University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus

6th Semester Syllabus for B.Tech
(Admission Batch 2023)

Electrical & Electronics Engineering									
B.Tech. 3rd Year Course Structure									
6th Semester									
Sl No	**Type of Course**	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**S**	**Total Contact**	**Credit Points**
Theory									
1	Professional Core Courses	PCC-EEE601	Power System-II	3	0	0		3	3
2	Professional Core Courses	PCC-EEE602	Microprocessor & Microcontroller	3	1	0		4	3
3	Professional Core Courses	PCC-EEE603	Analog and Digital Communication	3	1	0		4	3
4	Professional Core Courses	PCC-EEE671	VLSI Design	3	0	0		3	3
5	Professional Elective Courses	PEC-EEE 602	A: Digital Signal Processing/ B: Bio-Medical Engineering/	3	0	0		3	4
	Professional Elective Courses	PEC602	Automotive	3	0	0		3	
6	Open Elective Courses	OEC- EEE 601	A: IOT/ B: Image Processing C:Industrial Automation II	3	0	0		3	3
7	Humanities and social sciences including Management	ESPEE601	Essential Studies For Professionals VI	2	0	0		2	0.5
PRACTICAL									
8	Professional Core Courses	PCC-EEE 691	Power System-II Laboratory	0	0	2		2	1
9	Professional Core Courses	PCC-EEE 692	Microprocessor & Microcontroller Laboratory	0	0	2		2	1
10	Professional Elective Courses	PCC-EEE 693	Analog and Digital Communication Laboratory	0	0	2		2	1
SESSIONAL									
11	Humanities and social sciences including Management	SDP681	Skill Development For Professionals VI				2	2	0.5
12	Project. Seminar and Industrial Training	PW-EEE 04	Mini Project IV				1	1	1
Value Added Courses									
13	Massive Open Online Courses (MOOCs)	MOOCS	Massive Open Online Courses (MOOCs)						
14	Industry and Foreign Certification (IFC)	IFC	Industry and Foreign Certification (IFC)						
15	Mandatory Additional Requirements (MAR)	MAR681	Mandatory Additional Requirements (MAR)						
Total Credit Points of Semester				**23**	**2**	**6**	**3**	**34**	**24**

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Syllabus for B.Tech Admission Batch

Subject Name: Power System -II **Credit: 03**

Lecture Hours: 42 **Subject Code: PCCEEE601**

Study material	Coursera	Nptel	LinkedIn Learning	Infosys Springboard

Maximum: 100 marks (Internal: 30 marks; External: 70 marks)

List of Faculty Members handling the Subject –
Dr. Prof. Manas Mukherjee

Pre-requisite: Power System I

Course objectives:

1. To understand different methods of load flow studies.
2. To understand the principle of power system stability.
3. To understand the different monitoring and control techniques in power systems.
4. To understand the different economic aspects of the power system.
5. To solve numerical problems on the topics studied.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	TEXT BOOK	Mapped Chapter
1	**Power Flow Analysis**	Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications. Application of numerical methods for the solution of nonlinear algebraic equations – Gauss-Seidel and Newton-Raphson methods for the solution of the power flow equations. Special Power Flow Technique in distribution network. Computational Issues in Large-scale Power Systems. Power flow analysis using different AI-based optimization approaches.	**Industry Mapping:** MATLAB **International Academia:** https://ocw.mit.edu/courses/6-061-introduction-to-electric-power-systems-spring-2011/	08	1. Design the incidence matrix for a distribution system for maintaining the power quality issue using MATLAB. 2. Design IEEE standard bus system for analyzing the voltage, and current profile using the Gauss-seidel method of AC load flow using the method in MATLAB 3. Design IEEE standard bus system for analyzing the voltage, and current profile using the Newton-Raphson method of AC load flow using method in MATLAB.	Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.	6
2	**Power system stability**	Steady-state stability, transient stability, equal area criteria, swing equation, multi-machine stability concept.	**Industry Mapping:** MATLAB **International Academia:** https://ocw.mit.edu/courses/6-061-introduction-to-electric-power-systems-spring-2011/	08	Optimize the synchronizing condition for a motor generator set considering the different stability criteria for supplying the variable load demand.	Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.	12

3	**Automatic Generation Control: Frequency and Voltage Control**	Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control. Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators and automatic Voltage Regulators. Shunt Compensators, Static VAR compensators and STATCOMs. Tap Changing, Transformers. Power flow control using embedded DC links and phase shifters	**Industry Mapping:** MATLAB **International Academia:** https://ocw.mit.edu/courses/6-061-introduction-to-electric-power-systems-spring-2011/	8	1. Design Static Var Compensator Using Thyristor- Switched Capacitor and Thyristor-Controlled Reactor using MATLAB SIMULINK. 2. Designing of over voltage relay for protecting the synchronous generator for AGC control.	Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.	8
4	**Monitoring and Control**	Overview of Energy Control Centre Functions: SCADA systems. Phasor Measurement Units and Wide-Area Measurement Systems. Contingency Analysis. Preventive Control and Emergency Control.	**Industry Mapping:** MATLAB **International Academia:** https://ocw.mit.edu/courses/6-061-introduction-to-electric-power-systems-spring-2011/	8		Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.	17
5	**Power System Economics and Management :**	Economic Load Dispatch, Unit Commitment, Basic Pricing Principles: Generator Cost Curves, Utility Functions, Power Exchanges, Demand side management, Introduction to Wholesale Electricity Market. Introduction to Wholesale Electricity Market, Distributed Generation & Smart Grid. Application of different AI - based techniques in unit commitment.	**Industry Mapping:** MATLAB **International Academia:** https://ocw.mit.edu/courses/6-061-introduction-to-electric-power-systems-spring-2011/	10	1. Optimize the load demand of an industrial load using different optimization techniques in MATLAB. 2. Design an optimal load scheduling for a thermal power plant for meeting the real time industrial load demand in MATLAB.	Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.	7

Course outcome:

At the end of the course, the students will be able to
1. Understand the importance of load flow studies in power systems.
2. Understand the concept of power system stability.
3. Understand the necessity of different monitoring and control techniques in the power system.
4. Understand the economic aspects and how energy can be managed properly to benefit the economic side of the power system.

Suggested Learning Resources:

Text books: Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.

Reference books:

1. Electrical Power Systems, Subir Ray, PHI
2. Switchgear protection and power systems, Sunil S Rao, Khanna Publications.
3. A text book on Power System Engineering, M.L.Soni, P.V.Gupta, U.S. Bhatnagar & A. Chakrabarti, Dhanpat Rai & CO.
4. Handbook of Electrical Power Distribution, G. Ramamurthy, University Press
5. Electric Power Transmission and Distribution, S. Sivanagaraju, S.Satyanarayana, Pearson Education.
6. Power Systems Stability, Vol. I, II & II, E.W. Kimbark, Wiley

Lesson Plan:
Module No 1.: Module Name Power Flow Analysis (Faculty: Prof. Dr. Manas Mukherjee)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Review of the structure of a Power System and its components.
2	Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications.
3	Application of numerical methods for the solution of nonlinear algebraic equations – Gauss-Seidel of the power flow equation
4	Newton-Raphson methods for the solution of the power flow equations and distribution load flow
5	Computational Issues in Large-scale Power Systems. Power flow analysis using different AI-based optimization approaches

Module No 2.: Module Name Power System stability analysis (Faculty: Prof. Dr. Manas Mukherjee)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Syllabus discussion, Swing Equations of a synchronous machine connected to an infinite bus.
2	Power angle curve and its effect on stability.
3	Single and multi-machine connected to infinite bus
4	Description of the phenomena of loss of synchronism in a single machine infinite bus system following a disturbance like a three--phase fault.
5	Analysis using numerical integration of swing equations (Point by Point, Modified Euler's method).
6	Equal Area Criterion of stability.
7	Impact of stability constraints on Power System Operation, Effect of generation rescheduling of transmission lines on stability.
8	Effect of series compensation of transmission lines on stability, Numerical related to stability.

Module No 3.: Module Name Control of Frequency and Voltage (Faculty: Prof. Dr. Manas Mukherjee)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Syllabus discussion, Turbines and Speed-Governors, Frequency dependence of loads.
2	Droop Control and Power Sharing.
3	Automatic Generation Control.
4	Generation and absorption of reactive power by various components of a Power System.
5	Excitation System Control in synchronous generators.
6	Automatic Voltage Regulators.
7	Shunt Compensators, Static VAR compensators and STATCOMs.
8	Tap Changing Transformers, Power flow control using embedded dc links, phase shifters.

Module No 4.: Module Name Monitoring and Control (Faculty: Prof. Dr. Manas Mukherjee)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Overview of Energy Control Centre Functions: SCADA systems
2	Phasor Measurement Units and Wide-Area Measurement Systems.
3	Solving Practice problem
4	Solving real problem
5	Normal, Alert, Emergency, and Extremis states of a Power System.
6	Contingency Analysis. Preventive Control and Emergency Control.

Module No 5.: Module Name Power System Economics and Management (Faculty: Prof. Dr. Manas Mukherjee)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Economic Load Dispatch, Unit Commitment
2	Basic Pricing Principles: Generator Cost Curves, Utility Functions
3	Power Exchanges, Demand side management
4	Introduction to Wholesale Electricity Market, Distributed Generation & Smart Grid.
5	Application of different AI - based techniques in unit commitment.
6	Problem solving on power flow analysis
7	Problem solving on power flow analysis
8	Problem solving on load flow using Gauss seidel method
9	Problem solving on load flow using NR method
10	More Problem solving on load flow
11	More Problem solving on load flow
12	Distribution load flow analysis
13	Problem solving Distribution load flow analysis
14	Assignment Discussion

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	2	2	3	0	0	0	0	0	0	0
CO2	2	2	2	2	2	1	0	0	0	0	0
CO3	3	3	2	1	1	1	0	0	1	0	1
CO4	1	1	2	3	2	0	2	1	2	1	1

University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus

Syllabus for B.Tech Admission Batch 2023-2027

Subject Name: Microprocessors and Microcontrollers **Credit: 3**
Lecture Hours: 40 **Subject Code: PCEEE602**

List of Faculty Members handling the Subject –

1. Prof. Dr. Rajat Shubhra Pal
2. Prof. Arijita Das

Pre-requisite: Digital Electronics, Basic concept of programming.

Study Material Coursera Nptel LinkedIn Learning

Course Objective:

1. To understand the architecture of 8-bit and16-bit microprocessor.
2. To study the architecture of 8-bit microcontroller
3. To learn the design aspects of I/O and Memory Interfacing circuits.
4. To design a microcontroller-based system
5. To get a brief idea of advanced processors

Module number	Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
1	Fundamentals of 8-bit microprocessor architecture. Comparison between 8-bit and 16-bit architecture. The 8086 Microprocessor: Introduction to 8086-Microprocessor architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming – Modular Programming – Linking and Relocation – Stacks – Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation. 8086 System bus structure: 8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations	**Industry Mapping:** home appliances, process control, motor control, and robotic operations. **International Academia:** https://ocw.mit.edu/courses/2-996-biomedical-devices-design-laboratory-fall-2007/resources/lec5_mcroprcsr_1/	10	1. Programming using 8086 to implement the concept of Look Up table. 2. Programming using 8086 to implement the concept of Binary to ASCII conversion	Advanced Microprocessors and Peripheral, Koshor M Bhurchandi, Ajay Kumar Ray, 3rd Edition, MC Graw hill education.	Chapter 1 - 4,8
2	I/O INTERFACING: Memory Interfacing and I/O interfacing – Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer – Keyboard /display controller – Interrupt controller –DMA controller – Programming and applications Case studies: Traffic Light control, LED display, LCD display, Keyboard interface and Alarm Controller. Case Study: Virtual Testing of 8086-Based Traffic Light Controller Using AI Simulation Prompts	**Industry Mapping:** conveyor systems, robotic arms, temperature and pressure monitoring systems, smart home devices, Traffic light controllers. **International Academia:** https://ocw.mit.edu/courses/2-996-biomedical-devices-design-laboratory-fall-2007/resources/lc6_mcroprcsor2/	8	Design a traffic light controlling system using 8086.	Advanced Microprocessors and Peripheral, Koshor M Bhurchandi, Ajay Kumar Ray, 3rd Edition, MC Graw hill education.	Chapter 5,6,7

3	Microcontroller: Architecture of 8051 – Structure of internal memory - Special Function Registers (SFRs) – I/O Ports – Instruction set – Addressing modes – Assembly language programming.	**Industry Mapping:** Consumer Electronics and Home Automation, Industrial Automation and Robotics, Medical and Healthcare Devices **International Academia:** **https://ocw.mit.edu/courses/res-3-002-collaborative- design-and-creative-expression-with-arduino-microcontrollers-january-iap-2017/**	**8**	1. Design a circuit using 8051/Arduino/Raspberry Pi to measure the room temperature 2. Design a circuit to control the speed of a stepper motor using 8051/Arduino/Raspberry Pi 3. Design a virtual keyboard using 8051/Arduino/Raspberry Pi 4. Design a circuit using 8051/Arduino/Raspberry Pi to display digits 0 to 9 in a 7 segment display 5. Design a circuit to measure air pressure of a particular room using 8051/Arduino/Raspberry Pi	The 8051 Microcontroller and Embedded systems, Muhammad Ali Mazidi & J. G. Mazidi, Pearson Education.	Chapter 1 - 6
4	Interfacing Microcontroller: Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD & Keyboard Interfacing – ADC, DAC & Sensor Interfacing – External Memory Interface- Stepper Motor and Waveform generation. Case Study: Design an AI-Assisted home automation system using 8051 to control lights, fans, and alarms based on sensor input.	**Industry Mapping:** Consumer Electronics and Home Automation, Industrial Automation and Robotics, Medical and Healthcare Devices **International Academia:** **https://ocw.mit.edu/courses/res-3-002-collaborative- design-and-creative-expression-with-arduino-microcontrollers-january-iap-2017/**	**8**	1. Design Analog to Digital converter using 8051/Arduino/Raspberry Pi. 2. Design a digital Tachometer using 8051/Arduino/Raspberry Pi. 3. Design a strain gauge based weighing machine using 8051/Arduino/Raspberry Pi. 4. Design an Arduino based Smoke detector. **5.** Design an Arduino based obstacle measurement system using Ultrasonic sensor.	The 8051 Microcontroller and Embedded systems, Muhammad Ali Mazidi & J. G. Mazidi, Pearson Education.	Chapter 9 - 14

5	Advanced Processor: Introduction to DSP processor and it's architecture, ARM processor: Introduction to ARM processor and it's architecture, RISC processor: Introduction to RISC processor and it's architecture	**Industry Mapping:** Radar systems, biomedical signal analysis, and telecommunications, Smartphones, IoT devices. **International Academia:** **https://ocw.mit.edu/courses/2-996-biomedical-devices-design-laboratory-fall-2007/resources/lec5_mcroprcsr_1/**	**6**	1. Familiarization with DSP processor architecture. Familiarization with process of storing and viewing the contents. **2.** Familiarization with ARM processor architecture. Familiarization with process of storing and viewing the contents.	Study material	**NA**

Course Outcome:

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

CO1. Understand processor microarchitecture, design and performance evaluation concepts.

CO2. Understand the architecture and instruction set of 8086 and 8051.

CO3. Develop simple programs in 8086 and 8051

CO4. Build microcontroller-based applications

Lesson Plan:

Module 1: The 8086 Microprocessor: 3rd Year, Sec A (Faculty: Prof. Arijita Das)

WORKING DAY	LESSON PLAN – DESCRIPTION
Day 1	Introduction to 8086- Microprocessor architecture – Addressing modes –
Day 2	Instruction set and assembler directives –
Day 3	Assembly language programming –
Day 4	Modular Programming – Linking and Relocation –
Day 5	Stacks – Procedures – Macros –
Day 6	Interrupts and interrupt service routines –
Day 7	Byte and String Manipulation
Day 8	8086 signals – Basic configurations –
Day 9	System bus timing –System design using 8086 –

Module 2: I/O Interfacing: 3rd Year, Sec A (Faculty: Prof. Arijita Das)

WORKING DAY	LESSON PLAN – DESCRIPTION
Day 10	I/O programming –
Day 11	System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations
Day 12	Memory Interfacing and I/O interfacing –
Day 13	Parallel communication interface – Serial communication interface –
Day 14	D/A and A/D Interface –
Day 15	Timer – Keyboard /display controller – Interrupt controller –
Day 16	DMA controller – Programming and applications
Day 17	Case studies: Traffic Light control, LED display, LCD display, Keyboard display interface and Alarm Controller

Module 3: Microcontroller: 3rd Year, Sec A (Faculty: Prof. Rajat Shubhra Pal)

WORKING DAY	LESSON PLAN – DESCRIPTION
Day 1	Introduction to Microcontroller and Microcontroller based system, Difference between Microprocessor and Microcontroller
Day 2	Architecture of 8051, Pin diagram
Day 3	I/O Pins Ports and Circuits, Demultiplexing of address and data bus
Day 4	Interfacing of External Program and Data memory
Day 5	Internal memory structure, Special Function Registers (SFRs)
Day 6	Concept of basic Microcontroller programming, Addressing modes
Day 7	Instruction set - Data transfer, arithmetic and logical type and relevant programming
Day 8	Instruction set - branch control type and relevant programming

Module 4: Interfacing Microcontroller: 3rd Year, Sec A (Faculty: Prof. Rajat Shubhra Pal)

WORKING DAY	LESSON PLAN – DESCRIPTION
Day 9	8051 Interrupts and Programming
Day 10	8051 Timer and Counter Programming
Day 11	8051 Serial Port Programming
Day 12	LCD & Keyboard Interfacing –
Day 13	ADC, DAC & Sensor Interfacing –
Day 14	External Memory Interface- Waveform generation
Day 15	External Memory Interface- Stepper Motor control
Day 16	AI-Assisted home automation system

Module 5: Advanced Processor: 3rd Year, Sec A (Faculty: Prof. Arijita Das)

WORKING DAY	LESSON PLAN – DESCRIPTION
Day 18	Introduction to DSP processor and it's architecture
Day 19	Introduction to ARM processor and it's architecture
Day 20	Introduction to RISC processor and it's architecture

Suggested sources of learning:
TEXT BOOK:

1. Advanced Microprocessors and Peripheral, Koshor M Bhurchandi, Ajay Kumar Ray, 3rd Edition, MC Graw hill education.
2. Microprocessor & Interfacing, D.V. Hall, Mc Graw Hill.
3. The 8051 Microcontroller and Embedded systems, Muhammad Ali Mazidi & J. G. Mazidi, Pearson Education.

REFERENCE BOOKS:

1. Advanced Microprocessors, Y. Rajasree, New Age international Publishers.
2. An introduction to the Intel family of Microprocessors, James L. Antonakos, Pearson Education.
3. The 8051 Microcontroller, Ayala, Thomson.
4. The 8086 Microprocessors: Programming & Interfacing the PC, K.J.Ayala, Thomson.
5. Microprocessor & Peripherals, S.P. Chowdhury & S. Chowdhury, Scitech.
6. Microchip technology data sheet, www.microchip.comerence books

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	3	1	-	-	-	-	2
CO2	3	3	2	2	3	1	-	-	-	-	2
CO3	3	3	3	3	3	2	-	-	-	-	2
CO4	3	3	3	3	3	3	-	1	1	1	3

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus

Syllabus and Lesson Plan for B.Tech Admission Batch 2023

Subject Name: Analog and digital Communication **Credit: 3**

Lecture Hours: 38 **Subject Code: PCEEE603**

Maximum: 100 marks (Internal: 30 marks; External: 70 marks)

List of Faculty Members handling the Subject – Neeta Sahay

Pre-requisite: Alectronics (analog and digital), signals and systems, mathematics (especially calculus, probability, and Fourier transforms), and electromagnetics.

Relevant Links:

Study Material	Coursera	NPTEL	LinkedIn Learning	**Infosys Springboard**

Course Objectives:

The purpose of learning this course is to-

1. Need for modulation and calculate the antenna size for different carrier frequencies
2. Compare between the different demodulation methods,
3. Identify the type of modulation, calculate the side-band frequencies
4. Calculate the Noise temperature & SNR for different systems
5. Sound knowledge on various digital communication systems.

Detailed Syllabus:

Module number	Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
1	Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.	***International Academia:*** ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:***	9	1. 1. Measurement of modulation index of an AM signal. 2. 2. Measurement of output power with varying modulation index an AM signal (for both DSB- & SSB). 3. 3. Measurement of distortion of the demodulated output with varying modulation index of an AM signal (for both DSB-SC & SSB). 4. 4. Measurement of power of different frequency components of a frequency modulated signal & the measurement of the bandwidth.	Modern Digital and Analog Communication Systems, B. P. Lathi, OXFORD UNIVERSITY PRESS	1,3,4,9
					Communication systems (analog and digital) By Sanjay Sharma, S.K. Kataria & Sons	1,4
2	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.	***International Academia:*** ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:***	10	1. 5. Design a PLL using VCO & to measure the lock frequency. 2. 6. Design a FM demodulator using PLL. 3. 7. Measurement of SNR of a RF amplifier. 4. 8. Measurement of selectivity,sensitivity,fidelity of a superheterodyne receiver. 5. 9. Study of waveforms of various functional points (output of RF,IF & video) of a B/W TV receiver. 6. 10. Study of the vertical & horizontal sweep of the time base unit of a B/W TV.	Communication systems (analog and digital) By Sanjay Sharma, S.K. Kataria & Sons	1,3,4,6, 8,9

3	Sampling process. Uniform and non-uniform quantizer. Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers	***International Academia:*** ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:***	8	1. 1. Design, implementation and study of all the properties of 7-length and 15-length pn sequences using shift register. 2. 2. Study of PAM and demodulation. 3. 3. Study of PCM and demodulation. 4. 4. Study of line coders: polar/unipolar/bipolar NRZ, RZ and Manchester. 5. 5. Study of delta modulator and demodulator. 6. 6. Study of adaptive delta modulator and demodulator.	Communication systems (analog and digital) By Sanjay Sharma, S.K. Kataria & Sons Modern Digital and Analog Communication Systems, B. P. Lathi, OXFORD UNIVERSITY PRESS	3,4 4
4	Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion. Baseband digital communication system. Passband Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying. Optimum demodulation of digital signals over band-limited channels-Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.	***International Academia:*** ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:***	11	1. 7. Study of BPSK modulator and demodulator. 2. 8. Study of BFSK modulator and demodulator. 3. 9. Study of ASK modulator and demodulator. 4. 10. Study of QPSK modulator and demodulator. 5. 11. Simulation study of probability of symbol error for BPSK modulation. 6. 12. Simulation study of probability of symbol error for BFSK modulation.	Communication systems (analog and digital) By Sanjay Sharma, S.K. Kataria & Sons	9, 10,11,13

Course Outcomes:

At the end of this course, students will demonstrate the ability to

CO1. Develop the generation and detection technique of analog communication system and analyze the different multiplexing techniques.

CO2. Examine the signal-to-noise ratio (SNR) performance of analog communications systems

CO3. Demonstrate the theory of probability and identify various complex program of communication system.

CO4. Execute the operation of different error control coding schemes for the reliable transmission of digital representation of signals and information over the channel.

Lesson Plan:

Module 1: Review of signals and systems Year 2025 , (Faculty : Neeta Sahay)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Frequency domain representation of signals, -., ,.
2	Principles of Amplitude Modulation Systems
3	DSB, SSB and VSB modulations
4	DSB, SSB and VSB modulations
5	Angle Modulation
6	Representation of FM and PM signals
7	Representation of FM and PM signals
8	Spectral characteristics of angle modulated signals
9	Spectral characteristics of angle modulated signals

Module 2: Review of probability and random process. Year 2025 , (Faculty : Neeta Sahay)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Gaussian and white noise characteristics
2	Gaussian and white noise characteristics
3	Noise in amplitude modulation systems
4	Noise in amplitude modulation systems
5	Noise in Frequency modulation systems
6	Noise in Frequency modulation systems
7	Pre-emphasis and De-emphasis
8	Pre-emphasis and De-emphasis
9	Threshold effect in angle modulation.
10	Threshold effect in angle modulation.

Module 3: Pulse modulation Year 2025 , (Faculty : Neeta Sahay)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Sampling process.
2	Uniform and non-uniform quantizer.
3	Pulse Amplitude and Pulse code modulation (PCM)
4	Differential pulse code modulation
5	Noise considerations in PCM
6	Time Division multiplexing
7	Digital Multiplexers
8	Delta modulation

Module 4: Elements of Detection Theory and Digital Modulation trade offs: Year 2025 , (Faculty : Neeta Sahay)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Optimum detection of signals in noise
2	Coherent communication with waveforms
3	Probability of Error evaluations.
4	Baseband Pulse Transmission, Inter symbol Interference and Nyquist criterion
5	Baseband digital communication system
6	Passband Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying
7	Quadrature Amplitude Modulation
8	Continuous Phase Modulation and Minimum Shift Keying
9	Optimum demodulation of digital signals over band-limited channels
10	Maximum likelihood sequence detection (Viterbi receiver).
11	Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**
2	**1**	**1**	**3**	**3**	**3**	**1**	**3**	**1**	**3**	**-**	**1**
3	**2**	**3**	**3**	**2**	**1**	**3**	**-**	**1**	**-**	**1**	**-**
4	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**-**	**-**	**3**

TEXT BOOK:

1. B. P. Lathi, Modern Digital and Analog Communication Systems, , OXFORD UNIVERSITY PRESS.
2. Sanjay Sharma, Communication systems (analog and digital) By, S.K. Kataria & Sons.

Reference Books

4. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.
5. Wozencraft J. M. and Jacobs I. M., "Principles of Communication Engineering", John Wiley, 1965.
6. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus

Syllabus for B.Tech Admission Batch

Subject Name: Digital Signal Processing **Credit: 3**

Lecture Hours: 41 **Subject Code: PECEEE 601A**

Study material	Coursera	nptel	LinkedIn Learning	Infosys Springboard

Maximum: 100 marks (Internal: 30 marks; External: 70 marks)

List of Faculty Members handling the Subject –

1. Suman Sarkar

Pre-requisite: Signal System

Course objectives:

1. To provide background and fundamental material for the analysis and processing of digital signals.
2. To understand the fast computation of DFT and appreciate the FFT processing.
3. To study the designs and structures of digital (IIR and FIR) filters and analyze and synthesize for a given specification.
4. To acquaint in Multi-rate signal processing techniques and finite word length effects.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	TEXT BOOK	Mapped Chapter
1	Introduction and Multirate Digital Signal Processing	Introduction to Digital Signal Processing: Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Normalized Frequency, Linear Shift Invariant Systems, Stability, and Causality, linear differential equation to difference equation, Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems. Multirate Digital Signal Processing: Introduction, Down Sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion.	**International Standards**: https://ocw.mit.edu/courses/res-6-008-digital-signal-processing-spring-2011/ ***AICTE prescribed syllabus:*** https://www.aicte.gov.in/sites/default/files/Final_ECE.pdf ***Industry Mapping: MATLAB***	9	(A.) Discrete- time signal generation (Square wave, Sine wave, & Impulse signal). (B.) Impulse and Step response of an LTI system. (C.) Step-response of an LTI system using convolution.	Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009	1
2	Discrete Fourier series and Transforms	Fourier Series, Fourier Transform, Laplace Transform and Z-Transform relation, DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series, Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of DFT: Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and Z- Transform. Fast Fourier Transforms: Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in Frequency FFT Algorithms, Inverse FFT.	**International Standards**: https://ocw.mit.edu/courses/res-6-008-digital-signal-processing-spring-2011/ ***AICTE prescribed syllabus:*** https://www.aicte.gov.in/sites/default/files/Final_ECE.pdf ***Industry Mapping: MATLAB***	10	(A.) Representation of continuous time signal and its FT, sampled signal & its DFT. (B.) Linear Convolution using DFT (C) Circular Convolution using DFT	Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009	2

3	IIR Digital Filters	Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations.	**International Standards**: https://ocw.mit.edu/courses/res-6-008-digital-signal-processing-spring-2011/ ***AICTE prescribed syllabus:*** https://www.aicte.gov.in/sites/default/files/Final_ECE.pdf ***Industry Mapping: MATLAB***	7	To design a Digital IIR filter, using Bilinear transformation method.	Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009	3
4	FIR Digital Filters:	Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR filters.	**International Standards**: https://ocw.mit.edu/courses/res-6-008-digital-signal-processing-spring-2011/ ***AICTE prescribed syllabus:*** https://www.aicte.gov.in/sites/default/files/Final_ECE.pdf ***Industry Mapping: MATLAB***	7	To design a Digital FIR filter, using Windowing method	Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009	4
5	Realization of Digital Filters	Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms. Finite Word Length Effects: Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round Off Noise, Methods to Prevent Overflow, Trade Off Between Round Off and Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.	**International Standards**: https://ocw.mit.edu/courses/res-6-008-digital-signal-processing-spring-2011/ ***AICTE prescribed syllabus:*** https://www.aicte.gov.in/sites/default/files/Final_ECE.pdf ***Industry Mapping: MATLAB***	8		Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009	5

Course outcome:

1. Understand the LTI system characteristics and Multirate signal processing.
2. Understand the inter-relationship between DFT and various transforms.
3. Design a digital filter for a given specification.
4. Understand the significance of various filter structures and effects of round off errors.

Suggested Learning Resources:

Text books:

1. Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009
2. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.

Lesson Plan:

Module No.: Introduction and Multirate Digital Signal Processing (Faculty: Prof. Suman Sarkar)

WORKING DAY	LESSON PLAN – DESCRIPTION
DAY1	Introduction to Digital Signal Processing: Discrete Time Signals & Sequences,
DAY2	conversion of continuous to discrete signal, Normalized Frequency,
DAY3	Linear Shift Invariant Systems, Stability, and Causality,
DAY4	Linear Shift Invariant Systems, Stability, and Causality,
DAY5	linear differential equation to difference equation, Linear Constant Coefficient Difference Equations,
DAY6	Frequency Domain Representation of Discrete Time Signals and Systems.
DAY7	Multirate Digital Signal Processing: Introduction, Down Sampling,
DAY8	Decimation, Up sampling,
DAY9	Interpolation, Sampling Rate Conversion.

Module No.: Discrete Fourier series and Transforms Module Name (Faculty: Prof. Suman Sarkar)

WORKING DAY	LESSON PLAN – DESCRIPTION
DAY1	Fourier Series, Fourier Transform,
DAY2	Laplace Transform and Z-Transform relation,
DAY3	DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series,
DAY4	Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT,
DAY5	Computation of DFT: Over-Lap Add Method,
DAY6	Over-Lap Save Method,
DAY7	Relation between DTFT, DFS, DFT and Z- Transform.
DAY8	Fast Fourier Transforms: Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time
DAY9	Decimation-in Frequency FFT Algorithms, Inverse FFT.
DAY10	Decimation-in Frequency FFT Algorithms, Inverse FFT.

Module No.: IIR Digital Filters Module Name (Faculty: Prof. Suman Sarkar)

WORKING DAY	LESSON PLAN – DESCRIPTION
DAY1	Analog filter approximations – Butterworth
DAY2	Chebyshev,
DAY3	Design of IIR Digital Filters from Analog Filters,
DAY4	Step and Impulse Invariant Techniques,
DAY5	Step and Impulse Invariant Techniques
DAY6	Bilinear Transformation Method,
DAY7	Spectral Transformations.

Module No.: FIR Digital Filters **(Faculty: Prof. Suman Sarkar)**

WORKING DAY	LESSON PLAN – DESCRIPTION
DAY1	Characteristics of FIR Digital Filters,
DAY2	Frequency Response.
DAY3	Design of FIR Filters: Fourier Method,
DAY4	Digital Filters using Window Techniques,
DAY5	Frequency Sampling Technique,
DAY6	Comparison of IIR
DAY7	FIR filters.

Module No.: Realization of Digital Filters **(Faculty: Prof. Suman Sarkar)**

WORKING DAY	LESSON PLAN – DESCRIPTION
DAY1	Applications of Z – Transforms, Solution of Difference Equations of Digital Filters,
DAY2	System Function, Stability Criterion, Frequency Response of Stable Systems,
DAY3	Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms.
DAY4	Finite Word Length Effects: Limit cycles, Overflow Oscillations,
DAY5	Round-off Noise in IIR Digital Filters, Computational Output Round Off Noise,
DAY6	Methods to Prevent Overflow, Trade Off Between Round Off and Overflow Noise,
DAY7	Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.
DAY8	Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**2**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	-	**-**	**-**
CO2	**2**	**2**	**2**	**1**		**-**	**-**	**-**	-	**-**	**-**
CO3	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	-	**-**	**2**
CO4	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	-	**-**	**2**

University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus

Syllabus for B.Tech Admission Batch 2023-27

Subject Name: Biomedical Engineering **Credit: …4**
Lecture Hours: 36 **Subject Code: PECEEE601B**

Study Material	Coursera	Nptel:	LinkedIn Learning:	Infosys Springboard:

Course Objective:

1 To introduce the basic biomedical engineering technology

2 To introduce different biological signals, their acquisition measurements and related constraints.

Course Outcome:

CO1. Understand the application of the electronic systems in biological and medical applications.
CO2. Understand the practical limitations on the electronic components while handling bio substances
CO3. Understand and analyze the biological processes like other electronic processes.
CO4. Understand the signal processing techniques and requirements.

Module number	Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
1	Brief introduction to human physiology. Biomedical transducers: displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases	***International Academia***: (https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006/) ***AICTE-prescribed syllabus***: (https://makautexam.net/aicte_details/Syllabus/EEE/sem8.pdf) Industry Mapping: MATLAB	10		**Khandpur** R.S, Handbook of **Biomedical** Instrumentation, Tata McGraw-Hill	1,2,3

2	Introduction and basic concepts of Biomedical Instrumentation	***International Academia***: (https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006/) ***AICTE-prescribed syllabus***: (https://makautexam.net/aicte_details/Syllabus/EEE/sem8.pdf) Industry Mapping: MATLAB	2		**Khandpur** R.S, Handbook of **Biomedical** Instrumentation, Tata McGraw-Hill	10,11,12,13,14, 15
3	Bio-electrodes and bio-potential amplifiers for ECG, EMG, EEG, etc. Measurement of blood temperature, pressure and flow. Impedance plethysmography. Ultrasonic, Xray and nuclear imaging, Basic concepts of Biomedical signal processing. AI-powered radiology and AI-assisted diagnosis. Brain-Computer Interface and Neuroprosthetics signal processing.	***International Academia***: (https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006/) ***AICTE-prescribed syllabus***: (https://makautexam.net/aicte_details/Syllabus/EEE/sem8.pdf) Industry Mapping: MATLAB	16	1. Real-time Monitoring of Bone Fracture Recovery By using Aware, Sensing, Smart And Active Orthopedic Devices 2. Prediction and early identification of disease through artificial intelligence (AI). 3. Potential for a predictive model to aid in the early identification of liver disease	**Khandpur** R.S, Handbook of **Biomedical** Instrumentation, Tata McGraw-Hill	4,5, 19, 20,21
4	Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects.	***International Academia:*** (https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006/) ***AICTE-prescribed syllabus***: (https://makautexam.net/aicte_details/Syllabus/EEE/sem8.pdf) Industry Mapping: MATLAB	10		**Khandpur** R.S, Handbook of **Biomedical** Instrumentation, Tata McGraw-Hill	18,21,25,26, 30

Suggested sources of learning:

TEXT BOOK:

1. **Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill.**

REFERENCE BOOKS:

1. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	–	1	–	–	1	–	1
CO2	2	3	2	3	2	–	–	–	1	–	2
CO3	2	2	3	2	3	1	–	2	2	2	2
CO4	1	1	1	–	1	2	3	2	2	1	3

University of Engineering and Management

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Syllabus for B.Tech Admission Batch 2023-2027

Subject Name: IOT **Credit: 3**

Lecture Hours: 40 **Subject Code: OECEEE601A**

Study material	Coursera	nptel	LinkedIn Learning	Infosys Springboard

Maximum: 100 marks (Internal: 30 marks; External: 70 marks)

List of Faculty Members handling the Subject – Pratik De Sarkar

Pre-requisite: Microprocessor & Microcontrollers

Course objectives:

1. To learn fundamentals of IoT and how to build hardware and software for IoT based systems
2. Emphasize on Industrial IoT development

Module number	Topic	Sub-topics	Mapping with Industry andInternational Academia	Lecture Hours	Text Book Mapping	Project Based Learning
1	**IoT** **Introduction and Fundamentals**	Introduction to IoT, Concept of Smartsensors and actuators	***International Academia:*** https://explorecourses.stanford.edu/search?view=catalog&filter- coursestatus-Active=on&q=EE%20284A:%20Introduction%20to%20Internet%20of%20Things&academicYear=20182019 ***AICTE-prescribed syllabus:https://www.aicte-india.org/sites/default/files/ModelCurriculum/Final_ECE%20after%20addedum.pdf***	6	**Introduction to IoT** **By Sudip Misra, Anandarup Mukherjee, ArijitRoy (Cambridge University Press):**	**1. Smart Home Automation System:** Build a system to control lights, fans, and appliancesremotely using a Raspberry Pi and a smartphone app. **2. IoT-Based Weather Station:** Develop a weather station that measures temperature, humidity, and air pressureusing sensors and uploadsthe data to the cloud. **3. Smart Irrigation System for Agriculture:** Create a system to monitorsoil moisture and automateirrigation. **4. Industrial Machine Health Monitoring System:** Monitor the vibration and temperatureof machines to predict failures. **5. Real-Time Smart Parking System:** Design aparking system that detectsavailable slots and guidesusers.
2	**Communication and Networking in IoT**	L1- Basic of IoT networking Internet Communications: AnOverview MQTT, CoAP, REST Api and gRPC, Different Communication protocols :(RFID, IEEE 802.15.4, Zigbee, 6LoWPAN, Bluetooth), LoRa, Machine-to-Machine(M2M) Communications, MQTT Broker	**International Standards** : https://explorecourses.stanford.edu/search?view=catalog&filter- coursestatus-Active=on&q=EE%20284A:%20Introduction%20to%20Internet%20of%20Things&academicYear=20182 019 ***AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf***)	10	**Introduction to IoTby Sudip Misra, Anandarup Mukherjee, Arijit Roy (Cambridge University Press):** Chapter 7 (IoT Connectivity Technologies) Chapter 8 (IoT Communication Technologies): 8.2, 8.4	

3	**Modern networking**	Introduction to Arduino Programming, integration of Sensors having analog and i2c.Connecting Arduino with ESP8266 WiFi module, L1-Introduction to Python programming with IoT modules, Introduction & Implementation ofRaspberry Pi, Pico using microPython in IoT	**International Standards** : https://explorecourses.stanford.edu/search?view=catalog&filter- coursestatus-Active=on&q=EE%20284A:%20Introduction%20to%20Internet%20of%20Things&academicYear=20182 019 ***AICTE prescribed syllabus:*** ***https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf)*** ***Industry mapping:*** Python, micropython	8	**Introduction to IoTby Sudip Misra, Anandarup Mukherjee, Arijit Roy (Cambridge University Press):** Chapter 16 (Beginning IoT Hardware Projects)	**6. Energy Monitoringand Optimization System**: Monitor and optimize energy consumption in a household or factory. **7. IoT-Enabled Smart Waste Management System**: Build a system tomonitor waste bin levels and optimize waste collection routes. **8. Smart Traffic Management System**: Use IoT devices to monitor traffic density and optimize signal timings. **9. IoT-Based Health Monitoring System**: Create a wearable healthdevice to monitor vital signs and send data to a cloud platform. **10. Industrial IoT (IIoT) Energy Dashboard**: Builda dashboard for monitoring and analyzingenergy usage in an industrial setup. **Key Learning Outcomes** Hands-on experience with • IoT protocols (MQTT, CoAP).
4	**Cloud Computing & IoTAnalytics**	Introduction to cloud computing, Cloud models & implementation; Introduction to ML in IoT and implementation of few selected algorithms in IoT	**International Standards** : https://explorecourses.stanford.edu/search?view=catalog&filter- coursestatus-Active=on&q=EE%20284A:%20Introduction%20to%20Internet%20of%20Things&academicYear=20182019 ***AICTE prescribed syllabus:*** ***https://www.aicte-india.org/sites/default/files/Model Curriculum/Final_ECE%20after%20addedum.pdf***)	6	**Introduction to IoTby Sudip Misra, Anandarup Mukherjee, Arijit Roy (Cambridge University Press):** Chapter 10 (Cloud Computing) & Chapter 17 (IoT Analytics)	

5	**IoT Applications**	IoT applications like Home Automation, Precision Agriculture,Smart vehicles, SmartGrid	**International Standards** : https://explorecourses.stanford.edu/search?view=catalog&filter- coursestatus-Active=on&q=EE%20284A:%20Introduction%20to%20Internet%20of%20Things&academicYear=20182 019 ***AICTE prescribed syllabus:*** ***https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf*** ***Industry mapping:*** Python,micropython	6	**Introduction to IoT by Sudip Misra, Anandarup Mukherjee, ArijitRoy (Cambridge University Press):** Chapter 12, 13, 14 & 15	• Integration of Raspberry Pi with sensors and actuators. • Implementation of cloud platforms for IoT dataanalytics. • Understanding ofreal-world IoT applications and their challenges. These projects provide practical exposure to IoTconcepts and foster skillsin system design, programming, and problem-solving.

Course outcome:

CO1. To be well versed with the design flow of IoT based systems.

CO2. Able to build IoT nodes using different sensors, microcontrollers and processors.

CO3. Able to understand different communication protocols like GPRS and WiFi for connecting IoT nodes to server.

CO4. Able to understand the internet communications like IP, TCP.UDP, the server application and user interface software

Suggested Learning Resources:

Text Books:

1. "Introduction to IoT" by Sudip Misra, Anandarup Mukherjee, Arijit Roy (Cambridge University Press)
2. Arshdeep Bahga and Vijay Madisetti , "Internet of Things, a hands on approach" , Universities Press (India) Pvt. Ltd. 2017

Reference Book:

1. Rajkumar Buyya, Amir Vahid Dastjerdi, "Internet of Things Principles and Paradigms, Elsevier Inc

Lesson Plan:

Module	Working Day	Lesson Plan – Description
Module 1: IoT Introduction and Fundamentals		
1	1	Syllabus discussion: Overview of the course structure, objectives, and outcomes
	2	Introduction to IoT: Definition, evolution, and significance; Applications in various fields
	3	Concept of Smart Sensors and Actuators: Working principles, types, and use cases
	4	IoT Architecture: Layered architecture, key components (sensing, communication, processing)
	5	Characteristics of IoT: Scalability, interoperability, real-time analytics, challenges
	6	Case Studies in IoT: Smart homes, industrial automation, innovative IoT projects
	7	Practical Applications: Simple simulation exercises using sensors, basic IoT prototyping
	8	IoT Sensing and Actuation: Part 1 - Introduction to sensing, types of sensors, sensor characteristics, and technologies
	9	IoT Sensing and Actuation: Part 2 - Data acquisition and processing, signal conditioning, data acquisition systems, real-time data processing
	10	IoT Sensing and Actuation: Part 3 - Introduction to actuation, types of actuators, actuator characteristics, integration of sensors and actuators
Module 2: Communication and Networking in IoT		
2	11	IoT Networking Basics: Overview of internet communications, M2M communication
	12	MQTT Protocol: Basics, message structure, application examples in IoT
	13	CoAP and REST API: Introduction to CoAP, RESTful architecture, use in lightweight IoT systems
	14	Other Communication Protocols: RFID, IEEE 802.15.4, Zigbee; Comparison and use cases
	15	LoRa and Bluetooth: Low-power wireless technologies for IoT, application scenarios
	16	6LoWPAN and WiFi: Features and benefits for IoT, integration in IoT devices
	17	gRPC Protocol: Introduction, role in IoT communication, practical examples
	18	IoT Connectivity Technologies: Comparative study, design considerations
	19	Standards in IoT: International standards and regulations, role in global IoT deployment
	20	Lab Session on IoT Protocols: Practical implementation of MQTT and CoAP, network simulation tools

Module 3: Modern Networking in IoT		
3	21	Introduction to Arduino Programming: Basics of Arduino IDE, simple LED and sensor programming
	22	Integration of Sensors: Interfacing analog and I2C sensors with Arduino, practical examples
	23	ESP8266 WiFi Module: Features, applications, connecting to Arduino for IoT projects
	24	Introduction to Python for IoT: Basics of Python programming, Python libraries for IoT
	25	MicroPython Programming: Overview, examples with ESP8266 and sensors
	26	Introduction to Raspberry Pi: Setup, features, basic IoT applications using Raspberry Pi
	27	Introduction to Pico: Features of Raspberry Pi Pico, IoT examples using MicroPython
	28	Implementation of Raspberry Pi using MicroPython: Part 1
	29	Implementation of Raspberry Pi using MicroPython: Part 2
	30	Lab Session on Microcontrollers: Hands-on integration of sensors and WiFi modules, IoT project simulation
Module 4: Cloud Computing & IoT Analytics		
4	31	Introduction to Cloud Computing: Overview of cloud models and implementation, role in IoT data management
	32	IoT Data Storage and Analytics: Methods for storing and analyzing IoT data, challenges and solutions
	33	Machine Learning in IoT: Overview of ML concepts for IoT, applications in predictive analytics
	34	Selected ML Algorithms in IoT: Implementing algorithms like k-NN, regression, real-world use cases
	35	Cloud Platforms for IoT: Examples like AWS IoT Core, Google Cloud IoT, practical examples and integration
	36	IoT Analytics: Part 1
	37	Lab Session on Cloud Analytics: Uploading IoT data to the cloud, visualizing data using analytics tools

Module 5: IoT Applications		
5	38	Home Automation and Precision Agriculture: Smart homes (lights, appliances, security systems), agriculture (irrigation, crop monitoring)
	39	Smart Vehicles and Traffic Management: IoT in autonomous vehicles, traffic optimization systems
	40	Smart Grid and Energy Optimization: IoT in energy management, examples of smart grids
	41	IoT in Healthcare: Wearable health monitoring devices, remote health diagnostics
	42	Real-World Design Constraints: Scalability, security, cost issues, overcoming real-world IoT challenges
	43	Capstone Project Review: Discussion of project ideas, course wrap-up, future trends in IoT
	44	Advanced IoT Applications: Exploration of cutting-edge IoT applications and technologies

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	3	1	3	–	–	1	1	2	2
CO2	3	3	3	2	3	–	–	2	1	2	2
CO3	3	2	2	1	3	–	–	1	2	1	2
CO4	3	2	2	2	3	–	–	1	2	1	2

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Syllabus for B.Tech Admission Batch 2023

Subject Name: Image Processing **Credit: 3**

Subject Code: OECEEE601B **Lecture Hours: 36**

Study Material	Coursera	Nptel:	LinkedIn Learning:	Infosys Springboard:

Course Objectives:

To understand fundamentals and mathematical transforms necessary for image processing.
To understand the image enhancement techniques.
To understand the image restoration procedures
To understand the image compression procedures.

Course Outcome(s) (COs):

CO1. Explain the fundamental concepts of a digital image processing system.
CO2. Enhance images in the spatial and frequency domain using various transforms.
CO3. Apply different image segmentation techniques.
CO4. Categorize various compression techniques.

Module	Topic	Sub-topic	Mapping with Industry and International Academia	Lecture Hours	Text Book	Mapped Chapter
1	**Introduction**	Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.	***International Academia:***) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping: GPU, Colab***	8	Digital Image Processing, R.C Gonzalez and R. Woods, Pearson publication	Chapter 1 & 2: Digital Image Fundamental
2	**Image Enhancement in the spatial Domain**	Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.	**International Standards** ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping: GPU, Colab***	8	Digital Image Processing, R.C Gonzalez and R. Woods, Pearson publication	Chapter3: Intensity Transformations and Spatial Filtering

3	**Image Enhancement In Frequency Domain**	Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT, Discrete Cosine Transform (DCT), Image filtering in frequency domain.	***International Standards*** : ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** ***GPU, Colab***	7	Digital Image Processing, R.C Gonzalez and R. Woods, Pearson publication	Chapter 4: Filtering in the Frequency Domain
4	**Image Segmentation**	Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.	***International Standards:*** ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** ***GPU, Colab***	7	Digital Image Processing, R.C Gonzalez and R. Woods, Pearson publication	Chapter 10: Image Segmentation
5	**Image Compression**	Introduction, coding Redundancy, Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding. Applications of supervised and unsupervised learning in image analysis.	***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** ***GPU, Colab***	6	Digital Image Processing, R.C Gonzalez and R. Woods, Pearson publication	Chapter 8: Image Compression and Watermarking

Text books:

1. Digital Image Processing, R.C Gonzalez and R. Woods, Pearson publication, 2017
2. Digital Image Processing, Anil K. Jain, Prentice-Hall, India, 1988.

Reference books:

1. Digital Image Processing, W.K. Pratt, John Wiley & Sons, 1991.
2. Digital Image Processing and Analysis, B. Chanda & D. Dutta Majumder Prentice-Hall India, 2011
3. Image Processing- Theory, Algorithms & Architecture, M. A. Sid-Ahmed, McGraw-Hill, 1994.

CO-PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	1	-	-	-	-	-	1
CO2	2	3	2	1	2	-	-	-	-	-	1
CO3	2	3	2	2	2	-	-	-	-	-	1
CO4	1	2	3	2	3	-	-	1	1	1	2

SMS group

INDUSTRIAL AUTOMATION CURRICULAM

6th Semester

Sl. No.	Topics	No. of Lectures	Remarks
	TOTAL	**30**	**1 hr duration for each session**
1	**PLC/DCS HARDWARE**	**1**	
1.1	Controller	1	
1.2	Signal Modules		
1.3	Technological Modules		
2	**PLC PROGRAMMING**	**8**	
2.1	Recapitulation of PLC Programming	1	
2.2	Hardware Configuration	1	Theory + Practical
2.3	Programming in Statement List (STL)	6	1 Theory + 5 Practical Sessions
2.4	Programming in Structured Control Language (SCL)		
2.5	Programming in Sequential Function Chart (SFC)		
3	**CONTROL MODES**	**3**	
3.1	ON-OFF control	1	
3.2	Feedback Control	1	
3.3	Feed-forward Control		
3.4	Cascade Control		
3.5	Ratio Control	1	
3.6	Adaptive Control		
3.7	Split Range Control		
4	**PID CONTROL**	**2**	
4.1	Basics of PID Control	2	Theory + Practical
4.2	PID Control Tuning		
5	**HUMAN MACHINE INTERFACE**	**11**	
5.1	Introduction to HMI	1	
5.2	HMI Hardware		
5.3	Types of Operator Interfaces	1	
5.4	Connection Wiring of HMI		
5.5	Data Handling with HMI	1	
5.6	HMI Screen	3	1 Theory + 2 Practical Sessions
5.7	Configuration & Interfacing to PLC & Other Systems	1	Theory + Practical
5.8	Reports	4	2 Theory + 2 Practical Sessions
5.9	Trends		
5.10	Messages – Alarm, Warning, Event		
5.11	User Administration		
6	**NETWORKS OF INDUSTRIAL AUTOMATION**	**2**	
6.1	Types of Networks	2	
6.2	Network Topologies		
6.3	Passive & Active Network Components		
7	**COMMUNICATION**	**3**	
7.1	Communication between PLC & Drives	1	
7.2	Communication between two PLCs/PLC & other systems	2	1 Theory + 1 Practical Sessions

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus

Syllabus for B.Tech Admission Batch 2023

Subject Name: VLSI Design **Credit: 3**

Lecture Hours: 48 **Subject Code: PCCEEE 671**

Study material	Coursera	nptel	LinkedIn Learning	Infosys Springboard

Maximum: 100 marks (Internal: 30 marks; External: 70 marks)

List of Faculty Members handling the Subject –

1. **Prof. Dr. Tanmay Sinha Roy**

Pre-requisite: Electronic Devices, Analog Electronic Circuits, Digital Electronic Circuits.

Course objectives:

1. To learn about basic CMOS circuits both in analog and digital domain
2. To learn about VLSI physical design automation
3. To learn the concepts of designing VLSI subsystems.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hour	Corresponding Lab Assignment	TEXT BOOK	Mapped Chapter
1	**Device Physics & IC Fabrication Steps**	MOS device physics and modeling; Wafer processing; oxidation; epitaxy; Diffusion & Ion implantation; Photolithography; Etching; Basic n-well process; p-well process; twin tub process; Layout and stick diagram.	***International Academia:*** (https://ocw.mit.edu/courses/6-374-analysis-and-design-of-digital-integrated-circuits-fall-2003/pages/readings/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** **Language:** T Spice, H Spice, LT Spice, VHDL/Verilog **Software:** Cadence, Tanner EDA Tool, Xilinx ISE, Silvaco TCAD **Hardware:** FPGA Development Board (Spartan 6/ Artix-7)	12	1. MOSFET Device characteristics simulation in Silvaco TCAD 2. Simulating oxidation process step in Silvaco TCAD 3. Simulating epitaxy process step in Silvaco TCAD 4. Simulating diffusion & ion implantation process steps in Silvaco TCAD 5. Simulating photolithography process step in Silvaco TCAD 6. Simulating etching process step in Silvaco TCAD 7. Doing basic layout of different standard cells in Cadence	Debabrata Das, VLSI Design, Second Edition, Oxford University Press.	Chapter 1, 2,
2	**Digital CMOS Design**	Inverter characteristics; Combinational circuit design: CMOS logic families including static, dynamic, and dual rail logic; Sequential circuit design: design of latches and flip-flops; Delay in digital circuits: RC delay model, linear delay model, logical path efforts; Basic concept of SRAM, DRAM and ROM.	**International Standards**: (https://ocw.mit.edu/courses/6-374-analysis-and-design-of-digital-integrated-circuits-fall-2003/pages/readings/) (https://coursera.org/learn/vlsi-cad-logic) (https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013843033231450112292 72_shared/overview) A***ICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** **Language:** T Spice, H Spice, LT Spice, VHDL/Verilog **Software:** Cadence, Tanner EDA Tool, Xilinx ISE **Hardware:** FPGA Development Board (Spartan 6/ Artix-7)	12	1. CMOS inverter transfer charactersitics simulation 2. Cadence Design of basic gates in Xilinx ISE in all programming 3. styles Design of adder/subtractor in 4. Xilinx ISE in all programming styles 5. Design of multiplier/ divider in Xilinx 6. ISE in all programming styles Design of registers and latches in Xilinx ISE Design of counters (synchronous and asynchronous) in Xilinx ISE **Project :** Design of any complex digital architecture using the basic building blocks in Xilinx ISE	Debabrata Das, VLSI Design, Second Edition, Oxford University Press.	Chapter 3, 4

3	**Analog CMOS Design**	Single stage amplifiers; Differential amplifiers; Active loads; Current mirrors; Current and voltage references; Switched capacitor circuits.	***International Standards*** : (https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2005/pages/lecture-notes/) (https://www.coursera.org/learn/mosfet) (https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013843033231450112292 72_shared/overview) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** **Language:** T Spice, H Spice, LT Spice, VHDL/Verilog **Software:** Cadence, Tanner EDA Tool, Xilinx ISE **Hardware:** FPGA Development Board (Spartan 6/ Artix-7)	12	1. Design of single stage amplifiers (CS, 2. CD, CG) in Cadence Design of differential 3. amplifiers in Cadence Design of amplifiers with 4. different active loads in Cadence 5. Design of basic and cascode current mirror in 6. Cadence Design of different current and voltage references in 7. Cadence Design of switched capacitor circuits and circuits for discrete time signal processing in Cadence **Project :** Design of any complex analog circuit using the basic building blocks in Cadence	Debabrata Das, VLSI Design, Second Edition, Oxford University Press.	Chapter 5, 6
4	**VLSI Design Automation**	Compaction, Placement, Floor planning and Routing Problems, Concepts and Algorithms, Physical Design cycle for FPGA's partitioning and routing for segmented and staggered models	***International Standards:*** (https://ocw.mit.edu/courses/6-111- introductory-digital-systems-laboratory- fall-2002/resources/fpga/) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) (https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013843033231450112292 72_shared/overview) ***Industry Mapping:*** **Language:** T Spice, H Spice, LT Spice, VHDL/Verilog **Software:** Cadence, Tanner EDA Tool, Xilinx ISE, MATLAB **Hardware:** FPGA Development Board (Spartan 6/ Artix-7)	12	1. Implementing the basic compaction algorithms in 2. MATLAB Implementing the basic 3. placement algorithms in MATLAB 4. Implementing the basic floorplanning algorithms 5. in MATLAB Implementing the basic local routing algorithms in MATLAB Implementing the basic global routing algorithms in MATLAB	Debabrata Das, VLSI Design, Second Edition, Oxford University Press.	Chapter 7, 8

Course outcome:

CO 1: Know the different IC fabrication steps.

CO 2: Know how to design different CMOS analog circuits based on their specifications.

CO 3: Know how to design different CMOS digital circuits using various logic families.

CO 4: Know the different algorithms behind VLSI physical design.

Suggested Learning Resources:

Text books:

1. S.M.Sze, VLSI Technology, 2nd Ed, McGraw Hill Education
2. S. Mo. Kang and Y. Leblebici, CMOS Digital Integrated Circuits: Analysis & Design, 3rd Ed, Tata McGraw Hill, 2003
3. P. Allen and D. Holberg, CMOS Analog Circuit Design, 2nd Ed, Oxford University Press, 2002
4. Naveed Sherwani, Algorithms for VLSI Physical Design Automation, 3rd Ed, Springer International Edition
5. Debabrata Das, VLSI Design, Second Edition, Oxford University Press.

Reference books:

1. N.H.E. Weste and D.M. Harris, CMOS VLSI Design: A Circuits and Systems Perspective, 4th Ed, Pearson Education India, 2011
2. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979
3. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997
4. B. Razavi, Design of Analog CMOS Integrated Circuits, Tata McGraw Hill, 2002
5. P. Douglas, VHDL: programming by example, McGraw Hill, 2013
6. S.H.Gerez, “Algorithms for VLSI Design Automation,” John Wiley 1999

Lesson Plan:

Module 1: Device Physics & IC Fabrication Steps Year 2025, (Faculty: Prof. Dr. Tanmay Sinha Roy)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Fundamental concepts: MOS device physics and modeling
2	Wafer processing
3	oxidation
4	epitaxy
5	Diffusion & Ion implantation
6	Photolithography
7	Etching
8	Basic n-well process
9	p-well process
10	twin tub process
11	Layout and stick diagram
12	stick diagram

Module 2: Digital CMOS Design Year 2025, (Faculty: Prof. Dr. Tanmay Sinha Roy)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Inverter characteristics
2	Combinational circuit design
3	Static CMOS logic families
4	dynamic, and dual rail logic
5	Sequential circuit design
6	design of latches and flip-flops
7	Delay in digital circuits
8	RC delay model
9	linear delay model
10	logical path efforts
11	Basic concept of SRAM
12	DRAM and ROM

Module 3: Analog CMOS Design Year 2025, (Faculty: Prof. Dr. Tanmay Sinha Roy)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Single stage amplifiers
2	Single stage amplifiers
3	Differential amplifiers
4	Differential amplifiers
5	Active loads
6	Active loads
7	Current mirrors
8	Current references
9	Voltage references
10	CMOS design rules
11	CMOS design rules
12	Switched capacitor circuits

Module 4: VLSI Design Automation Year 2025, (Faculty: Prof. Dr. Tanmay Sinha Roy)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Compaction
2	Placement
3	Floor planning
4	Floor planning
5	Routing Problems
6	Routing Problems
7	Concepts and Algorithms
8	Concepts and Algorithms
9	Physical Design cycle for FPGA’s partitioning for segmented and staggered models
10	Physical Design cycle for FPGA’s partitioning for segmented and staggered models
11	Physical Design cycle for FPGA’s routing for segmented and staggered models
12	Physical Design cycle for FPGA’s routing for segmented and staggered models

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	3	1	3	1	2	0	0	0	0	0	3
CO 2	2	2	3	1	1	0	0	0	0	0	2
CO 3	3	1	1	0	3	0	2	3	0	3	3
CO 4	3	3	3	0	3	0	0	2	0	2	3

University of Engineering and Management

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Syllabus for B.Tech Admission Batch 2023-2027

Name of the Course:	Power System Laboratory II	**Subject Code:**	PCC-EEE 691
Semester:	6th	**Course Nature:**	Practical
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
0	**0**	**3**	**1**

Detailed Syllabus

Module No	Description	Hrs.
1	Performance analysis and trip characteristic testing of a Numerical Overcurrent Relay for fault detection and mitigation. Hands-on **hardware** design and **simulation** of a numerical relay- performance and accuracy testing of the numerical overcurrent relay under various fault conditions, including normal load, overcurrent, and short-circuit scenarios and to determine its trip characteristics and response time.	3
2	Testing of time-dependent characteristics of on-time delay relay and off-time delay relay for application of load management. Design of simulation model for activation or deactivation of heavy electrical loads to reduce peak demand using on-time delay relay and off-time delay relay.	3
3	Performance analysis and testing of polarity, ratio and magnetization characteristics of CT and PT for proper transformer connection in a system. Design and simulation of connection diagram by CT-PT for protection of a distribution system using MATLAB/ETAP.	3
4	Testing of IDMT characteristics of under voltage relay and MATLAB based design for application in transmission line faults analysis.	3

5	Simulation of different IEEE distribution bus systems framework and assessment of voltage, current and load profile using AC load flow analysis implementing Gauss-Seidel method in ETAP/MATLAB platform.	3
6	Simulation of different IEEE distribution bus systems framework and assessment of voltage, current and load profile using AC load flow analysis implementing Newton Raphson method in ETAP/MATLAB platform.	3
7	Design and simulation of DC and AC distribution system with protection arrangements for assessment of current and voltage profile using MATLAB. Design of hands-on app-based hardware for Ring Main system.	3
8	Design and simulation of different transformer and generator protection schemes for an electrical network using ETAP/ MATLAB simulation.	3
9	Design and simulation of transient stability of a multi-machine system in a power network for reliable power supply using MATLAB	3
10	Testing of time-dependent voltage current characteristics of over current relay for application to generator protection, transformer protection and motor protection. Design of op-amp based overcurrent fault protection.	3
11.	Design of protection scheme of distribution substation using earth fault relay and testing of its IDMT characteristics.	3
12.	Development of bus admittance matrix of an interconnected power network for load flow analysis following IEEE standard using MATLAB. Design and AI based simulation of a microgid system using renewable and non-renewable micro-sources for demand side management (DSM).	3
13.	Simulation and analysis of different types of unsymmetrical and symmetrical faults exists in distribution system network using MATLAB	3
Total		39

Course Outcomes:

After completion of this course, the learners will be able to

CO1 Identify appropriate equipment and instruments for the particular experiments.

CO2 Perform the experiments related to transformers, various types of relays and validate the measured results by constructing the circuits with the appropriate instruments and safety precautions.

CO3 Design of experiments and analyze the experimental results obtained from simulation of problems related to stability, fault, power flow using appropriate IT tools like ETAP, MATLAB etc.

CO4 Data interpretation, proper communication with report writing, building effective teamwork and leadership.

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	0	0	0	0	1	0	0	0	0	0
CO2	3	3	0	0	1	0	0	2	0	0	1
CO3	0	0	3	2	2	0	0	1	1	0	0
CO4	2	1	0	0	0	1	1	1	2	2	1

University of Engineering and Management

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Syllabus for B.Tech Admission Batch 2023-2027

Name of the Course/ Subject	Microprocessor & Microcontroller Laboratory	Subject Code:	PCCEEE692
Semester	**6th**	**Course Nature**	**Practical**
Pre-Requisite(s):			
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
0	**0**	**3**	**1**

Course Objective(s):

1. To understand the architecture of 8-bit and16-bit microprocessor.
2. To study the architecture of 8-bit microcontroller
3. To learn the design aspects of I/O and Memory Interfacing circuits.
4. To design a microcontroller-based system
5. To get a brief idea of advanced processors

Detailed Syllabus

Module No.	Description	No of period
1	Design a circuit using 8051/Arduino/Raspberry Pi to measure the room temperature.	3
2	Design an Arduino based obstacle measurement system using Ultrasonic sensor.	3
3	Design an Arduino based Smoke detector.	3
4	Design a digital Tachometer using 8051/Arduino/Raspberry Pi.	3
5	Design a circuit using 8051/Arduino/Raspberry Pi to display digit 0 to 9 in a seven segment display.	3
6	Design an Analog to Digital converter using 8051/ Arduino /Raspberry Pi.	3

7	Design AI-Based Smart Traffic Light System using Arduino	3
8	Programming using 8086 to implement the concept of Binary to ASCII conversion	3
9	Programming using 8086 to implement the concept of Look Up table	3
10	Design a circuit to measure air pressure of a particular room using 8051/Arduino/Raspberry Pi	3
11	Design a strain gauge based weighing machine using 8051/Arduino/Raspberry Pi.	3
12	Design a circuit to control the speed of a stepper motor using 8051/Arduino/Raspberry Pi.	3
13	Design a circuit using 8051/Arduino/Raspberry Pi to measure the moisture using moisture sensor.	3
14	Familiarization with ARM processor architecture. Familiarization with process of storing and viewing the contents.	3
15	Familiarization with DSP processor architecture. Familiarization with process of storing and viewing the contents.	3

Course Outcomes:

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

CO1: Understand processor microarchitecture, design and performance evaluation concepts.
CO2: Understand the architecture and instruction set of 8086 and 8051.
CO3: Develop simple programs in 8086 and 8051
CO4: Build microcontroller-based applications

Suggested Learning Resources:

1. Advanced Microprocessors and Peripheral, Koshor M Bhurchandi, Ajay Kumar Ray, 3rd Edition, MC Graw hill education.
2. Microprocessor & Interfacing, D.V. Hall, Mc Graw Hill.
3. The 8051 Microcontroller and Embedded systems, Muhammad Ali Mazidi & J. G. Mazidi, Pearson Education.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	3	1	-	-	-	-	2
CO2	3	3	2	2	3	1	-	-	-	-	2
CO3	3	3	3	3	3	2	-	-	-	-	2
CO4	3	3	3	3	3	3	2	-	1	1	3

University of Engineering and Management

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Syllabus for B. Tech Admission Batch 2023

Name of the Course/ Subject	Analog and Digital Communication Laboratory	Subject Code:	PCEEE 693
Semester	**6th**	**Course Nature**	**Practical**
Pre-Requisite(s):	Analog and digital communication theory		
Lecture Periods/Week	TutorialPeriods/Week	PracticalPeriods/Week	Credits
3	**0**	**3**	**1**

Course Objective(s):

The purpose of learning this course is to-

Serial No	Course Objective
1	Understand various modulation and demodulation techniques in time domain and frequency domain.
2	Comprehend pulse analog modulation and demodulation techniques
3	Impart hands on experience and train the students to analyze various base band and pass band modulation and demodulation techniques and understand their performance
4	Comprehend various coding techniques on transmission medium in digital communications

Detailed Syllabus

Module No.	Description	No of period
1.Analog Communication	1. Measurement of modulation index of an AM signal. 2. Measurement of output power with varying modulation index an AM signal (for both DSB- & SSB). 3. Measurement of distortion of the demodulated output with varying modulation index of an AM signal (for both DSB-SC & SSB). 4. Measurement of power of different frequency components of a frequency modulated signal & the measurement of the bandwidth. 5. Design a PLL using VCO & to measure the lock frequency. 6. Design a FM demodulator using PLL. 7. Measurement of SNR of a RF amplifier. 8. Measurement of selectivity,sensitivity,fidelity of a superheterodyne receiver. 9. Study of waveforms of various functional points (output of RF,IF & video) of a B/W TV receiver. 10. Study of the vertical & horizontal sweep of the time base unit of a B/W TV. 11. One innovative experiment.	3

2. Digital Communication	1. Design, implementation and study of all the properties of 7-length and 15-length pn sequences using shift register. 2. Study of PAM and demodulation. 3. Study of PCM and demodulation. 4. Study of line coders: polar/unipolar/bipolar NRZ, RZ and Manchester. 5. Study of delta modulator and demodulator. 6. Study of adaptive delta modulator and demodulator. 7. Study of BPSK modulator and demodulator. 8. Study of BFSK modulator and demodulator. 9. Study of ASK modulator and demodulator. 10. Study of QPSK modulator and demodulator. 11. Simulation study of probability of symbol error for BPSK modulation. 12. Simulation study of probability of symbol error for BFSK modulation.	3

Course Outcomes:

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

LO1. Understand various modulation and demodulation techniques in time domain and frequency domain.
LO2. Comprehend pulse analog modulation and demodulation techniques
LO3. Analyze various base bandand pass band modulation and demodulation techniques and understand their performance
LO4. Comprehend various coding techniques on transmission medium in digital communications.

CO-PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	1	-	-	-	-	-	-
CO2	2	2	-	1	2	-	-	-	-	-	-
CO3	3	3	2	2	2	-	-	-	-	-	-
CO4	2	2	1	2	3	-	-	-	1	1	1