ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

SCHOOL OF ELECTRONIC SCIENCES

Minor in Communication Engineering (Next Generation Technology)

Curriculum and Syllabus

(**2023-24 admitted students**)

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, MahalaxmiVihar,Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

School/ Department: SCHOOL OF ELECTRONIC SCIENCES

Abbreviation used:

AC	Audit course	LC	Laboratory Course	PA	Practical Assessment
PC	Professional Core	PR	Project/ Practical/ Internship	L	Lecture
PE	Professional Elective	SE	Seminar/ Expert Lecture/ Etc.	T	Tutorial
OE	Open Elective	IA*	Internal Assessment	P	Practical
MC/BS/HS	Mandatory/ Common Course	EA	End-Semester Assessment		
ACC	Advanced Competency Course				
*Internal Assessment Mark (40 marks) consists of (i) Mid Semester (20 marks) (ii) Quiz/ Assignment/Attendance (20 marks)					

Minor Degree in "Communication Engineering (Next Generation Technology)"

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	PE	EI3263	Modern Analog and Digital Communication	3	0	0	3	40	60	-	100
2		EI3563	Modern Analog and Digital Communication Lab	0	0	3	1.5	-	-	100	100
3		EI3264	Digital Signal Processing	3	0	0	3	40	60	-	100
4		EI4563	Digital Signal Processing Lab	0	0	3	1.5	-	-	100	100
5		EI4265	Information Theory and Coding	3	0	0	3	40	60	-	100
6		EI4267	Wireless and Data communication	3	0	0	3	40	60	-	100
7		EI4264	Optical Fiber and Satellite Communication	3	0	0	3	40	60	-	100
			Total	**15**	**0**	**3**	**18**	**200**	**300**	**200**	**700**

Minor Degree in

Communication Engineering

(Next Generation Technology)

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, MahalaxmiVihar,Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
MODERN ANALOG AND DIGITAL COMMUNICATION	EI3263	3-0-0	3

Prerequisite: Signals and Systems, Basic Electronics, Probability and Statistics

Course Outcomes:

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

CO1: Analyze different modulation schemes

CO2: Compute the spectrum of different signals

CO3: Evaluate the design and performance of various AM and FM transmitters and receivers

CO4: Investigate the fundamentals of digital communication schemes

Module I: Fundamentals of Analog Communication **06 Hours**

Review of signals and systems, Frequency domain representation of signals, Elements of Electrical communication systems – Modulation and its needs and types – Fundamental physical limitations – Electromagnetic spectrum and Areas of Applications. Amplitude modulation – Full AM, DSBSC and SSB – Generation and detection methods – VSB – Frequency translation – FDM – Nonlinear distortion and inter modulation.

Module II: Angle modulation **08 Hours**

Phase and frequency modulation – NBFM – WBFM – Multitone FM – Transmission Bandwidth of FM – Direct and indirect generation of FM – Demodulation methods – Nonlinear effects – FM Versus AM.

Module III: Pulse analog& Digital Modulation **08 Hours**

TDM, types of pulse modulation-PAM, PWM, PPM, Generation and demodulation of PAM, PWM and PPM,TDM. Pulse Digital Modulation: Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization and coding, Quantization error, companding in PCM systems. Differential PCM Systems (DPCM). Delta Modulation: Delta Modulation, its drawbacks, adaptive delta modulation, comparison of PCM and delta and adaptive delta modulation, noise in PCM and DM systems.

Module IV: Digital Modulation Techniques **08 Hours**

Introduction, BPSK, DPSK, DEPSK, QPSK, M-ary PSK, ASK, QASK, BFSK, M-ary FSK, MSK, Duobinary Encoding, Comparison of digital modulation techniques, Partial response signalling.

Total lecture hours: **30 Hours**

Text Book:

1. Simon Haykin, Communication Systems, 4th Edition, Wiley & Sons.
2. H. Taub and D. Schilling, Principle of Communication Systems, 3rd Edition, TMH, 2007.

Reference Book:

1. K. Sam Shanmugam, Analog and Digital Communication, Wiley, 2005.
2. B. P. Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, 4th Edition.

CO-PO-PSO MAPPING

MODERN ANALOG AND DIGITAL COMMUNICATION															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	3	2	2	3	1	1	1	1	2	2	2	3	2	2
CO2	3	3	2	2	3	1	1	1	1	2	2	2	3	2	2
CO3	3	3	3	2	3	1	1	1	1	2	2	2	3	2	2
CO4	3	3	3	3	3	2	2	2	1	3	3	3	3	3	3
Average	3	3	2.5	2.3	3	1.3	1.3	1.3	1	2.3	2.3	2.3	3	2.3	2.3
Level of Correlation: 3 - High 2 - Medium 1 - Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, MahalaxmiVihar,Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
MODERN ANALOG AND DIGITAL COMMUNICATION LABORATORY	**EI4564**	0-0-3	1.5

Prerequisite: Basic working knowledge of MATLAB, Simulink, LabVIEW.

Course Outcomes:

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

- **CO1:** Implement the basic theories of communication system
- **CO2:** Design different types of modulators and demodulators like AM, FM, PWM, PAM, PPM
- **CO3:** Verify the operation of multiplexing, mixer circuit, PLL characteristics etc.
- **CO4:** Simulate various digital modulation schemes using MATLAB/Simulink/LabVIEW.

LIST OF EXPERIMENTS

(Any 10 experiments should performed and should be implemented using MATLAB/Simulink/LabVIEW)

EXP 1 : Basic Measurements using Spectrum Analyzer
EXP 2 : Study of Amplitude Modulation and Demodulation
EXP 3 : DSB-SC modulator and Demodulator
EXP 4 : SSB Modulation and Demodulation
EXP 5 : Study of Frequency Modulation and Demodulation
EXP 6 : Study of PAM, PPM and PWM Modulator and Demodulator
EXP 7 : TDM Multiplexer and Demultiplexer
EXP 8 : FDM Multiplexer and Demultiplexer
EXP 9 : PN Sequence Verification – Check whether the given sequence is a PN sequence by verifying Balance Property, Run Length Property, and Autocorrelation Property.
EXP 10 : Modeling – Generate different mobile channels (e.g., Rayleigh, Rician) and verify their properties (impulse response, frequency response, histogram).
EXP 11 : ASK, FSK, PSK Modulation and Demodulation – Implement using Simulink.
EXP 12 : BER Analysis of BPSK – Plot BER curves in AWGN and Rayleigh channels.
EXP 13 : BER Analysis of BFSK – Plot BER in AWGN and Rayleigh channels using coherent/non-coherent detection.
EXP 14 : QPSK vs 4-QAM – Compare BER performance in AWGN and Rayleigh fading channels.
EXP 15 : BER Analysis of MSK – Analyze MSK performance in different channel conditions.
EXP 16 : Error Detection using Hamming Code – Simulate transmission with Hamming coding and evaluate BER in AWGN and Rayleigh channels.
EXP 17 : A mini-project/case study suitable for students to simulate a full communication system including modulation, channel effects, and decoding.

Text Book:

1. S. Haykin, Digital Communications, 1st ed. New York, NY, USA: Wiley, 1988.
2. J. G. Proakis and M. Salehi, Digital Communications, 5th ed. New York, NY, USA: McGraw-Hill, 2008.
3. P Ramakrishna Rao, “Analog Communication” McGraw Hill, 2011
4. Simon Haykin and Michael Moher, "Analog and Digital Communications ", John Wiley Student, 5thEdn.

Reference Book:

1. L. W. Couch, Digital and Analog Communication Systems, 8th ed. Boston, MA, USA: Pearson, 2013.
2. K. Choi and H. Liu, Communication Systems Modeling and Simulation using MATLAB and Simulink, Hoboken, NJ, USA: Wiley, 2013.
3. R. G. Lyons, Understanding Digital Signal Processing, 3rd ed. Boston, MA, USA: Pearson, 2010.
4. Schaum's Outlines on " Analog and Digital Communication", Hwei P Hsu, McGraw Hill, 3rdEdn.

CO-PO-PSO MAPPING

MODERN ANALOG AND DIGITAL COMMUNICATION LABORATORY															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	3	2	2	3	1	1	1	1	2	2	2	3	2	2
CO2	3	3	2	2	3	1	1	1	1	2	2	2	3	2	2
CO3	3	3	3	2	3	1	1	1	1	2	2	2	3	2	2
CO4	3	3	3	3	3	2	2	2	1	3	3	3	3	3	2
Average	3.0	3.0	2.5	2.25	3.0	1.25	1.25	1.25	1.0	2.25	2.25	2.25	3.0	2.25	2.0
Level of Correlation:			3 - High			2 - Medium				1 - Low					

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, MahalaxmiVihar,Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
DIGITAL SIGNAL PROCESSING	EI3264	3-0-0	3

Prerequisite: Basic knowledge of Signals and systems, Fourier series and transform differential equations.

Course Outcomes:

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

CO1: Analyze the mathematical operation on discrete signals and systems

CO2: Implement Z transform and the inverse Z transform of discrete signals

CO3: Analyze DFT, Inverse DFT, and FFT operations on discrete-time signals

CO4: Model Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) filters, and evaluate the performance to meet expected system specifications

Module I: **08 Hours**

INTRODUCTION TO DIGITAL SIGNAL PROCESSING: Signals, systems, and signal processing, Classification of signals, The concept of frequency in continuous-time and discrete-time signals, Analog-to-Digital and Digital-to-Analog conversion.

DISCRETE-TIME SIGNALS AND SYSTEMS: Discrete-time signals and Discrete-time systems, Analysis of discrete-time linear time-invariant systems, Discrete-time systems described by difference equations, Implementation of discrete-time systems, Correlation of discrete-time signals.

Module II: **08 Hours**

THE Z-TRANSFORM AND ITS APPLICATION TO THE ANALYSIS OF LTI SYSTEMS: The Direct Z-Transform, The Inverse Z-Transform, Properties of the Z-Transform, Rational Z-Transforms, Poles and Zeros, Pole Location and Time-Domain Behaviour for Causal Signals, The System Function of a Linear Time-Invariant System, Inversion of the Z-Transform, The Inverse Z-Transform by Contour Integration, The Inverse Z-Transform by Power Series Expansion, The Inverse Z-Transform by Partial-Fraction Expansion, Solution of Difference Equations, Analysis of Linear Time-Invariant Systems in the Z-Domain, Response of Systems with Rational System Functions, Response of Pole-Zero Systems with Nonzero Initial Conditions, Transient and Steady-State Responses, Causality, and Stability.

Module III: **09 Hours**

THE DISCRETE FOURIER TRANSFORM: ITS PROPERTIES AND APPLICATIONS: Frequency Domain Sampling: The Discrete Fourier, Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform (DFT), The DFT as a Linear Transformation, Relationship of the DFT to Other Transforms, Properties of the DFT, Periodicity. Linearity. and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties, Linear Filtering Methods Based on the DFT, Use of the DFT in Linear Filtering, Filtering of Long Data Sequences, Frequency Analysis of Signals Using the DFT.

EFFICIENT COMPUTATION OF THE DFT: FAST FOURIER TRANSFORM ALGORITHMS: Efficient Computation of the DFT FFT Algorithms, Radix-2 FFT Algorithms, Implementation of FFT Algorithms, Applications of FFT Algorithms, Efficient Computation of the DFT of Two Real Sequences, Efficient Computation of the DFT of a 2N-Point Real Sequence, Use of the FFT Algorithm in Linear Filtering and Correlation.

Module IV: **05 Hours**

DESIGN OF DIGITAL FILTERS: Design of FIR Filters, Symmetric and Antisymmetric FIR Filters, Design of Linear-Phase FIR Filters Using Windows, by the Frequency-Sampling Method, IIR Filter Design by Approximation of Derivatives, IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation.

Total lecture hours: **32 Hours**

Text Book:

1. J. G. Proakis and D. G. Manolakis, Digital Signal Processing, 4th ed. Upper Saddle River, NJ, USA: Prentice Hall, 2007.
2. A. V. Oppenheim and R. W. Schafer, Discrete-Time Signal Processing, 3rd ed. Upper Saddle River, NJ,

Reference Book:

1. S. K. Mitra, Digital Signal Processing, 4th ed. New York, NY, USA: McGraw-Hill, 2011.
2. S. Salivahanan, A. Vallabraj, and C. Gnanapriya, Digital Signal Processing. New Delhi, India: Tata McGraw-Hill (TMH) Publishing Co.
3. A. NagoorKani, Digital Signal Processing. New Delhi, India: TMH Education.

CO-PO-PSO MAPPING

DIGITAL SIGNAL PROCESSING															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	1	2	2	1	1	1	2	1	2	1	3	1	1
CO2	3	3	1	2	2	1	1	1	2	1	2	1	3	1	1
CO3	3	2	1	2	2	1	1	1	1	1	2	1	3	2	1
CO4	3	3	3	3	3	3	2	1	1	2	2	2	3	2	3
Average	3	2.5	1.5	2.2	2.2	1.5	1.2	1	1.5	1.2	2	1.2	3	1.5	1.5
Level of Correlation: 3 - High 2 - Medium 1 - Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, MahalaxmiVihar,Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
DIGITAL SIGNAL PROCESSING LAB	**EI4563**	**0-0-3**	**1.5**

Prerequisite: Signals and Systems

Course Outcomes:

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

- **CO1:** Simulate basic signals using MATLAB for various DSP applications.
- **CO2:** Compute linear, circular convolution, correlation of discrete-time signals and solve difference equations.
- **CO3:** Perform DFT and FFT analysis, and interpret magnitude and phase spectra.
- **CO4:** Design and implement FIR and IIR digital filters to meet given specifications.

LIST OF EXPERIMENTS

(Any 10 experiments should be performed)

EXP 1 : Simulation of basic signals (unit step, impulse, ramp, exponential, sine, cosine) using MATLAB.

EXP 2 : Linear convolution of two sequences – Verify commutative, distributive, and associative properties.

EXP 3 : Auto-correlation and cross-correlation of two sequences – Verify symmetry and linearity properties.

EXP 4 : Solve a given difference equation using MATLAB – Analyze system response.

EXP 5 : Compute N-point DFT of a sequence and plot magnitude and phase spectra – Verify using built-in function.

EXP 6 : Perform circular convolution of two sequences using MATLAB.

EXP 7 : Linear convolution using Overlap-Add and Overlap-Save methods for long duration signals.

EXP 8 : FFT computation using DIT-FFT and DIF-FFT algorithms – Analyze and compare performance.

EXP 9 : Design and implementation of FIR filters using window methods – Plot frequency response.

EXP 10 : Design and implementation of IIR filters using Butterworth and Chebyshev methods.

EXP 11 : Perform spectral analysis of a real-time signal using FFT.

EXP 12 : Reconstruct signals using inverse DFT – Analyze effects of zero-padding and spectral leakage.

EXP 13 : Analyze quantization effects and round-off errors in digital signal processing.

EXP 14 : Z-transform and inverse Z-transform – Simulation and verification using MATLAB.

EXP 15 : Apply digital FIR/IIR filters to an audio signal and observe time-frequency characteristics.

EXP 16 : Mini-projects: Audio equalizer design, ECG signal filtering, noise removal, etc.

Text Book:

1. J. G. Proakis and D. G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4th ed. Upper Saddle River, NJ, USA: Prentice Hall, 2006.
2. S. K. Mitra, Digital Signal Processing: A Computer-Based Approach, 4th ed. New York, NY, USA: McGraw-Hill, 2011.

Reference Book:

1. A. V. Oppenheim and R. W. Schafer, Discrete-Time Signal Processing, 3rd ed. Upper Saddle River, NJ, USA: Pearson, 2010.
2. R. G. Lyons, Understanding Digital Signal Processing, 3rd ed. Upper Saddle River, NJ, USA: Pearson, 2010.

3. M. H. Hayes, Digital Signal Processing, New York, NY, USA: Schaum's Outline Series, McGraw-Hill, 1998.

CO-PO-PSO MAPPING

DIGITAL SIGNAL PROCESSING LAB															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	2	2	2	-	-	-	-	-	-	-	3	2	2
CO2	3	3	2	2	2	-	-	-	-	-	-	1	3	3	2
CO3	3	3	3	3	2	-	-	-	-	-	-	1	3	3	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3
Average	3	2.7	2.5	2.5	2.2	-	-	-	-	-	-	1.3	3	2.7	2.2
Level of Correlation: 3 - High 2 - Medium 1 - Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, MahalaxmiVihar,Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
INFORMATION THEORY AND CODING	EI4265	3-0-0	3

Prerequisite: Basic Probability Theory, Discrete Mathematics, Fundamentals of Computer Networks

Course Outcomes:

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

CO1: Quantify information metrics such as entropy and information rate for memoryless sources.

CO2: Encode data using Shannon-Fano, Huffman, and prefix-free algorithms, satisfying optimality conditions.

CO3: Characterize discrete channels using joint probabilities and calculate capacity for Binary Symmetric Channel (BSC).

CO4: Design Linear Block, Cyclic, and Convolutional Codes for error detection and correction.

Module I: Introduction to Information Theory **8 Hours**

Review of Probability Theory, Introduction to information theory, Uncertainty, self-information, average information, Marginal Entropy, Joint Entropy and Conditional Entropy, Mutual Information, Relationship between entropy and mutual information and their properties.

Module II: Channel Models and Capacity **7 Hours**

Importance and types of various channel models - Channel capacity calculation – Binary symmetric channel, binary erasure channel - Shannon's channel capacity and channel coding theorem - Shannon's limit.

Module III: Source Coding **7 Hours**

Source coding theorem - Huffman coding - Non binary Huffman codes - Adaptive Huffman coding - Shannon Fano Elias coding - Non binary Shannon Fano codes, Arithmetic coding

Module IV: Channel Coding and Error Control **8 Hours**

Introduction to Error control codes - Block codes, linear block codes, cyclic codes and their properties, Convolution Codes- Properties, Encoder-Tree diagram, Trellis diagram, state diagram, transfer function of convolutional codes, Viterbi Decoding, Trellis coding, Reed Solomon codes, Turbo coder, Iterative Turbo decoder

Total lecture hours: **30 Hours**

Text Book:

1. Thomas M. Cover, Joy A. Thomas, Elements of Information Theory, Wiley-Interscience
2. R. Bose, Information Theory, Coding and Cryptography, McGraw-Hill
3. David J.C. MacKay, Information Theory, Inference and Learning Algorithms, Cambridge University Press

Reference Book:

1. W. W. Peterson and E. J. Weldon, Error-Correcting Codes, MIT Press
2. Trappe and Washington, Introduction to Cryptography with Coding Theory, Pearson
3. Todd K. Moon, Error Correction Coding: Mathematical Methods and Algorithms, Wiley
4. Simon Haykin, "Communication Systems", 2017, 5th Edition, Wiley India Pvt Ltd, India.

CO-PO-PSO MAPPING

INFORMATION THEORY AND CODING															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	1	2	0	0	0	0	0	0	0	0	3	1	0
CO2	3	3	2	2	2	0	0	0	0	0	0	0	3	2	0
CO3	3	2	2	2	2	0	0	0	0	0	0	0	3	2	0
CO4	3	2	2	2	2	0	0	0	0	1	0	0	3	2	0
Average	3.0	2.25	1.75	2.0	1.5	0.0	0.0	0.0	0.0	0.25	0.0	0.0	3.0	1.75	0.0
Level of Correlation: 3 - High 2 - Medium 1 - Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, MahalaxmiVihar,Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
WIRELESS AND DATA COMMUNICATION	**EI4267**	**3-0-0**	**3**

Prerequisite: Mathematics, Digital Communication

Course Outcomes:

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

CO1: Evaluate the fundamental principles and protocols of data communication and networking

CO2: Analyze various wireless communication technologies and their applications

CO3: Design basic wireless network models and evaluate performance parameters

CO4: Investigate emerging trends and standards in wireless communication

Module I: Introduction to Data Communication **8 Hours**

Concepts, components (sender, receiver, transmission medium, message, protocol), types of data flow (simplex, half-duplex, full-duplex), and communication models. Transmission Media: Guided media (Twisted Pair, Coaxial Cable, Optical Fiber); Unguided media (Radio Waves, Microwaves, Infrared). Encoding and Modulation Techniques Error Detection and Correction: Parity check, CRC, Hamming Code

Module II: Evolution of Wireless Communication **8 Hours**

Overview of 1G to 6G technologies and milestones Wireless Transmission Techniques: Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM), Code Division Multiplexing (CDM) Spread Spectrum Techniques: Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS) Cellular Concepts: Frequency reuse, handoff techniques, and cell splitting Mobile Radio Propagation: Path loss, fading, and multipath propagation Antennas and Baseband Signal Transmission

Module III: Wireless LANs **7 Hours**

IEEE 802.11 architecture, MAC, and physical layers Bluetooth and IEEE 802.15 WiMAX (IEEE 802.16), LTE, and 5G overview Wireless Network Layer Protocols Routing in Wireless Networks: Proactive vs. Reactive routing (AODV, DSR) Quality of Service (QoS) in wireless networks

Module IV: Wireless Sensor Networks (WSNs) **7 Hours**

Architecture, applications, and communication IoT Communication Protocols: MQTT, CoAP Mobile Ad-hoc Networks (MANET): Features, challenges Delay Tolerant Networks (DTNs): Concepts, applications Security in Wireless Networks: Threats and solutions Emerging Technologies: Introduction to 6G, Li-Fi, and Massive MIMO

Total lecture hours: **30 Hours**

Text Book:

1. Tannenbaum, A. S., & Wetherall, D. J. – Computer Networks, Pearson Education
2. Rappaport, T. S. – Wireless Communications: Principles and Practice, Pearson
3. Schiller, J. – Mobile Communications, Pearson Education
4. Kurose, J. F., & Ross, K. W. – Computer Networking: A Top-Down Approach, Pearson

Reference Book:

1. Stallings, W. – Data and Computer Communications, Pearson
2. Pahlavan, K., & Krishnamurthy, P. – Principles of Wireless Networks, Prentice Hall
3. Misra, S., Woungang, I., & Misra, S. C. – Guide to Wireless Ad Hoc Networks, Springer
4. Holger Karl & Andreas Willig – Protocols and Architectures for Wireless Sensor Networks, Wiley

CO-PO-PSO MAPPING

WIRELESS AND DATA COMMUNICATION															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	2	2	1	1	-	-	-	1	1	2	3	2	1
CO2	3	3	2	2	2	2	-	-	-	1	1	2	3	2	2
CO3	3	3	3	2	3	1	-	-	1	2	2	3	3	3	2
CO4	2	3	3	2	3	1	1	2	2	2	2	3	3	3	3
Average	2.75	2.75	2.5	2	2.25	1.25	1	2	1.5	1.5	1.5	2.5	3	2.5	2
Level of Correlation:			3 - High			2 - Medium				1 - Low					

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, MahalaxmiVihar,Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
OPTICAL FIBER AND SATELLITE COMMUNICATION	EI4264	3-0-0	3

Prerequisite: A working knowledge of Electromagnetics and Communication Systems.

Course Outcomes:

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

CO1: Examine the fundamental principles of optical fiber communication, including fiber modes, configurations, and signal distortions.

CO2: Analyze the operating principles and characteristics of optical sources and detectors.

CO3: Apply concepts of orbital mechanics and satellite sub-systems in satellite communication systems.

CO4: Evaluate satellite link budgets and compare various modulation and multiple access techniques used in satellite communications.

Module I: Introduction to Optical Fibre **8 Hours**

Elements of an Optical Fibre Communication link, Optical Fibre Modes and Configurations, Mode Theory for slab Waveguides, Single-mode Fibres, and Graded-Index Fibre Structure, Numerical aperture. Attenuation, Signal Distortion in Optical Waveguides, Pulse Broadening in Graded-Index Fiber guides

Module II: Optical Sources and Detectors **8 Hours**

Basic ideas of light sources and their principle of operation (LEDs and LASERS), Physical Principles of Photodetectors, Avalanche Photodiodes.

Module III: Architecture of Satellite Communication System **7 Hours**

Principles and architecture of satellite Communication.

Orbital Analysis: Orbital equations, Kepler's laws of planetary motion, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc of a satellite, concepts of Solar day and Sidereal day.

Satellite sub-systems: Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command, and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems, antenna sub -system.

Module IV: Satellite Communications **7 Hours**

Satellite link budget: Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA (Basics only)

Total lecture hours: **30 Hours**

Text Book:

1. Timothy Pratt and Others, "Satellite Communications", Wiley India, 2nd edition,2010
2. Gerd Keiser, "Optical Fiber Communications", McGraw Hill, 4th Edition.
3. John M. Senior, "Optical Fiber Communications", Pearson, 3rd Edn.

Reference Book:

1. C.K. Sarkar and D C Sarakar, "Optoelectronics and Fibre Optics Communication", New Age International Publishers, 2nd Edn., 2016
2. Tri T. Ha, "Digital Satellite Communications", Tata McGraw Hill, 2009.

CO-PO-PSO MAPPING

OPTICAL FIBER AND SATELLITE COMMUNICATION															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	2	2	1	1	1	1	-	1	-	-	3	2	1
CO2	3	3	3	2	2	2	2	1	-	2	-	-	3	3	2
CO3	3	3	3	2	2	2	1	1	-	1	-	-	3	3	2
CO4	3	3	3	3	2	2	1	1	-	2	-	-	3	3	2
Average	3.0	2.8	2.8	2.2	1.75	1.75	1.25	1.0	-	1.5	-	-	3.0	2.75	1.75
Level of Correlation: 3 - High 2 - Medium 1 - Low															