction to programming using Verilog
2	**Introduction to Boolean Algebra and K-map:**	Basic Definitions and Axiomatic Definition of Boolean Algebra, Boolean Functions, Canonical and Standard Forms. The Map Method - K-map, Product of Sums and Sum of Products	**International Standards** :(https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) ***AICTE prescribed syllabus:***	5	1. Design of BCD-Excess 3 code and vice-versa using basic gates (IC 7408, 7432,7404) 2. Design of basic digital circuits using Tinkercad.

	Text Books: Salivahanan and Arivazhagan: (Chapter 2)	Simplification, NAND and NOR Implementation.	(https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** Hardware Chipsets (IC 7408, 7432,7404), Software- TinkerCad		
3	**Designing Combinational Logic Circuits:** **Text Book: Salivahanan and Arivazhagan: (Chapter 5,6)**	Arithmetic circuits (ADDER and SUBTRACTOR), multiplier, comparators, decoders, encoders, multiplexers, de- multiplexers, parity generator and checker and their use in logic synthesis; Potential hazards in combinational circuits.	***International Standards*** : (https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** Hardware Chipset (IC 7408, 7432,7404, 74153, 74155, 74180) Software: LogiSim and VHDL	6	1. Design of Adder and Subtractor using basic gates (IC 7408, 7432,7404) and use of IC 74LS83 as BCD adder. 2. Design of MUX and DEMUX using basic gates (IC 74153, 74155) and also study the available ICS of MUX and DEMUX. Implement logic functions using these ICs. 3. Design and implementation of 16-bit odd/even parity checker/ generator using IC 74180. 4. Implementation of combinational circuits using LogiSim and VHDL
4	**Designing Sequential Logic Circuits:** **Text Book: Anand Kumar**	Basic memory element-S-R, J-K, D and T Flip Flops, various types of Registers and counters and their design, Design of Synchronous Sequential Circuits- State Table and State Diagrams, Design of Mealy and Moore FSM -Sequence Detection.	***International Standards:*** (https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/M	6	5. Design of R-S, J-K, D and T Flip flops using universal gates and also study master slave J-K flip flop IC 7476. 6. Design of synchronous and asynchronous counter using Flip Flop IC 7476. 7. Design of 4-bit shift register (shift right)

	(Chapter 8,9,10, 11,12)		odel_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** Hardware Chipset (IC 7476, 7474) Software: LogiSim and VHDL		IC 7476/7474 8. Implementation of sequential circuits using Logisim and VHDL
5	**Introduction to Digital Logic Devices, ADC and DAC:** **Text Book: Salivahanan and Arivazhagan: (Chapter 10, 13)**	Introduction of ROM and RAM, PLA, PAL and FPGA. IC iCE40 FPGA family D/A converter -specifications - weighted resistor type, R-2R Ladder type. A/D Converters specifications - Flash type-Successive Approximation type, Pipeline ADC AFEx8201 16-Bit and 14-Bit Digital-to-Analog Converters (DACs) With Voltage Reference and Diagnostic ADC for Low-Power Applications	***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** Hardware Chipset AFEx8201 ADC AD570, DAC 0808 Software TinkerCad (https://www.ti.com/lit/ds/symlink/afe88201.pdf?ts=1700473002665&ref_url=https%253A%252F%252Fwww.ti.com%252Fdata-converters%252Fintegrated-special-function%252Fprecision-adcs-and-dacs%252Fproducts.html)	4	9. Design of PLA and PAL using basic logic gates (IC 7408, 7432,7404) 10. Design and testing of half/full adder and multiplexer by burning FPGA Kit. 11. Design of ADC and DAC using IC ADC AD570, DAC 0808 12. Design of ADC and DAC using TinkerCad
6	**GEN AI for Digital**	Introduction of GEN AI			

	Circuits **Research papers and study material**	Use of GEN AI for Designing Digital Circuits Use of GEN AI for optimizing power and delay of Digital Circuits			

Text Books:

1. Digital Circuits and Design, by S. Salivahanan**,** S. Arivazhagan**,** 5th Edition, Oxford University Press India.
2. **Fundamentals of** Digital Circuits; Anand Kumar; PHI Publication
3. Digital Logic and Computer **Design; M Morris Mano, Pearson Publication**

Reference Books:

1. Digital Design, M. Morris. Mano & Michael D. Ciletti, PEARSON Publication

3. Digital Electronics; Tokheim; TMH Publication

Syllabus for BTech (ECE) – 4th Semester (2023-27 Batch)

Subject Name: **Artificial Intelligence & Machine Learning** Credit: **3** Lecture Hours: **36**
Subject Code: **PCCECE403**

Prerequisites: Mathematics (Linear Algebra, Statistics & Probability, Multivariate Calculus), Data Structure & Algorithms, Python coding using various libraries

Relevant Links:

Study Material | NPTEL | Coursera | LinkedIn Learning

Course Objective:

Obj 1. The students will understand the basics concepts of Artificial Intelligence and Machine Learning models, including Deep Learning models.
Obj 2. They will also learn and will be able to apply different Artificial Intelligence and Machine Learning models (including Deep Learning) to various datasets.

Course Outcome:

CO 1: Students will be able to understand the foundational concepts for building on their knowledge in the domain, including Intelligent Agents, Nature of Agents, Learning Agents.
CO 2: Students will know the concept of Machine Intelligence through Learning from Data sets, as opposed to Pre-determined and pre-programmed Logic and search algorithms.
CO 3: The student will be able to understand and apply, depending on the individual cases, the different models for Supervised and Unsupervised Learning methodologies.

CO 4: Students will know the shortcomings of classical Machine Learning models and how Deep Learning model (includes Backpropagation with Gradient Descent) has been able to overcome those to a significant extent. Students will be able to use Deep Learning models, e.g to analyze and classify images, and for Sequential and Time Series Data. Also will be able to use Generative-AI for different applications in various domains.

Module Number	Topic	**Sub- Topic**	**Mapping with Industry and International Academia**	**Lecture Hours**	**Corresponding Lab Assignment**
1	**Introduction to Artificial Intelligence**	Introduction Artificial Intelligence and its applications, Artificial Intelligence Techniques, Level of models, criteria of success, Intelligent Agents, Nature of Agents, Learning Agents. AI Techniques, advantages, and limitations of AI, Impact and Examples of AI, Application domains of AI. The AI Ladder – he Journey for Adopting AI Successfully, advice for a career in AI, Hotbeds of AI Innovation.	*AICTE-prescribed syllabus:* https://www.aicte-india.org/sites/default/files/UG_Emerging.pdf *International Academia: https://ocw.mit.edu/courses/6-034-artificial-intelligence- fall-2010/resources/lecture-1-introduction-and-scope/* *Industry Mapping: Python, TensorFlow Keras, PyTorch*	2	Basic Programs using Python from: https://onlinecourses.swayam2.ac.in/aic20_sp33/preview https://www.coursera.org/learn/introduction-tensorflow
Text-Book: "Artificial Intelligence ' - by Russell and Norvig, Part-I (Ch. 1, 2), (Pearson India, 4th ed, 2022);					
2	**Introduction to Machine Learning**	What Is Machine Learning, How Do We Define Learning; what are datasets and how to handle them, Feature sets, Dataset division: test, train and validation sets, Holdout, cross validation, k Cross validation, random sampling, LOOCV, Bootstrap sampling; Fitting of data; Evaluation Measures: SSE, MME, R2, Confusion Matrix, Precision, recall, F-Score, Kappa, ROC- Curve, AUC, Cross-Entropy Loss.	*AICTE-prescribed syllabus: https://www.aicte- india.org/sites/default/files/Model_Curriculum/AI CTE%20-%20UG%20CSE.pdf* *International Academia: https://ocw.mit.edu/courses/6-036-introduction-to- machine-learning-fall-2020/* *Industry Mapping: Python, TensorFlow Keras, PyTorch*	8	see corresponding AIML Lab Syllabus (PCCEC493)
Text-Book: (1) "Hands-On Machine Learning", - by Aurelien Geron, Part-I (Ch.: 1, 2, 3) , (O'Reilly, SPD, 3rd ed, 2022); **(2) "Artificial Intelligence ' - by Russell and Norvig, Part-V (Ch. 18), (Pearson India, 4th ed, 2022);**					

Module Number	Topic	Sub- Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
3	**Supervised & Unsupervised Learning techniques**	**Supervised Learning:** Classification and Regression: Binary, Multi-label, Multiclass, Imbalance; Linear Regression, Logistic Regression, K-Nearest Neighbour, Probabilistic Reasoning under Uncertainty: Baye's Rule and its Use, Naïve Bayes Models, Probabilistic Reasoning over Time: Time and Uncertainty, Inference in Temporal Models, Hidden Markov Models and Kalman Filters; Support Vector Machine (SVM); Kernel functions in SVM, Decision Tree. **Unsupervised Learning:** Introduction to clustering, Types of Clustering: K-means, DBSCAN, Hierarchical	*AICTE-prescribed syllabus:* *https://www.aicte-india.org/sites/default/files/Model_Curriculu m/ AICTE%20-%20UG%20CSE.pdf* *International Academia:* *https://ocw.mit.edu/cou rses/6-036-introduction-to- machine-learning-fall-2020/* ***MIT 6.S191: Introduction to Deep Learnin:*** ***https://introtodeeplearning.com/*** ***Stanford University:*** *https://cs230.stanford.edu/syllabus/* *Industry Mapping: Python, TensorFlow Keras, PyTorch*	9	See corresponding AIML Lab Syllabus (PCCEC493)

Text-Book: (1) "Hands-On Machine Learning", - by Aurelien Geron, Part-I (C h.: 4,5,6,7,8,9), (O'Reilly, SPD, 3rd ed, 2022);

(2) "Artificial Intelligence" - by Russell and Norvig, Part-IV (Ch. 12 – Sections 12.5, 12.6; Ch. 14 – Sections 14.1, 14.2, 14.3, 14.4), Part-V (Ch. 18, 20), (Pearson India, 4th ed, 2022);

4	**Introduction to Deep Learning**	Neural Network Architecture: Biological vs artificial neuron, Definition and Evolution of ANN, Perceptron, XOR problem, non-linearity, Choice of Activation Function: The Importance of Nonlinearity, Softmax Activation Function Common Loss/Error Functions, Regression, Binary classification, Multiclass classification Single Computational Layer: The Perceptron, Use of Bias What Objective Function Is the Perceptron Optimizing? Multilayer Neural Networks: The Multilayer Network as a Computational Graph Backpropagation, Gradient Descent, Gradient Descent Optimization using Batch, Mini-batch and Stochastic Gradient Descent, Parameter initialization, Avoiding Overfitting through Regularization Fine-tuning Neural Network Hyperparameters Training Deep Neural Networks: Vanishing/Exploding Gradient problems,,	*AICTE-prescribed syllabus:* *https://www.aicte-india.org/sites/default/files/Model_Curriculum/ AICTE%20-%20UG%20CSE.pdf* *International Academia:* *https://www.coursera.org/learn/convolutional-neural-networks* ***MIT 6.S191: Introduction to Deep Learnin:*** ***https://introtodeeplearning.com/*** ***Stanford University:*** *https://cs230.stanford.edu/syllab us/* *Industry Mapping:Python, TensorFlow Keras, PyTorch*	8	. See corresponding AIML Lab Syllabus (PCCEC493)

Text-Books: (1) "Machine Learning" – by Aurelien Geron – PART-II (Ch.10, 11, 14), (O'Reilly, SPD, 3rd ed, 2022);

(2) "Artificial Intelligence" --- by Russell and Norvig, Part-V (Ch. 21 – Sections 21.1, 21.2, 21.3), (Pearson India, 4th ed, 2022);

(3) "Neural-Networks and Deep-Learning – A Textbook" - by Charu C. Aggarwal (Ch. 1,2,3,4,5,9), (Springer USA, 2023,

2nd ed):

[Dr. Charu Aggarwal, PhD(MIT), is a Distinguished Scientist at IBM T.J.Watson Sr. Research Lab, Yorktown Heights, NY, USA]

Module Number	Topic	Sub- Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
5	**Deep Learning Models & Applications**	**Computer Vision using Convolutional Neural Networks (CNN):** Filter based image processing, convolution- 1D, 2D, 3D, subsampling, rectified-linear units, fully-connected layers, CNN design principles, The Basic Structure of a Convolutional Network, Convolutional Filters: Kernels, Padding, Strides, The ReLU Layer, Pooling, Fully Connected Layers, The Interleaving between Layers, Training a Convolutional Network: Backpropagating Through Convolutions, Backpropagation as Convolution with Inverted/Transposed Filter, Convolution/Backpropagation as Matrix Multiplications Example CNN Architectures (LeNet-5, AlexNet, VGGNet, ResNet) **Sequential and Time-Series Data using Recurrent Neural Networks RNN**: Recurrent Neurons and Layers: Memory Cells, Input and Output Sequences, Language Modeling Example of RNN, Backpropagation Through Time, Bidirectional Recurrent Neural Networks, Multilayer Recurrent Neural Networks, The Challenges of Training Recurrent Neural Networks, Layer Normalization Handling Long Sequences using improvisations on RNN, such as: Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) = for: Fighting the Unstable Gradients Problem; Tackling the Short-Term Memory Problem;	*AICTE-prescribed syllabus:* *https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf* *International Academia:* *https://www.coursera.org/learn/convolutional-neural- networks* ***MIT 6.S191: Introduction to Deep Learnin:*** ***https://introtodeeplearning.com/*** ***Stanford University:*** *https://cs230.stanford.edu/syllabus/* *Industry Mapping:Python, TensorFlow Keras, PyTorch*	**9**	See correspondin g AIML Lab Syllabus (PCCEC493)

Text-Books: (1) "Hands-On Machine Learning" – by Aurelien Geron – PART-II (Ch.15, 16,17), (O'Reilly, SPD, 3rd ed, 2022);

(2) "Artificial Intelligence" - by Russell and Norvig, Part-V (Ch. 21 – Sections 21.4, 21.5, 21.6, 21.7, 21.8; Ch. 24 – Sections 24.1, 24.2, 24.3, 24.4), (Pearson India, 4th ed,2022);

(3) "Neural-Networks-and-Deep-Learning - A-Textbook" - by Charu C. Aggarwal (Ch. 5- Section 5.10; Ch. 9, 8), (Springer USA, 2023, 2nd ed): [Dr. Charu Aggarwal, PhD(MIT), is a Distinguished Scientist at IBM T.J.Watson Sr. Research Lab, Yorktown Heights, NY, USA]

TEXT BOOKS:

1. All 5 modules - AI, ML & DL (THEORY) –:

'Artificial Intelligence: A modern approach' by Stuart Russel and Peter Norvig (Pearson India, 4th edition, 2022).

3. Modules 2 & 3 (Machine Learning) and also for Modules 4 & 5 (Deep Learning) – both THEORY & CODING:

'Hands-On Machine Learning', by Aurelien Geron (Part-I: Machine Learning; Part-II: Deep Learning) (O'Reilly, SPD, 3rd edition, 2022)

4. Additional THEORY textbook for Modules 4 & 5 (Deep Learnin

'Neural-Networks-and-Deep-Learning - A-Textbook' - by Charu C. Aggarwal (Springer, 2023, 2nd-edition);

[Dr. Charu Aggarwal, PhD(MIT), is a Distinguished Scientist at IBM T.J. Watson Sr. Research Lab, Yorktown Heights, NY, USA]

Mandatory Prerequisite: https://www.linkedin.com/learning/learning-python-4393370 (To be completed before the start of the class)

REFERENCE BOOKS:

1. ML: **'Machine Learning'** by Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das (Pearson, 2nd edition, 2024)
2. ML: **'Introduction to Machine Learning'** by Ethem Alpaydin (PHI, 3rd Edition, 2014)
3. ML: **'An Introduction to Statistical Learning – with Applications in Python'** by Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani (Springer, 2023)
4. DL: **'Deep Learning – Foundations and Concepts', by Christopher M. Bishop and Hugh Bishop** (**Springer, 2024**)
5. DL: **'Understanding Deep Learning'** by Simon J.D. Prince (MIT Press, 2024)
6. DL: **'Deep Learning'** by Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra, Amlan Chakrabarti (Pearson, 2022)
7. DL: **'Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms'** by Nithin Buduma, Nikhil Buduma, Joe Papa (O'Reilly - SPD, 2nd edition, 2022)

Online Resources:

1. https://nptel.ac.in/courses/106102220
2. https://nptel.ac.in/courses/106105077
3. https://nptel.ac.in/courses/106106139
4. https://onlinecourses.nptel.ac.in/noc20_cs81/preview
5. https://onlinecourses.nptel.ac.in/noc20_cs49/preview
6. https://www.coursera.org/learn/machine-learning-duke
7. https://www.linkedin.com/learning/artificial-intelligence-foundations-machine-learning-22345868?trk=course_title&upsellOrderOrigin=default_guest_learning
8. https://www.mooc-list.com/course/transformer-models-and-bert-model-coursera
9. https://www.coursera.org/learn/nlp-sequence-models

List of Mini Projects

#	Project Title	Project Detail
1	AI-powered Legal Documentation Assistant	https://sih.gov.in/sih2023PS#:~:text=AI%2Dpowered%20Legal%20Documentation%20Assistant
2	Use of Digital Technology to calculate water footprints	https://sih.gov.in/sih2023PS#:~:text=Use%20of%20Digital%20Technology%20to%20calculate%20water%20footprints%20for%20different%20daily%20use%20items
3	Digital Assistant for Legal Awareness and Designing - a KYR Know-Your-Rights framework in India	https://sih.gov.in/sih2023PS#:~:text=Digital%20Assistant%20for%20Legal%20Awareness%20and%20Designing%20a%20KYR%20Know%2DYour%2DRights%20framework%20in%20India
4	AI-powered Legal Documentation Assistant	https://sih.gov.in/sih2023PS#:~:text=AI%2Dpowered%20Legal%20Documentation%20Assistant

5	Projection of the extent of inundation corresponding to theforecasts of flood levels in a river.	https://sih.gov.in/sih2023PS#:~:text=Projection%20of%20the%20extent%20of%20inundation%20corresponding%20to%20the%20forecasts%20of%20flood%20levels%20in%20a%20river
6	Development of AI, ML and Chatbot-powered Interactive RoboMascot (Chacha Chaudhary) and digital avatar to strengthen the riverpeople connect component of Namami Gange.	https://sih.gov.in/sih2023PS#:~:text=Development%20of%20AI%2C%20ML%20and%20Chat%20boat%2Dpowered%20Interactive%20Robot%20Mascot%20(Chacha%20Chaudhary)%20and%20digital%20avatar%20to%20strengthen%20the%20river%20people%20connect%20component%20of%20Namami%20Gange
7	AI-enabled water well predictor	https://sih.gov.in/sih2023PS#:~:text=AI%2Denabled%20water%20well%20predictor
8	Automatic regulation of valves for release of water based upon soi moisture availability in the root zoneof the crop, using artificia intelligence, in piped and micro irrigation network of irrigation system.	tps://sih.gov.in/sih2023PS#:~:text=Automatic%20regulation%20of%20valves%20for%20release%20of%20water%20based%20upon%20soil%20moisture%20availability%20in%20the%20root%20zone%20of%20the%20crop%2C%20using%20artificial%20intelligence%2C%20in%20a%20piped%20and%20micro%20irrigation%20network%20of%20irrigation%20system
9	Al-based Generative design of Hydro power plants.	https://sih.gov.in/sih2023PS#:~:text=Al%2Dbased%20Generative%20design%20of%20Hydro%20power%20plants
	Developing an AI-powered energy management system for industrial commercial facilities to optimize energy consumption.	https://sih.gov.in/sih2023PS#:~:text=Developing%20an%20AI%2Dpowered%20energy%20management%20system%20for%20industrial%20commercial%20facilities%20to%20optimize%20energy%20consumption

#	Project Title	Project Detail
	Chatbot to respond to text queries pertaining to various Acts, Rules, and Regulations applicable to Mining industries	https://sih.gov.in/sih2023PS#:~:text=Chatbot%20to%20re20queries%20pertaining%20to%20various%20Acts%2C%20Rules%2C%20and%20Regulations%20applicable%20to%20Mining%20industries
	Forecasting and scheduling of railway rakes.	https://sih.gov.in/sih2023PS#:~:text=Forecasting%20and%20scheduling%20of%20railway%20rakes
	Air and water quality index and environment monitoring	https://sih.gov.in/sih2023PS#:~:text=Air%20and%20water%20quality%20index%20and%20environment%20monitoring
	AI Assisted Tele-medicine KIOSK for Rural India	https://sih.gov.in/sih2023PS#:~:text=AI%20Assisted%20Tele%2Dmedicine%20KIOSK%20for%20Rural%20India
	360-degree feedback software for the Government of India related News Stories in Regional Media using Artificial Intelligence / Machine Learning	https://sih.gov.in/sih2023PS#:~:text=360%2Ddegree%20feedback%20software%20for%20the%20Government%20of%20India%20related%20News%20Stories%20in%20Regional%20Media%20using%20Artificial%20Intelligence%20/%20Machine%20Learning

Syllabus for B.Tech Admission Batch 2023

Subject Name: Sustainability, Climate Actions & Environmental Sciences Credit: 2 Lecture Hours: 24

Study Material **LinkedIn** **NPTEL** **Coursera**

Subject Code: MCC471

Course Outcomes:

The concepts developed in this course will help the students in their higher studies. The course will enable the student to

CO1: Understand fundamental concepts of environmental systems, sustainability, United Nations Sustainable Development Goals (UNSDGs) and their interrelationship with human society.

CO2: Apply knowledge of sustainable practices, different technical tools and existing frameworks to address environmental and societal challenges.

CO3: Analyze the challenges and strategies associated with climate change mitigation, sustainable cities, and waste management within the context of international agreements and frameworks.

CO4: Evaluate and design innovative approaches to energy, water, and waste management, considering the principles of the circular economy and global SDG progress reports.

Module Number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
I	**Overview - United Nations Sustainable Development Goals (UNSDGs)**	Basic ideas of environment, basic concepts: man, society & environment, their interrelationship. Significance of sustainability in today's world. 17 United Nations Sustainable Development Goals (UNSDGs) - background, significance, interconnectedness of goals, global challenges and recent progress. Climate change and mitigation. Explain and evaluate the evidence for human-caused climate change, in the context of historical climate change, as well as the relevant scientific uncertainties and possible evidence to the contrary.	***International Academia:*** ***https://unccelearn.org/course/view.php?id=170&page=overview*** ***https://unccelearn.org/course/view.php?id=181&page=overview*** ***Industry Mapping:***	4	Assess the college campus alignment with the United Nations Sustainable Development Goals (SDGs) and rank the performance across selected goals mentioning the actionable strategies for improvement.
II	**Sustainable Management**	Sustainable management of water and sanitation- introduction, key components, challenges and innovative approaches. Ensure access to affordable, reliable, sustainable, and modern energy- introduction, importance, key targets, challenges and strategies. Sustainable Cities and Communities- Definition of sustainable cities, current challenges, strategies, innovative solution, smart city	***International Academia:*** ***https://ocw.mit.edu/courses/res-env-006-teaching-with-sustainability-january-iap-2022/*** ***Industry Mapping:***	4	Design and propose innovative, sustainable solutions for managing water, energy, and urban systems, inspired by the principles of SDG 6, SDG 7 and SDG 11.
III	**Climate Action**	Climate change and its consequences, international agreements on climate change, strategies and actionable step, Life Below Water- Importance of water bodies and marine ecosystem, strategies for protecting aquatic life	***International Academia:*** ***https://unccelearn.org/course/view.php?id=7***	4	Using data analytics and modeling tools - evaluate climate change impacts, assess ecosystem health, and propose technical solutions for

		and water bodies, Life on Land- importance of biodiversity, carbon sequestration, Food security, Strategies for Conservation and Restoration of Ecosystems, Sustainable Land Management, Biodiversity Conservation, Accountable steps for life on land. The successes and failures of past national and international efforts to address climate change, and evaluate prospects for future management of climate change. Provisions of the United Nations Framework Convention on Climate Change, Paris Agreement	***&page=overview&lang=en*** ***https://unccelearn.org/course/view.php?id=145&page=overview*** ***https://unccelearn.org/course/view.php?id=48&page=overview*** ***https://ocw.mit.edu/courses/res-env-001-climate-action-hands-on-harnessing-science-with-communities-to-cut-carbon-january-iap-2017/*** ***Industry Mapping:***		mitigation and conservation efforts.
IV	**UN-call for Action**	Focus on **annual SDG Goals Report** and the **United Nations Secretary-General's calls for action** to accelerate the progress on the Sustainable Development Goals (SDGs). Examine the global progress trends, challenges highlighted in recent reports, and key priorities proposed by the Secretary-General to achieve the 2030 Agenda.	***International Academia:*** ***https://unccelearn.org/course/view.php?id=175&page=overview*** ***Industry Mapping:***	4	Using quantitative analysis, strategic planning, and innovative approaches, evaluate the global progress on the Sustainable Development Goals (SDGs) as highlighted in the annual SDG Goals Report.

V	**Environmental Systems Analysis**	Environmental impact assessment - lifecycle assessment (LCA),Using of LCA software tools – OpenLCA, Environmental, social, and governance (ESG), Integrated Impact Assessment of ESG, Carbon Management, Green Hydrogen, Importance of green building (LEED, IGBC etc.) certification. Environmental Management System (EMS) in industry - ISO 14001.	***International Academia:*** https://www.lse.ac.uk/united-states/Assets/Documents/Syllabus-Hub-PDFs/Michael-Carbajales-Dale-Clemson-Environmental-Systems-Analysis.PDF https://www.igmpi.ac.in/environmental-social-governance?gad_source=1 https://www.iso.org/standard/60857.html#:~:text=ISO%2014001%20is%20the%20internationally,continually%20improve%20their%20environmental%20performance. ***Industry Mapping:***	4	Life Cycle Assessment of a college building using OpenLCA software.
VI	**Waste Management**	Waste Management Rules - Hazardous Waste, E-waste, Municipal Solid Waste, Bio-medical waste, Plastic Waste & Construction and Demolition Waste. Management of different waste streams – collection, transportation, treatment, storage and disposal. Basel Convention, Extended producer responsibility (EPR) Energy & Resource Recovery - Incineration, Co-processing, Composting, Bio-methanation, Management of solar photo-voltaic modules or panels or cells, Battery Waste Management Rules, Circular Economy	***International Academia:*** ***https://cpcb.nic.in/rules-6/*** ***https://ocw.mit.edu/courses/ec-716-d-lab-waste-fall-2015/*** ***https://unccelearn.org/course/view.php?id=131&page=overview***	5	Mapping the supply chain of different waste management system and finding the issues & challenges.

			https://unccelearn.org/course/view.php?id=87&page=overview ***Industry Mapping:***		

Field works will be assigned for each and every student/ group of students, on completion of which they have to give a presentation alongwith a model display if possible.

Learning Resources:

Text Books:

This syllabus has been designed on the United Nations Sustainability Development Goals, so there is no prescribed text books. Please refer to the study material and online courses.

4th Semester Syllabus for B.Tech Admission Batch 2023-2027

Subject Name: Mathematics - IV **Credit: 3** **Lecture Hours: 36**

Subject Code: BSM401

Pre-requisite: Mathematics – III

Relevant Links:

Study Material-BSM401 Coursera NPTEL

COURSE OBJECTIVES:

1. To learn about Calculus of Complex functions.
2. To learn about Fourier series and Fourier Transform.
3. To learn about Laplace transform.
4. To learn about Z-transform.
5. To develop a basic understanding of Data analysis using Python.

COURSE OUTCOMES:

CO1: Identify different tools for differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

CO2: Appraise the notions of Fourier Series and Transform to solve advanced engineering problems.

CO3: Apprehend the concept of Laplace Transform together with its applications in evaluating integrals and solving ordinary differential equations.

CO4: Relate the use of Z-Transform for discrete functions and solve difference equations using Z-Transform technique.

CO 5: Acquire an understanding of handling and analyzing datasets, creating data visualizations, solving linear equations.

Module number	Topics	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Text Book Mapping	Corresponding Lab Assignment
1.	**Calculus of Complex Functions**	Complex function, Limit, Continuity and Differentiation; Analytic functions, Cauchy-Riemann equations (statement only); Harmonic functions, Harmonic Conjugate; construction of Analytic functions; elementary Analytic functions (exponential, trigonometric, logarithmic) and their properties. Statement for Cauchy's	***International Academia:*** ● https://ocw.mit.edu/courses/18-04-complex-variables-with-applications-spring-2018/ ***AICTE-prescribed syllabus:*** ● https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf	**8**	Text book 1: Chapter **19** & Chapter **20**	❖ Evaluation of contour integrals using **MATLAB**.

		Integral formula for evaluation of $\int_C f(z)dz$, where C is a circle.	***Industry Mapping:*** To analyze the frequency response of filters by evaluating the behavior of complex functions that represent signals or system responses along a contour. https://in.mathworks.com/help/matlab/math/complex-line-integrals.html			
2.	**Fourier Series & Transform**	*Fourier Series*: Even function, Odd function. Periodic function, Euler's formula, Dirichlet's conditions; Sum of the Fourier series at the point of discontinuity and end points of an interval; Half Range Sine and Cosine Series; Parseval's Theorem (statement only). *Fourier Transforms*: Fourier Transform and its properties; Fourier Sine and Cosine Transforms, Fourier Transform of derivatives (statement only); Inverse Fourier Transform (statement only); Convolution	***International Academia:*** ● https://see.stanford.edu/Course/EE261 ***AICTE-prescribed syllabus:*** ● https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf ***Industry Mapping:*** To analyze periodic signals and transform them into frequency components. https://in.mathworks.com/hel	**10**	*Fourier Series:* Textbook 1: Chapter **10** *Fourier Transform:* Textbook 1: Chapter **22**	❖ Perform Fourier sine and cosine transforms using **MATLAB**. ❖ Write Fourier series for some elementary functions using **MATLAB**. ❖ Compare Fourier Transform results with Spectrum Analyzer outputs in real-world signal frequency analysis.

		theorem (statement only), related problems.	p/matlab/math/fourier-transforms.html			
3.	**Laplace Transform**	Laplace Transform and its properties; First and Second Shifting theorems; Laplace Transform of Periodic functions; Inversion of Laplace Transform by different methods, Convolution theorem; evaluation of integrals by Laplace Transform; solving boundary value problems by Laplace Transform method.	***International Academia:*** ● https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/resources/mit6_003f11_lec06/ ● https://web.stanford.edu/~boyd/ee102/ ***AICTE-prescribed syllabus:*** ● https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf ***Industry Mapping:*** To analyze system dynamics, stability, and control in electrical circuits and automation. https://in.mathworks.com/help/symbolic/sym.laplace.html	**8**	Textbook 1: Chapter **21**	❖ Perform Laplace transform of some elementary functions using **MATLAB**. ❖ Perform inverse Laplace transform using **MATLAB**. ❖ Analyze system stability using Laplace Transform and verify results through control lab experiments with real-world systems.

4.	**Z-Transform**	Sequence, representation of sequence, Z-Transform and its properties, Shifting theorems, Inverse Z-transform, Convolution theorem, region of convergence, concept of difference equation and their solution by Z-Transform method.	***International Academia:*** ● https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/64490a008c1c5c25c86044351465abf7_MIT6_003F11_lec05.pdf ***AICTE-prescribed syllabus:*** ● https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf ***Industry Mapping:*** To analyze discrete-time systems, especially in control systems and digital signal processing (DSP). https://in.mathworks.com/help/symbolic/sym.ztrans.html	**6**	Textbook 1: Chapter **23**	❖ Compute Z-transform of some elementary of some functions using **MATLAB.** ❖ Solve linear difference equations with constant coefficients using **MATLAB.**

5.	**Data Analysis using Python**	Arithmetic, logical operations; List, tuple, dictionary, set; Managing arrays and matrices; Solving linear equations; Data handling: Import, clean, sort, filter, summarize, handle missing data; Calculating central tendency, standard deviation of dataset; Data visualization: Line plot, Bar plot, Histogram.	***International*** ***Academia:*** ● https://ocw.mit.edu/courses/15-075j-statistical-thinking-and-data-analysis-fall-2011/pages/lecture-notes/ ● https://ocw.mit.edu/courses/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016/pages/readings/ ***Industry Mapping:*** 1. To handle datasets and visualize for real-time insights. 2. To solve systems of equations for applications like signal processing.	**4**	Textbook 2:	❖ Handling of data using Panda Library. ❖ Plot data using Matplotlib. ❖ Compute Matrix operations using Numpy library. ❖ Calculate central tendencies, standard deviation of a dataset.

TEXT BOOK:

1. **B. S. Grewal**, "Higher Engineering Mathematics", 44th Edition (2021), Khanna Publishers. (Chapter No.s: 10, 19, 20, 21, 22, 23)

2. **Wes Mckinney**, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", 2nd Edition (2017), United States: O'Reilly Media. .

REFERENCE BOOKS:

1. **Biswadip Basu Mallik & Krishanu Deyasi,** "Engineering Mathematics" – Vol. 2B, 1st Edition (2020), Cengage Learning.
2. **B. K. Pal & K. Das,** "Engineering Mathematics" - Vol. IIB, 13th Edition (2019), Vol. IIIB, 8th Edition (2019), U. N. Dhur & Sons.
3. **Erwin Kreyszig,** "Advanced Engineering Mathematics", 10th Edition (2017), John Wiley & Sons.
4. **R. K. Jain and S. R. K. Iyengar,** "Advanced Engineering Mathematics", 5th Edition (2016), Narosa Publication House.
5. **B. V. Ramana,** "Higher Engineering Mathematics", 11th Reprint (2017), Tata McGraw Hill.

University of Engineering and Management, Kolkata
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus for B.Tech (Admission Batch 2023)

Subject Name: Analog and Digital Communication Lab

Subject Code: PCCECE491

Lecture Hours: 30

Pre-requisite: Signals and Systems, Mathematics, Basic electronics.

Coursera link: https://www.coursera.org/learn/wireless-communications?
Linked link: https://www.linkedin.com/learning/iot-foundations-low-power-wireless-networking
NPTEL link: https://onlinecourses.nptel.ac.in/noc22_ee05/preview

COURSE OBJECTIVE:

1. To learn about Analog Modulation
2. To learn about Digital Modulation

3. To learn about Waveform Coding Techniques
4. To learn about Transmitter/Receiver

COURSE OUTCOMES:

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth.
2. Investigate pulsed modulation system, baseband transmission and analyze their system performance.
3. Analyze different digital modulation schemes and can compute the bit error performance trade off issues, equalization, carrier recovery

Module number	Topic	Sub-Topics	Lecture Hours
1	**Signal generator**	**Low frequency message and high frequency carrier signal generation using suitable oscillator.**	**3**
2	**Analog modulation-I**	**Construct a modulator and demodulator based amplitude modulation (AM) system and test an analog filter to evaluate the effects of noise on audio signals.**	**3**
3	**Analog modulation-II**	**Construct a modulator of frequency modulation (FM) system and tuning a certain station of FM band to test the performance of filter.**	**3**
4	**Transmitter and receiver design**	**A proper antenna design technique to transmit a certain band of AM signal and to receive it at certain receiver.**	**3**
5	**Digital Modulation-I**	**Construction of baseband modulation technique to obtain digital signal from an audio input and transmit it at suitable band of transmission.**	**3**
6	**Digital Modulation-II**	**Construction of a practical higher order modulation (like, QAM-256) to minimize the error and to enhance the data rate of communication system.**	**6**
7	**AI based detection technique**	**AI based channel estimation and demodulation technique for both analog and digital communication technique using MATLAB or Python code.**	**3**
8	**Project work**	**Assignment I and Assignment-II**	**6**

4th Semester Syllabus for B.Tech in ECE Batch 2023-2027

Subject Name: Digital Electronics Laboratory **Credit:** 1 **Lecture Hours:** 2
Subject Code: (PCCECE492)

COURSE OBJECTIVES:

1. To impart knowledge of number systems, binary arithmetic, and Boolean algebra.
2. To impart knowledge on Design and implement combinational circuits like adders, subtractors, and multiplexers.
3. To impart knowledge on sequential circuits and understand their timing diagrams
4. To impart knowledge on simulation tools like Multisim, Xilinx, or VHDL/Verilog for digital circuit design and testing.

COURSE OUTCOMES:

CO 1: Demonstrate knowledge of basic digital logic gates, truth tables, Boolean algebra and K-Map to simplify logical expressions.

CO 2: Design and implement combinational Circuits using both hardware and software.

CO 3: Design and implement sequential Circuits using both hardware and software.

CO 4: Design and implementation of ADC-DAC

Digital Electronics Laboratory (PCCECE492)

Serial No	Experiment Title	Description
1	**Introduction to Lab Components and Equipment.**	Overview of breadboards, Basic Gates FPGAs, power supplies, and digital ICs.
2	**Introduction to VHDL and Basic Syntax**	Basic VHDL programming concepts: entity, architecture, signals, and assignments.
3	**Combinational Circuit Design (Hardware and Software)**	Design of **Multi-bit binary adder /Basic arithmetic units in small-scale processors** using VHDL/Verilog. Also perform the experiment using IC7483.
4		Design of **Carry Look-Ahead Subtractor** circuit using VHDL/Verilog and verify the result on FPGA board.
5		Design **16X1 Multiplexer using 4X1 multiplexer** using VHDL/Verilog and verify the result on FPGA board. Also perform the experiment using TTL and CMOS ICs.
6		Design **1-16 Demultiplexer using 1-4 Demultiplexer** using VHDL/Verilog and verify the result on FPGA board. Also perform the experiment using TTL and CMOS ICs.
7		Design **a code converter circuit** using FPGA Board.
8	**Sequential Circuit Design (Hardware and Software)**	Design and simulate flip-flop circuits (SR, D, JK, T) using VHDL. Build a **small RAM module** using **D flip-flops.**

9		Design a sequential **circuit to control a traffic light system with specific timing using** VHDL/Verilog. Also perform the experiment using Flip flop ICs.
10		Design a circuit that detects a **specific binary sequence** using hardware.
11		Design a sequential circuit which can convert **serial Data to parallel data** using register.
12	**A/D and D/A Converters**	Design of **Temperature Indicator** using IC ADC AD570. Design a circuit using IC Chip **AFEx8201 Digital-to-Analog Converters (DACs) for PLC applications.**

Textbooks and Resources

Digital Design with VHDL by Mark Zwolinski
Digital Systems Design Using VHDL by Charles H. Roth

Syllabus for BTech (ECE) – 4th Semester (2023-27 Batch)

Subject Name: **Artificial Intelligence & Machine Learning Laboratory** Credit: **2** Lab Hours: **36**
Subject Code: **PCCECE493**

Prerequisites: Data Structure & Algorithms,
Python coding using various libraries: Numpy, Pandas, Matplotlib, Keras with Tensorflow, Scikitlearn, etc.

Course Objective:

Obj 1. The students will understand the basics concepts of Artificial Intelligence and Machine Learning models, including Deep Learning models.
Obj 2. They will also learn and will be able to apply different Artificial Intelligence and Machine Learning models (including Deep Learning) to various datasets.

Course Outcome:

CO 1: Students will be able to understand the foundational concepts for building on their knowledge in the domain, including Intelligent Agents, Nature of Agents, Learning Agents.
CO 2: Students will know the concept of Machine Intelligence through Learning from Data sets, as opposed to Pre-determined and pre-programmed Logic and search algorithms.
CO 3: The student will be able to understand and apply, depending on the individual cases, the different models for Supervised and Unsupervised Learning methodologies.
CO 4:Students will know the shortcomings of classical Machine Learning models and how Deep Learning model (includes Backpropagation with Gradient Descent) has been able to overcome those to a significant extent. Students will be able to use Deep Learning models, e.g to analyze and classify images, and for Sequential and Time Series Data. Also will be able to use Generative-AI for different applications in various domains.

Assignment Number	Topic	Sub- Topic	Mapping with Industry and International Academia
1	**Lab Assignment on Feature Selection**	Use t-SNE to reduce the MNIST dataset down to two dimensions and plot the result using Matplotlib. You can use a scatterplot using 10 different colors to represent each image's target class. Alternatively, you can replace each dot in the scatterplot with the corresponding instance's class (a digit from 0 to 9), or even plot scaled-down versions of the digit images themselves (if you plot all digits, the visualization will be too cluttered, so you should either draw a random sample or plot an instance only if no other instance has already been plotted at a close distance). You should get a nice visualization with well-separated clusters of digits. Try using other dimensionality reduction algorithms such as PCA, LLE, or MDS and compare the resulting visualizations. **Industry Application:** As a part of the Data-Centric AI approach innovated and initiated by Prof Andrew Ng of Stanford University, data pre-processing techniques is a must learn skill without which implementing ML/DL algorithms is an impossibility. Taking a cue from the above-mentioned point, dimension reduction techniques form one of the basic building pillars for Data analytics. Can be and actually used in multiple industry-based projects.	*AICTE-prescribed syllabus:* https://www.aicte-india.org/sites/default/files/UG_Emerging.pdf *International Academia:* https://ocw.mit.edu/courses/6-034-artificial-intelligence- fall-2010/resources/lecture-1-introduction-and-scope/ *Basic Programs using Python from*: https://onlinecourses.swayam2.ac.in/aic20_sp33/preview https://www.coursera.org/learn/introduction-tensorflow
2	**Lab Assignment on Regression**	This lab assignment will teach students the power of Linear Regression in understanding factors influencing the pricing of cars and to model the price of cars which could prove to be an effective way to understand and appreciate **dynamic pricing of the car industry**. Students shall also get introduced to various performance metrics like R-Square, Adjusted R-Square, RMSE etc and many other important concepts like that of multi-collinearity. **Industry Application:** Core application area is the Car industry. Techniques that will be learnt spins around dynamic pricing strategies which are even applicable for other industries like that of the airline.	

3	**Lab Assignment on Classification**	Project on **Multi-Class Classification [On Molecular Oncology]**: Using suitable dataset, students will be asked to build multiple classifiers and cross-compare results. The lab assignment would test the students on the followings: Initial **Data Pre-processing** steps including **but not limited to** ▪ Missing value imputation ▪ Feature Selection ▪ Feature engineering ▪ Outlier Detection Data splitting in Train-Validation-Test and using Hyper-parameter tuning using Grid Search CV and Randomized Search CV. Building Multiple Classifiers using various algorithms like Logistic Regression, KNN, SVM, Decision Trees, Random Forest etc. Cross—comparing various models using the several performance metrics. **Industry Application:** This lab assignment is of much use in medical domain and beyond. Although core area of application is the medical domain but the techniques that the student shall learn can be generalized to other industry needs/domains as well	*Industry Mapping: Python, TensorFlow Keras, PyTorch*

4	**Lab Assignment on Clustering**	**On Customer Segmentation:** Using some suitable dataset, students will be asked to perform Clustering using various algorithms like K-Means, DB Scan etc. The ideas will help students to perform and understand the need for Customer Segmentation which comes under Marketing analytics. **Industry Application:** Immensely used in Marketing domain to enable differential strategies including but not limited to differential pricing. Outsources by the marketing firm of various companies even to Service industries.	*AICTE-prescribed syllabus:* https://www.aicte-india.org/sites/default/files/UG_Emerging.pdf

5	**Lab to demonstrate the impact of different activation functions**	Design an experiment to empirically demonstrate the impact of different activation functions (e.g., sigmoid, ReLU, tanh) on the convergence speed and final accuracy of backpropagation in training deep neural networks. Discuss how your findings contribute to understanding activation function selection in practice. **Industry Application:** Relevance of Activation Functions in Deep Learning for Industrial Applications: Activation functions are critical components in deep learning architectures, enabling neural networks to model complex relationships and solve intricate problems. Their significance extends beyond theoretical constructs, finding practical applications across various industrial sectors. This overview highlights the role of activation functions in deep learning and their relevance to real-world industrial applications. **Understanding Activation Functions** Activation functions introduce non-linearity into neural networks, allowing them to learn complex patterns in data. Without these functions, a neural network would merely perform linear transformations, limiting its ability to capture intricate relationships within datasets. Common activation functions include: • Sigmoid: Maps inputs to a range between 0 and 1, useful for binary classification tasks. • Tanh: Outputs values between -1 and 1, providing zero-centered outputs that can enhance learning. • ReLU (Rectified Linear Unit): Outputs the input directly if positive; otherwise, it outputs zero. This function is popular due to its simplicity and efficiency in training deep networks. • Leaky ReLU: A variant of ReLU that allows a small gradient when the input is negative, addressing the "dying ReLU" problem. • Softmax: Used in the output layer for multi-class classification tasks, converting logits into probabilities. **Industrial Applications** The application of activation functions in industrial settings can be categorized into several key areas:	*International Academia:* https://ocw.mit.edu/courses/6-034-artificial-intelligence- fall-2010/resources/lecture-1-introduction-and-scope/ *Basic Programs using Python from:* https://onlinecourses.swayam2.ac.in/aic20_sp33/preview https://www.coursera.org/learn/introduction- tensorflow *Industry Mapping: Python, T ensorFlow Keras, PyTorch*

1. Computer Vision

Deep learning models utilizing convolutional neural networks (CNNs) rely heavily on activation functions to process and classify **images.** For instance, ReLU is frequently used in hidden layers of CNNs due to its ability to accelerate convergence during training, which is crucial for real-time image processing tasks such as facial recognition and autonomous driving systems

2. Natural Language Processing (NLP)

In NLP applications like sentiment analysis and language translation, activation functions help models understand contextual relationships within text data. The choice of activation function can significantly impact the model's ability to learn nuanced language patterns, with functions like softmax being essential for generating probability distributions over vocabulary during text generation tasks

3. Predictive Maintenance

In manufacturing and industrial settings, predictive maintenance models leverage deep learning to predict equipment failures. Activation functions enable these models to learn from historical operational data, identifying complex patterns that signify potential breakdowns. For example, using ReLU can enhance the model's performance by effectively handling large datasets typical in industrial IoT applications

4. Financial Forecasting

Activation functions play a vital role in financial modeling applications such as stock price prediction and risk assessment. Non-linear activation functions allow models to capture the volatility and non-linear trends inherent in financial data, leading to more accurate predictions and better decision-making tools for investors

5. Healthcare Diagnostics

Deep learning models applied in medical diagnostics utilize activation functions to analyze complex medical images or patient data. For instance, CNNs equipped with ReLU can efficiently process MRI scans or X-rays, improving diagnostic accuracy by identifying subtle patterns that may indicate disease

Conclusion

Activation functions are indispensable in deep learning architectures, facilitating the modeling of non-linear relationships essential for solving complex real-world problems across various industries. Their ability to enhance learning capabilities directly impacts the effectiveness of applications ranging from computer vision to predictive maintenance and healthcare diagnostics. As industries continue to adopt AI technologies, understanding and optimizing activation functions will remain crucial for developing robust deep learning models that drive innovation and efficiency.

6	**Lab on training an MLP**	Train a deep MLP on the MNIST dataset (you can load it using `tf.keras.datasets.mnist.load_data()`. See if you can get over 98% accuracy by manually tuning the hyperparameters. Try searching for the optimal learning rate by using the approach presented in this chapter (i.e., by growing the learning rate exponentially, plotting the loss, and finding the point where the loss shoots up). **Advantages of MLP and some of their their industrial applications areas:** Advantages of Multilayer Perceptrons over classical Machine Learning models:	
		• **Versatility**: MLPs can be applied to both classification and regression tasks across various domains. • **Non-linearity**: They utilize activation functions that enable the modeling of non-linear relationships in data. • **Scalability**: MLPs can be scaled to handle large datasets effectively, particularly when combined with modern computational techniques like GPU acceleration Key Applications in Industry **1. Image and Speech Recognition** The ability to handle non-linear relationships makes MLPs particularly effective in these domains. **2. Financial Forecasting** Their capability to approximate complex functions allows them to capture market dynamics effectively. **3. Data Compression and Encryption** MLPs play a vital role in data compression and encryption. They can identify redundant data elements that can be removed without losing quality, optimizing storage and transmission. In encryption, MLPs help secure sensitive information by transforming data into formats that are difficult to decipher without the appropriate keys . This application is particularly important for businesses handling personal or proprietary information. **4. User Profiling and Recommendation Systems** Businesses utilize MLPs for user profiling and creating recommendation systems. By analyzing user behavior and preferences, MLPs can suggest products or services tailored to individual needs, enhancing customer experience and engagement . This is widely seen in e-commerce platforms and streaming services.**5. Healthcare Applications** In healthcare, MLPs are used for diagnosing diseases based on patient data analysis. For instance, they can assist in identifying cancerous cells in medical images or predicting patient outcomes based on historical health records . The ability to learn from complex datasets makes them invaluable in improving diagnostic accuracy.	

7	**Lab on Image Recognition by CNN from scratch (computer vision)**	**CNN:** **Advantages of CNN and some of their their industrial applications areas:** Convolutional Neural Networks (CNNs) have become a cornerstone of modern artificial intelligence, finding applications across various industries. Their ability to process and analyze visual data makes them particularly effective in tasks that involve image and video analysis. Below are some notable real-life industrial applications of CNNs: Image Classification and Recognition CNNs excel in **image classification** and **recognition**, Object Detection and Localization In **autonomous vehicles**, CNNs are vital for **object detection** and **localization**, allowing cars to identify obstacles, pedestrians, and traffic signs in real-time. Techniques like YOLO (You Only Look Once) and SSD (Single Shot	
		Multibox Detector) are commonly used for this purpose . CNNs play a significant role in **medical imaging** by analyzing diagnostic images such as X-rays, MRIs, and CT scans. They can detect anomalies like tumors with high accuracy, often surpassing human capabilities. For instance, CNNs have been shown to identify cancerous cells with up to 95% accuracy . This application enhances early disease detection and improves patient outcomes. **In agriculture**, CNNs analyze aerial images to assess crop health, predict yields, and detect diseases early. This application aids farmers in making informed decisions that enhance productivity and sustainability . Beyond visual tasks, CNNs are also applied in **natural language processing** (NLP). They can perform text classification, sentiment analysis, and even language translation by treating text as a 2D structure similar to images. This capability helps improve customer service automation and information extraction CNNs are utilized for **environmental monitoring**, analyzing satellite imagery to detect changes in land use or natural disasters. This application supports timely responses to environmental challenges In the realm of **video analytics**, CNNs are employed for action detection, object tracking, and scene segmentation. They help identify unusual events in real-time surveillance footage, enhancing security measures **We will build dense neural networks on the MNIST dataset.** **Load the data and create train-test splits:** 1: Preprocessing: Normalize the data: map each feature value from its current representation (an integer between 0 and 255) to a floating-point value between 0	

		and 1.0. Store the floating-point values in x_train_normalized and x_test_normalized. Map the class label to a on-hot-encoded value. Store in y_train_encoded and y_test_encoded. 2: Create a deep neural net model Implement a create_model function which defines the topography of the deep neural net, specifying the following: The number of layers in the deep neural net: Use 2 dense layers for now. The number of nodes in each layer: these are parameters of your function. Any regularization layers. Add at least one dropout layer. The optimizer and learning rate. Make the learning rate a parameter of your function as well. Consider: What should be the shape of the input layer? Which activation function you will need for the last layer, since this is a 10-class classification problem?	
		3: Create a training function Implement a train_model function which trains and evaluates a given model. It should do a train-validation split and report the train and validation loss and accuracy, and return the training history. 4: Evaluate the model Train the model with a learning rate of 0.003, 50 epochs, batch size 4000, and a validation set that is 20% of the total training data. Use default settings otherwise. Plot the learning curve of the loss, validation loss, accuracy, and validation accuracy. 5. Finally, report the performance on the test set. Optimize the model Try to optimize the model, either manually or with a tuning method. At least optimize the following: the number of hidden layers the number of nodes in each layer the amount of dropout layers and the dropout rate Try to reach at least 96% accuracy against the test set.	
8	**Lab on improving accuracy of image recognition using CNN**	Build your own CNN from scratch and try to achieve the highest possible accuracy on MNIST. The following model uses 2 convolutional layers, followed by 1 pooling layer, then dropout 25%, then a dense layer, another dropout layer but with 50% dropout, and finally the output layer. It reaches about 99.2% accuracy on the test set. This places this model roughly in the top 20% in the MNIST Kaggle competition). Can you do better? To reach 99.5 to 99.7% accuracy on the test set, you need to add image augmentation, batch norm, use a learning schedule such as 1-cycle, and possibly create an ensemble.	

9	**Lab on 1-D and 2-D Sequential and Time-Series Data using RNN: Next Word Prediction using RNN-LSTM:**	**RNN-LSTM:** **Industrial Applications of RNN and LSTM** Recurrent Neural Networks (RNNs) and their advanced variant, Long Short-Term Memory networks (LSTMs), have found significant applications across various industries due to their ability to process sequential data. Here are some key industrial applications: 1. Natural Language Processing (NLP) • Machine Translation: RNNs and LSTMs are extensively used in translating text from one language to another by understanding the context of sentences over time • Text Generation: These networks can generate coherent text based on a given input, making them useful for applications such as chatbots and automated content creation • Sentiment Analysis: Businesses utilize RNNs to analyze customer feedback and social media content to gauge public sentiment towards products or services 2. Speech Recognition RNNs are pivotal in converting spoken language into text. They analyze audio signals sequentially, enabling accurate transcription of speech in

real-time applications like virtual assistants and automated customer service systems

.3. Healthcare

In the healthcare sector, RNNs and LSTMs are employed to predict patient outcomes by analyzing sequences of medical records. This includes forecasting disease progression based on historical patient data, which aids in personalized treatment plans

4. Financial Forecasting

RNNs are used in stock market prediction and risk assessment by analyzing time-series data of stock prices and other financial indicators. Their ability to remember past trends helps in making informed predictions about future market movements

5. Image and Video Processing

- Image Captioning: RNNs can generate descriptive captions for images by processing the visual data sequentially
- Video Analysis: They are used for video tagging and summarization, where they analyze frames over time to provide insights or generate summaries of video content

.6. Anomaly Detection

RNNs are effective in detecting anomalies in time-series data, such as monitoring network traffic or financial transactions for fraudulent activities. By learning normal patterns over time, they can identify deviations that may indicate security threats

7. Music Generation

LSTMs have been successfully applied in generating music compositions by learning from existing musical patterns and structures, Allowing for the creation of new melodies that adhere to learned styles

.8. Robotics and Automation

In robotics, RNNs help in motion prediction and control by processing sequences of sensor data, enabling robots to make decisions based on past movements and environmental changes

Conclusion

The versatility of RNNs and LSTMs makes them invaluable across various sectors, particularly where sequential data is prevalent. Their ability to remember previous inputs allows for more accurate predictions and analyses, leading to enhanced decision-making processes in industrial applications.

Lab-Assignment:

The word prediction problem comes in three levels: word completion, next-word prediction and multi-word prediction. This simple next-word prediction is the process of predicting the next word given a sequence of words, and is based on the previous history.
These kinds of applications can be seen in smartphones and virtual keyboards on desktops.
Since a sequence is a sequence of words, we use RNN-LSTM to predict the next word.

Dataset: The Hill of Dreams by Arthur Machen (1907).
For processing, the sentences are split into words, and a sequence of these words are taken as the input and the next word is taken as the output (or label).

10	**Lab on application of to predicting stock market – using Sequential and Time- Series Data using RNN, LSTM and Bi-LSTM**	Take as your input TRAINING DATA the last 5 years DAILY CLOSING STOCK VALUES of INFOSYS, UPTO 31st. DECEMBER, 2023 (from yahoo finance): Based on this input, predict the CLOSING STOCK VALUE of INFOSYS using the following DEEP LEARNING models: (1) Normal conventional RNN; (2) LSTM; (3) Bidirectional LSTM Using EACH of the 3 models as above, show the predicted values of the CLOSING STOCK PRICES of INFOSYS, using each model, for the following dates in 2024: 10 January, 10 June, 30 August, 01 October Plot these 3 curves on the same graph along with 1 additional curve for ACTUAL TRUE CLOSING STOCK PRICES of INFOSYS on those dates. Compute the average % error in each model.	

TEXTBOOKS:

1. ML & DL: **'Hands-On Machine Learning' (Part-I: Machine Learning; Part-II: Deep Learning), by Aurelien Geron, (O'Reilly, SPD, 3rd edition, 2022)**
2. ML: **'An Introduction to Statistical Learning – with Applications in Python'** by Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani (Springer, 2023)
3. DL: **'Deep Learning with Python' -- by Francois Chollet (Manning Publishing Co., NY, USA; 2nd edition, 2021)**

REFERENCE BOOKS:

1. DL: **'Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms'** by Nithin Buduma, Nikhil Buduma, Joe Papa (O'Reilly - SPD, 2nd edition, 2022)
2. Python Coding: **'PYTHON ODYSSEY' – by Subhabrata Banerjee (Gyanavi Publishers & Distributers, New Delhi, 2025)**

https://www.linkedin.com/learning/learning-python-14393370

Mandatory Prerequisite: **(To be completed before the start of the class)**

Syllabus for B.Tech Admission Batch 2023-2027

Subject Name: Object Oriented Programming with Java **Credit: 2** **Lecture Hours: 30**

Subject Code: OEC481

Pre-requisite: C, Basic knowledge of programming language.

Relevant Links:

Study Material | Coursera | NPTEL | Linkedin Learning | Infosys Springboard

COURSE OBJECTIVES:

1. To introduce the object-oriented programming concepts.
2. To understand object-oriented programming concepts, and apply them in solving problems.
3. To introduce the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes, the concepts of exception handling.
4. To introduce the design of Graphical User Interface using applets and swing controls.

COURSE OUTCOMES:

CO1: Identify the need for solving the real world problems using the concepts of java programming – advantages of java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, array, creation of class.

CO2: Understand the implementation of Object oriented concepts using Java through. Class, object, message passing, inheritance, encapsulation, polymorphism.

CO3: Apply the concept of mutable and immutable string, basics of I/O operations – keyboard input using Buffered Reader & Scanner classes for real life applications.

CO4: Create web applications and GUI based applications.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Text Book Mapping	Corresponding Lab Assignment
1	**Concepts of object oriented programming language using Java**	Basic concepts of java programming – advantages of java, byte-code & JVM, JDK, JRE , concepts of classes and objects, variables and data types, access modifiers, operators, control statements & loops, array, creation of class. Methods and, Visibility, switch-case, Use of Static, final, Java Stack and Heap with Reference Variables, Records. Ways of creating	***International Academia:*** https://drive.google.com/file/d/10z00dMd26WjiPThhCercGbsi6u3ciE62/view?usp=drive_link https://drive.google.com/file/d/1k3qrfDL9p5_IJR_iP2mt6c6AzwmByNtf/view?usp=sharing ***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf ***Industry Mapping:*** Hackerrank, TCS Codevita projects, GitHub Platform.	**4**	**Chapter 1, 2, 3, 4, 5, 6, 7, 8**	1. WAP in Java to create a class with two methods to perform area and perimeter of a circle. 2. WAP in java to show the use of methods with return types and methods without return types. 3. WAP in java to show hope to take user defined input using Command Line argument. 4. WAP to show how using command Line arguments String, Float, Double variables are accessed in a code. 5. WAP in java to show how to use "for" loops in the main class to evaluate any iterative classes. 6. Create a calculator to show basic operations like addition, multiplication and Subtraction.

		Objects, cloning of Objects, compiling Java programs using command line, creating and deploying executable programs using JARs, creating Jars using command line, Primitive Types in Java, Casting in Java, Operators, operands and expressions ts using Java. Difference between OOP and other conventional programming – advantages and disadvantages. Class, object, message passing, inheritance, encapsulation, polymorphism. Interfaces, Abstract Classes. Overloading, Overriding(Method and constructor overloading), Static and Instance variables. final and static keywords in javaConstructors in Java, Types of constructors, Copy	NetBeans and Eclipse IDE will be used.			

		constructors.				
2	**Object oriented concepts**	Implementation of Object oriented concept.	**International Standards** https://drive.google.com/file/d/1Rc1KOzkVRHqLEWApFBplwz7s8IwsyFlf/view?usp=sharing https://drive.google.com/file/d/1e8g7D6nuMwEruToXtNDbh68vx2VKUrgS/view?usp=sharing ***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf ***Industry Mapping:***Hackerrank, TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.	**4**	**Chapter 8, 9, 32**	1. Defined methods to perform basic operations like add, subtract, division, multiplication where values must be passed from the main method. 2. Define user-defined methods for the following: without argument and without return type, with argument/s and without return type, with argument/s and with return type. Call all from the main. 3. Write the program to show: single inheritance, multilevel inheritance, hierarchical inheritance, multiple inheritance. 4. Write a program to show the polymorphism: constructor overloading, method overloading, method overriding. 5. WAP to show how the “final” keyword can be used to prevent method overriding. 6. WAP to show what are the significant uses of “final” keyword in java. 7. WAP to show how “static” keyword can be used to create static variables. 8. WAP to show how “static” block can be created. 9. WAP to show how “static” keywords can be used with a constructor. 10. Justify when method overloading behaves like method

						overriding. 11. WAP in java to show "multiple inheritance " can be implemented in java. 12. WAP in java to show "interface can be extended in java" 13. WAP in java to show using Single inheritance how a method can be overloaded. 14. WAP to define "abstract" class in java.
3	**Object properties Language features to be covered:** **Java Collection Framework**	Object, constructor, garbage collection in java (finalize()) Use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables & methods, basic string handling concepts. Concept of mutable and immutable string. String Buffer and StringBuilder Basics of I/O operations – keyboard input using Buffered	***International Standards*** : ***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf ***Industry Mapping:*** Hackerrank, TCS Codevita projects, GitHub Platform. NetBeans and Eclipse IDE will be used.	**8**	**Chapter 6, 7, 13, 15 and 17**	1. Write a program to demonstrate for the following: object as a parameter of method, object type as return type of a method. 2. Consider a class Visit, on creation of each object value of a counter variable is incremented by 1 and shows the value each time. Use the static variable and write the program. 3. Write a program to show the use of command argument passing. 4. Write a program to take input of first name, last name. Then print as full name. 5. Write a program to take user inputs for int, float, double, String using Scanner class. Then print all. 6. Take a string input and show use of different string methods. 7. WAP in java to show String in java is "mutable" or "immutable."

		Reader & Scanner classes. List, ArrayList, Map, HashMap, Set, TreeSet, HashSet.				
4	**Reusability properties**	Super class & subclasses including multilevel hierarchy. Process of constructor calling in inheritance, use of super and final keywords with super() method. Dynamic method dispatch, use of abstract classes & methods, interfaces.	***International Standards:*** https://ocw.mit.edu/ans7870/6/6.005/s16/classes/09-immutability/ https://ocw.mit.edu/courses/6-088-introduction-to-c-memory-management-and-c-object-oriented-programming-january-iap-2010/67b1aec3f2867734ec0fb33034c8b5c8_MIT6_088IAP10_lec05.pdf ***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf ***Industry Mapping:*** Hackerrank, TCS Codevita projects, GitHub Platform. NetBeans and Eclipse IDE will be used.	**6**	**Chapter 8, 15**	1. Write a program to show the use of super and super(). 2. "Super class gets constructed before subclasses". write a program to support this in multilevel and hierarchical inheritance. 3. Create an abstract class named "Shape" with an abstract method "calculateArea()." Implement two subclasses, "Circle" and "Rectangle," which extend the "Shape" class and provide their implementations for the "calculateArea()" method. 4. Create an abstract class named "Vehicle" with instance variables for "model" and "year." Include an abstract method named "start()" and a non-abstract method "displayDetails()" that prints the model and year. Implement two subclasses, "Car" and "Motorcycle," each with its own version of the "start()" method. 5. Create an abstract class "Bank" with an abstract method "calculateInterest()." Implement two subclasses, "SavingsAccount" and "LoanAccount," each with its own implementation of the "calculateInterest()" method. 6. Create an interface named "Drawable" with a method "draw()." Implement two classes, "Circle" and "Rectangle," each implementing the "Drawable" interface with its own version of the "draw()" method. 7. WAP to show multilevel inheritance, deal with default constructors and find the order of output being encountered. 8. WAP program in java to show how hybrid inheritance can be implemented in java. 9. WAP in java to show how constructors can be used while using

						inheritance.
5	**Exception handling Multithreading**	System defined and Used define Packages,Exception handling basics, Basics of multithreading.	***International Standards:*** https://drive.google.com/file/d/1kbRGF396sQPdQbA4w-N81ElKU_bdGgFs/view?usp=sharing ***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf ***Industry Mapping:*** Hackerrank, TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.	**4**	**Chapter 10 and 11**	1. WAP to show how "ArithmeticException" and "ArrayIndexOutOfBoundsException" can be used. 2. WAP to justify "is it possible to use"try " without"catch " block". 3. WAP to show the use of "Nested Try Catch" in java. 4. WAP to show how to use system defined packages in java. 5. WAP to use how to create user defined packages in java. 6. Consider a method div that takes two arguments of int type to perform division. Use try, catch, finally so that the program will not be terminated due to any exception for all scenario (values passes through div). 7. Write a program to show the working of multiple threads using Thread class, and Runable interface.
6	**Applet and swing Programming**	Basics of applet programming, applet life cycle. Difference between application & applet programming. Server/client	***AICTE prescribed syllabus:***https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf ***Industry Mapping:*** Hackerrank, TCS Codevita	**4**	**Chapter 13 and 29**	1. WAP in java using an applet to show how to draw "Line,Arc,Oval, Rectangle and String." 2. WAP in java to show how to color boundaries and complete area of specific objects designed by applet. 3. WAP in java Design an applet program to design different shapes.

		communication, Hardware communication, Enterprise communication	projects, GitHub Platform. NetBeans and Eclipse IDE will be used.			4. Develop an applet program to demonstrate lifecycle of applet. 5. Design a swing application to show the user of Listener. 6. Design a swing application of basic calculators. 7. Design and implementation Printer driver. 8. Designing of Enterprise Resource Planning (ERP) and application. 9. Designing of Customer Relationship Management (CRM). 10. TCP Client-Server communication (Socket programming).

Text Books:

1. Schildt, H. (2014). Java: the complete reference. McGraw-Hill Education Group.

Reference Books:

1. Horton, I. (2004). Beginning JavaTM, John Wiley & Sons.