University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus

8th Semester Syllabus for B.Tech
(Admission Batch 2022)

Electrical & Electronics Engineering									
B.Tech. 4th Year Course Structure									
8th Semester									
Sl No	**Type of Course**	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**S**	**Total Contact**	**Credit Points**
Theory									
1	Professional Core Courses	PCC-EEE 801	Digital signal processing	3	1	0		4	3
2	Professional Elective Courses	PEC- EEE 801	A. Fiber Optic Communications B. Mobile Communication and Networks	3	0	0		3	3
3	Open Elective Courses	OEC- EEE 801	A. Electrical Materials B. Power Plant Engineering	3	0	0		3	3
4	Humanities and social sciences including Management	ESP801	Essential Studies For Professionals VIII	0	0	2		2	0.5
SESSIONAL									
5	Project. Seminar and Industrial Training	PW-EEE881	Project stage-II				8	8	3
6	Project. Seminar and Industrial Training	PW-EEE882	Grand Viva				0	0	3
7	Project. Seminar and Industrial Training	INP881	Internship II						4
8	Humanities and social sciences including Management	SDP881	Skill Development For Professionals VIII –VI				2	2	0.5
Value Added Courses									
9	Massive Open Online Courses (MOOCs)	MOOCS	Massive Open Online Courses (MOOCs)						
10	Industry and Foreign Certification (IFC)	IFC	Industry and Foreign Certification (IFC)						
11	Mandatory Additional Requirements (MAR)	MAR881	Mandatory Additional Requirements (MAR)						
Total Credit Points of Semester				**9**	**1**	**2**	**10**	**22**	**20**

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus

Syllabus for B.Tech Admission Batch 2022

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

Lecture Hours: 41 **Subject Code: PCCEEE 801**

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 2022

Subject Name: Fiber Optic Communications **Credit: 3**

Lecture Hours: 40 **Subject Code: PECEEE 801A**

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: Analog & Digital Communication

Course objectives:

1. **Understand the properties of the optical fibers and optical components and the operation of lasers, LEDs, and detectors.**
2. **Analyze system performance of optical communication systems.**
3. **Design optical networks and understand non-linear effects in optical fibers.**

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	TEXT BOOK	Mapped Chapter
1	Introduction to Fiber Optic Communications	Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.	https://ocw.mit.edu/courses/1-264j-database-internet-and-systems-integration-technologies-fall-2013/resources/mit1_264jf13_lect_35/	6	Study of Frequency modulation and demodulation using Optical fiber.	J. Keiser, Fibre Optic communication , McGraw-Hill, 5th Ed. 2013	1, 2
2	Optical Fibers	Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.	https://ocw.mit.edu/courses/1-264j-database-internet-and-systems-integration-technologies-fall-2013/resources/mit1_264jf13_lect_35/	6	Write a program to study the modes of a step index cylindrical core optical fiber.	S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.	3, 5
3	Optical Sources	Optical sources - LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.	https://ocw.mit.edu/courses/1-264j-database-internet-and-systems-integration-technologies-fall-2013/resources/mit1_264jf13_lect_35/	10	Study of Characteristics of LASER diode. Study of I-V Characteristics of Fiber optic LED and Photodetector.	J. Keiser, Fibre Optic communication , McGraw-Hill, 5th Ed. 2013	3, 4
4	Optical Switches	Optical switches - coupled mode analysis of directional couplers, electrooptic switches. Optical amplifiers - EDFA, Raman amplifier. WDM and DWDM systems. Principles of WDM networks.	https://ocw.mit.edu/courses/1-264j-database-internet-and-systems-integration-technologies-fall-2013/resources/mit1_264jf13_lect_35/	12	Study of setting up an analog and digital link using optical fiber.	J. Keiser, Fibre Optic communication , McGraw-Hill, 5th Ed. 2013	6, 7

5	Non-Linear Effects in Fiber Optic Communications	Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and solition based communication.	https://ocw.mit.edu/courses/1-264j-database-internet-and-systems-integration-technologies-fall-2013/resources/mit1_264jf13_lect_35/	6	Measurement of numerical aperture of the plastic fiber provided using 660 nm wavelength	G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.	1, 2

Course outcome:

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

CO1. Understand the principles fiber-optic communication, the components and the bandwidth advantages.
CO2. Understand the properties of the optical fibers and optical components.
CO3. Analyze system performance of optical communication systems.
CO4. Analyze system performance of optical communication systems and design optical networks and understand non-linear effects in optical fibers

Suggested Learning Resources:

Text books:

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).

Reference books:

1. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
2. J. Gowar, Optical communication systems, Prentice Hall India, 1987.
3. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.
4. G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
5. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997
6. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).

Lesson Plan:

Module No.1: Introduction to Fiber Optic Communications Year 2025, (Faculty: Prof. Dr. Tanmay Sinha Roy)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Introduction to vector nature of light
2	propagation of light
3	propagation of light in a cylindrical dielectric rod
4	Ray model
5	wave model
6	wave model

Module No.2: Optical Fibers. Year 2025, (Faculty: Prof. Dr. Tanmay Sinha Roy)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Different types of optical fibers
2	Modal analysis of a step index fiber
3	Signal degradation on optical fiber due to dispersion and attenuation
4	Signal degradation on optical fiber due to dispersion and attenuation
5	Fabrication of fibers and measurement techniques like OTDR
6	Fabrication of fibers and measurement techniques like OTDR

Module No.3: Optical Sources Year 2025, (Faculty: Prof. Dr. Tanmay Sinha Roy)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Optical sources - LEDs and Lasers
2	Photo-detectors - pin-diodes
3	APDs, detector responsivity
4	Noise
5	Optical receivers
6	Optical link design
7	BER calculation
8	quantum limit
9	power penalties
10	power penalties

Module No.4: Optical Switches Year 2025, (Faculty: Prof. Dr. Tanmay Sinha Roy)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Optical switches
2	coupled mode analysis of directional couplers
3	coupled mode analysis of directional couplers
4	electrooptic switches
5	Optical amplifiers
6	EDFA
7	Raman amplifier
8	Raman amplifier
9	WDM Systems
10	DWDM Systems
11	Principles of WDM networks
12	Principles of WDM networks

Module No.5: Non-Linear Effects in Fiber Optic Communications Year 2025, (Faculty: Prof. Dr. Tanmay Sinha Roy)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Nonlinear effects in fiber optic links
2	Nonlinear effects in fiber optic links
3	Concept of self-phase modulation
4	Concept of self-phase modulation
5	group velocity dispersion
6	solition based communication

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

Institute of Engineering & Management, Salt Lake Campus

Syllabus for B.Tech Admission Batch 2022-2026

Subject Name: Mobile Communication and Networks **Credit: 3**

Lecture Hours: 32 **Subject Code: PECEEE801B**

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. **Pratik De Sarkar**

Pre-requisite: Analog and Digital Communication

Course objectives:

1. Understand the working principles of the mobile communication systems.
2. Understand the relation between the user features and underlying technology
3. Analyze mobile communication systems for improved performance

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	TEXT BOOK	Mapped Chapter
1.	Cellular concepts	Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G, 3G and 4G cellular standards.	***International Academia:*** (https://web.stanford.edu/class/cs444n/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** NetBox, OpenStreetMap (OSM), DATADOG	6	WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990	1, 2, 7, 10, 11, 12
2.	Signal propagation and Propagation mechanism	Reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small-scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate.	***International Academia:*** (https://web.stanford.edu/class/cs444n/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** NetBox, OpenStreetMap (OSM), DATADOG	10	WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990	2, 8, 14, 18
3.	Channel Capacity and Multiple Access Techniques	Capacity of flat and frequency selective channels. Antennas-Antennas for mobile terminal- monopole antennas, PIFA, base station antennas and arrays. Multiple access schemes-FDMA, TDMA, CDMA and SDMA. Modulation schemes-BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.	***International Academia:*** (https://web.stanford.edu/class/cs444n/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** NetBox, OpenStreetMap (OSM), DATADOG	6	WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990	4, 6, 7, 8, 16

4.	Receiver Architectures and Diversity Schemes	Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme.	***International Academia:*** (https://web.stanford.edu/class/cs444n/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** NetBox, OpenStreetMap (OSM), DATADOG	4	WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990	4, 7, 9, 12, 16
5.	MIMO Systems and Space	MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff.Performance measures- Outage, average snr, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.	***International Academia:*** (https://web.stanford.edu/class/cs444n/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** NetBox, OpenStreetMap (OSM), DATADOG	6	WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990	5, 6, 8, 15, 16

Course outcome:

CO1: Understand the relationship between user features and the underlying technology to explain the working principles of mobile communication systems.

CO2: Analyze mobile communication systems and apply suitable modulation schemes to enhance their performance.

CO3: Evaluate noise in mobile communication system.

CO4: Design MIMO integrated advanced communication system.

Suggested Learning Resources:

Text Books:

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.

Reference Books:

1. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
2. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.
3. VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.

Lesson Plan:
Module No.:1 Module Name: Cellular concepts (Faculty: Pratik De Sarkar)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Cell structure,
2	frequency reuse,
3	cell splitting, channel assignment,
4	handoff, interference,
5	capacity, power control;
6	Wireless Standards: Overview of 2G and 3G cellular standards.

Module No.:2 Module Name: Signal propagation and Propagation mechanism (Faculty: Pratik De Sarkar)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Reflection, refraction, diffraction and scattering,
2	large scale signal propagation and lognormal shadowing.
3	Fading channels-Multipath and small-scale fading- Doppler shift,
4	statistical multipath channel models,
5	narrowband and wideband fading models,
6	power delay profile, average and rms delay spread,
7	coherence bandwidth and coherence time,
8	flat and frequency selective fading,
9	slow and fast fading,
10	average fade duration and level crossing rate.

Module No.:3 Module Name: Channel Capacity and Multiple Access Techniques (Faculty: Pratik De Sarkar)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Capacity of flat and frequency selective channels
2	Antennas-Antennas for mobile terminal- monopole antennas, PIFA, base station antennas and arrays.
3	Multiple access schemes-FDMA, TDMA, CDMA and SDMA.
4	Modulation schemes- BPSK, QPSK and variants,
5	QAM, MSK and GMSK,
6	multicarrier modulation, OFDM.

Module No.:4 Module Name: Receiver Architectures and Diversity Schemes (Faculty: Pratik De Sarkar)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Diversity receivers- selection
2	MRC receivers, RAKE receiver,
3	equalization: linear-ZFE and adaptive, DFE.
4	Transmit diversity-Altamonte scheme.

Module No.:5 Module Name: MIMO Systems and Space (Faculty: Pratik De Sarkar)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	MIMO and space time signal processing,
2	spatial multiplexing, diversity/multiplexing tradeoff.
3	Performance measures- Outage, average snr, average symbol/bit error rate.
4	System examples- GSM, EDGE,
5	GPRS, IS-95,
6	CDMA 2000 and WCDMA

CO-PO Mapping:

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

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

Syllabus for B.Tech Admission Batch 2022

Subject Name: Electrical Material **Credit: 3**
Lecture Hours: 40 **Subject Code: OECEEE801A**

List of Faculty Members handling the Subject –

1. Dr. Nirban Chakraborty

Study Material	Coursera

Course Objective:

The purpose of learning this course is

1. To understand the general properties of any electrical materials used for engineering and technologies.

Detailed Syllabus:

Module number	Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
1	**Conductivity of Metal**: Introduction, factors affecting the resistivity of electrical materials, motion of an electron in an electric field, Equation of motion of an electron, current carried by electrons, mobility, energy levels of a molecule, emission of electrons from metals, thermionic emission, photoelectric emission, field emission, effect of temperature on electrical conductivity of metals, electrical conducting materials, thermal properties, thermal conductivity of metals, thermoelectric effects.	**International Academia:** https://ocw.mit.edu/courses/3-15x-electrical-optical-and-magnetic-materials-and-devices-spring-2020/	8	NA	Study Material	NA

2	**Dielectric Properties**: Introduction, effect of a dielectric on the behavior of a capacitor, polarization, the dielectric constant of monatomic gasses, frequency dependence of permittivity, dielectric losses, significance of the loss tangent, dipolar relaxation, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulators, insulating materials, ferroelectricity, piezoelectricity.	**International Academia:** https://ocw.mit.edu/courses/3-15x-electrical-optical-and-magnetic-materials-and-devices-spring-2020/	**10**	NA	Study Material	NA
3	**Magnetic properties of Materials:** Introduction, Classification of magnetic materials, diamagnetism, paramagnetic, ferromagnetism, magnetization curve, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials, magnetic resonance.	**International Academia:** https://ocw.mit.edu/courses/3-15x-electrical-optical-and-magnetic-materials-and-devices-spring-2020/	**8**	NA	Study Material	NA
4	**Semiconductors:** Energy band in solids, conductors, semiconductors and insulators, types of semiconductors, Intrinsic semiconductors, impurity type semiconductor, diffusion, the Einstein relation, hall effect, thermal conductivity of semiconductors, electrical conductivity of doped materials.	**International Academia:** https://ocw.mit.edu/courses/3-15x-electrical-optical-and-magnetic-materials-and-devices-spring-2020/	**8**	NA	Study Material	NA

Course Outcome:

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

CO1. Remember the Conductivity of the metal for different applications; understand the dielectric Properties of materials.
CO2. Apply the concept of semiconductors
CO3. Analyze the magnetic properties of materials; evaluate electrical conductivity of the materials.
CO4. Construct the junction of semiconductor materials

Suggested Learning Resources

Text Books:

1. C.S.Indulkar and S. Thiruvengadam, S., “An Introduction to Electrical Engineering.

Reference Books:

1. Kenneth G. Budinski,, “Engineering Materials: Prentice Hall of India, New Delhi.

Lesson Plan:

Module No 1: Conductivity of Metal (Faculty: Dr. Nirban Chakraborty)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Introduction, factors affecting the resistivity of electrical materials
2	Motion of an electron in an electric field, Equation of motion of an electron, current carried by electrons.
3	Mobility, energy levels of a molecule,
4	Emission of electrons from metals, thermionic emission,
5	Photoelectric emission, field emission,
6	Effect of temperature on electrical conductivity of metals,
7	Electrical conducting materials, thermal properties
8	Thermal conductivity of metals, thermoelectric effects.

Module No 2: Dielectric Properties (Faculty: Dr. Nirban Chakraborty):

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Introduction, effect of a dielectric on the behavior of a capacitor, polarization.
2	The dielectric constant of monatomic gasses.
3	Frequency dependence of permittivity, dielectric losses.
4	Significance of the loss tangent, dipolar relaxation
5	Frequency and temperature dependence of the dielectric constant,
6	Dielectric properties of polymeric system, ionic conductivity in insulators,
7	Dielectric properties of polymeric system, ionic conductivity in insulators,
8	Insulating materials
9	Ferroelectricity
10	Piezoelectricity.

Module No 3: Magnetic properties of Materials (Faculty: Dr. Nirban Chakraborty):

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Introduction, Classification of magnetic materials.
2	Diamagnetism, paramagnetic, ferromagnetism
3	Diamagnetism, paramagnetic, ferromagnetism
4	Magnetization curve, the hysteresis loop
5	Factors affecting permeability and hysteresis loss
6	Common magnetic materials.
7	Magnetic resonance.
8	Numerical Discussion

Module No 4: Semiconductors (Faculty: Dr. Nirban Chakraborty):

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Energy band in solids, conductors, semiconductors and insulators
2	Types of semiconductors, Intrinsic semiconductors, impurity type semiconductor
3	Types of semiconductors, Intrinsic semiconductors, impurity type semiconductor
4	Diffusion, the Einstein relation.
5	Hall effect,
6	Thermal conductivity of semiconductors,
7	Electrical conductivity of doped materials
8	Electrical conductivity of doped materials

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	13	2	2	3	0	0	0	0	0	0	0
CO2	2	2	3	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

Subject Name: Power Plant Engineering **Credit: 3**

Lecture Hours: 40 **Subject Code: OEC-EEE 801B**

Study material	Coursera	Nptel	LinkedIn Learning	Infosys Springboard

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

List of Faculty Members handling the Subject –

Prof. Dr. Manas Mukherjee

Pre-requisite: Power System I & II

Course objectives:

1. Understand the fundamentals of power generation
2. Analyze variable load problems and their solutions
3. Evaluate the economic aspects of power plant selection and operation
4. Acquire knowledge of steam power plant systems and operations
5. Gain proficiency in other power plant technologies

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	TEXT BOOK	Mapped Chapter
1	**Introduction**	Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion, steam generators and steam prime movers, steam condensers, water turbines.	https://ocw.mit.edu/courses/6-061-introduction-to-electric-power-systems-spring-2011/	3	-	Power Plant Engineering", by B. Vijaya Ramnath C. Elanchezhian, L. Saravanakumar, Published by Dreamtech Press, New Delhi	1
2	**Variable**	Load problem: industrial production and power generation compared, ideal and realised load curves, terms and factors. effect of variable load on power plant operation, methods of meeting the variable load problem.	https://ocw.mit.edu/courses/6-061-introduction-to-electric-power-systems-spring-2011/	3	-	Power Plant Engineering", by B. Vijaya Ramnath C. Elanchezhian, L. Saravanakumar, Published by Dreamtech Press, New Delhi	1
3	**Power plant economics and selection**	Effect of plant type on costs, rates, fixed elements, energy element, customer element and investor's profit; depreciation and replacement, theory of rates. Economics of plant section section, other consideration in plant selection	https://ocw.mit.edu/courses/6-061-introduction-to-electric-power-systems-spring-2011/	3		Power Plant Engineering", by B. Vijaya Ramnath C. Elanchezhian, L. Saravanakumar, Published by Dreamtech Press, New Delhi	5
4	**Steam power plant**	Power plant boilers including critical and super critical boilers, fluidized bed boilers, boilers mountings and accessories, general layout of a team power plant, different systems such as fluid handling system, combustion system, draft, ash handling system, feed water treatment and condenser and cooling system, turbine auxiliary systems such as governing feed heating, turbine mountings, lubrication, flange heating and gland leakage, operation and maintenance of steam power plant, heat balance and efficiency, trouble shooting and remedies.	https://ocw.mit.edu/courses/6-061-introduction-to-electric-power-systems-spring-2011/	11		Power Plant Engineering", by B. Vijaya Ramnath C. Elanchezhian, L. Saravanakumar, Published by Dreamtech Press, New Delhi	2

5	**Diesel power plant**	General layout, performance of diesel engine, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, cooling system, diesel plant operation and efficiency, heat balance, trouble shooting and remedies.	https://ocw.mit.edu/courses/6-061-introduction-to-electric-power-systems-spring-2011/	6		Power Plant Engineering", by B. Vijaya Ramnath C. Elanchezhian, L. Saravanakumar, Published by Dreamtech Press, New Delhi	4
6	**Gas turbine power plant:**	Elements of gas turbine power plants, regeneration and reheating, cogeneration auxiliary systems such as fuel, controls and lubrication, operation and maintenance performance and trouble shooting and remedies.	https://ocw.mit.edu/courses/6-061-introduction-to-electric-power-systems-spring-2011/	5		Power Plant Engineering", by B. Vijaya Ramnath C. Elanchezhian, L. Saravanakumar, Published by Dreamtech Press, New Delhi	4
7	**Nuclear power plant**	Principles of nuclear energy, basic components of nuclear reactions, nuclear power station/trouble shooting and remedies.	https://ocw.mit.edu/courses/22-921-nuclear-power-plant-dynamics-and-control-january-iap-2006/	3		Power Plant Engineering", by B. Vijaya Ramnath C. Elanchezhian, L. Saravanakumar, Published by Dreamtech Press, New Delhi	3
8	**Electrical system**	generators and generator cooling, transformers and their cooling, bus bar. etc.	https://ocw.mit.edu/courses/6-061-introduction-to-electric-power-systems-spring-2011/	3		Power Plant Engineering", by B. Vijaya Ramnath C. Elanchezhian, L. Saravanakumar, Published by Dreamtech Press, New Delhi	2
9	**Instrumentation**	Purpose, classification, selection and application, recorders and their use, listing of various control rooms	https://ocw.mit.edu/courses/6-061-introduction-to-electric-power-systems-spring-2011/	3		Power Plant Engineering", by B. Vijaya Ramnath C. Elanchezhian, L. Saravanakumar, Published by Dreamtech Press, New Delhi	1, 2

Course outcome:

CO1. Demonstrate a comprehensive understanding of power generation principles

CO2. Analyze and evaluate the challenges and solutions associated with variable loads

CO3. Assess the economic feasibility of different power plant options

CO4: Acquire practical knowledge of steam power plant systems and operations:

Suggested Learning Resources: ***Text book, study material, NPTEL, and Coursera courses***

Text books:

1. **"Power Plant Engineering", by B. Vijaya Ramnath C. Elanchezhian, L. Saravanakumar, Published by Dreamtech Press, New Delhi**

Reference books:

1. Verma Mahesh ,"Power Plant Engg" , Metropolitan Book Company Pvt. Ltd New Delhi
2. "Modern Power Station Practice", Central Electricity Generating Board(UK)vol.l to 7
3. "Power Plant Technology", Vakil

Lesson Plan:

Module No.: 1 Module Name Introduction (Faculty: Dr. Manas Mukherjee)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Power and energy, sources of energy,
2	review of thermodynamic cycles related to power plants, fuels and combustion,
3	steam generators and steam prime movers, steam condensers, water turbines.

Module No.: 2 Module Name Variable (Faculty: Dr. Manas Mukherjee)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Load problem: industrial production and power generation compared,
2	Ideal and realised load curves, terms and factors.
3	Effect of variable load on power plant operation, methods of meeting the variable load problem.

Module No.: 3 Module Name Power plant economics and selection (Faculty: Dr. Manas Mukherjee)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Effect of plant type on costs, rates, fixed elements, energy element,
2	customer element and investor's profit; depreciation and replacement, theory of rates.
3	Economics of plant section section, other consideration in plant selection

Module No.: 4 Module Name Steam power plant (Faculty: Dr. Manas Mukherjee)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Power plant boilers including critical and super critical boilers,
2	fluidized bed boilers,
3	boilers mountings and accessories,
4	general layout of a team power plant,
5	different systems such as fluid handling system
6	combustion system, draft, ash handling system,
7	feed water treatment and condenser and cooling system,
8	turbine auxiliary systems such as governing feed heating, turbine mountings, lubrication
9	flange heating and gland leakage, operation and maintenance of steam power plant
10	heat balance and efficiency, trouble shooting and remedies.
11	Assignment problem discussion

Module No.: 5 Module Name: Diesel power plant (Faculty: Dr. Manas Mukherjee)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	General layout, performance of diesel engine, fuel system,
2	lubrication system, air intake and admission system, supercharging system,
3	exhaust system, cooling system, diesel plant operation and efficiency
4	heat balance, trouble shooting and remedies.

Module No.: 6 Module Name: Gas turbine power plant: (Faculty: Dr. Manas Mukherjee)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Elements of gas turbine power plants
2	regeneration and reheating
3	cogeneration auxiliary systems such as fuel
4	controls and lubrication, operation
5	maintenance performance and trouble shooting and remedies

Module No.: 7 Module Name: Nuclear power plant: (Faculty: Dr. Manas Mukherjee)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Principles of nuclear energy
2	basic components of nuclear reactions
3	nuclear power station/trouble shooting and remedies

Module No.: 8 Module Name: Electrical system: (Faculty: Dr. Manas Mukherjee)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	generators
2	generator cooling
3	transformers and their cooling, bus bar. etc.

Module No.: 9 Module Name: Instrumentation: (Faculty: Dr. Manas Mukherjee)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Purpose, classification
2	selection and application, recorders, and their use
3	listing of various control rooms

CO-PO Mapping:

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