COMMUNICATION THEORY

Course Code	: 18EC751	CIE Marks	:40
Lecture Hours/Week	: 03	SEE Marks	:60
Total Number of Lecture Hours	: 40 (08 Hrs / Module)	Exam Hours	:03
	CREDITS – 03		

Course Learning Objectives: This course will enable students to:

- Describe essential elements of an electronic communications.
- Understand Amplitude, Frequency & Phase modulations, and Amplitude demodulation.
- Explain the basics of sampling and quantization.
- Understand the various digital modulation schemes.
- The concepts of wireless communication.

Module -1

Introduction to Electronic Communications: Historical perspective, Electromagnetic frequency spectrum, signal and its representation, Elements of electronic communications system, primary communication resources, signal transmission concepts, Analog and digital transmission, Modulation, Concept of frequency translation, Signal radiation and propagation
(Text 1: 1.1 to1.10)

L1, L2

Module -2

Noise: Classification and source of noise **(TEXT 1:3.1)**
Amplitude Modulation Techniques: Types of analog modulation, Principle of amplitude modulation, AM power distribution, Limitations of AM,
(TEXT 1: 4.1,4.2, 4.4, 4.6)
Angle Modulation Techniques: Principles of Angle modulation, Theory of FM-basic Concepts, Theory of phase modulation **(TEXT 1: 5.1,5.2, 5.5)**
Analog Transmission and Reception: AM Radio transmitters, AM Radio Receivers
(TEXT 1:6.1,6.2)

L1, L2

Module -3

Sampling Theorem and pulse Modulation Techniques: Digital Versus analog Transmissions, Sampling Theorem, Classification of pulse modulation techniques, PAM, PWM, PPM, PCM, Quantization of signals
(TEXT 1: 7.1 to 7.8)

L1, L2

Module-4

Digital Modulation Techniques: Types of digital Modulation, ASK,FSK,PSK,QPSK
(TEXT 1: 9.1 to 9.5)
Source and Channel Coding: Objective of source coding, source coding technique, Shannon's source coding theorem, need of channel coding, Channel coding theorem, error control and coding
(TEXT 1: 11.1 to 11.3, 11.8, 11.9,11.12)

L1, L2

Module-5

Evolution of wireless communication systems: Brief History of wireless communications, Advantages of wireless communication, disadvantages of wireless communications, wireless network generations, Comparison of wireless systems, Evolution of next-generation networks, Applications of wireless communication
(TEXT 2: 1.1 to 1.7)
Principles of Cellular Communications: Cellular terminology, Cell structure and Cluster, Frequency reuse concept, Cluster size and system capacity, Method of locating cochannel cells, Frequecy reuse distance
(TEXT 2: 4.1 to 4.7)

L1, L2

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

1. Describe operation of communication systems.
2. Understand the techniques of Amplitude and Angle modulation.
3. Understand the concept of sampling and quantization.
4. Understand the concepts of different digital modulation techniques.
5. Describe the principles of wireless communications system.

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

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SEMESTER – VIII

WIRELESS and CELLULAR COMMUNICATION

Course Code	: 18EC81	CIE Marks	: 40
Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40 (08 Hrs / Module)	Exam Hours	: 03
	CREDITS – 03		

Course Learning Objectives: This course will enable students to:

- Understand the concepts of propagation over wireless channels from a physics standpoint
- Application of Communication theory both Physical and networking to understand GSM systems that handle mobile telephony
- Application of Communication theory both Physical and networking to understand CDMA systems that handle mobile telephony.
- Application of Communication theory both Physical and networking to understand LTE-4G systems.

Module-1

Mobile Radio Propagation –
Large Scale Path Loss - Free Space Propagation Model, Relating Power to Electric Field, Three Basic Propagation Mechanisms – Reflection (Ground Reflection) , Diffraction, Scattering, Practical Link Budget,
(Text 1 - 2.2 and Ref1 - Chapter 4)
Fading and Multipath – Broadband wireless channel, Delay Spread and Coherence Bandwidth, Doppler Spread and Coherence Time, Angular spread and Coherence Distance **(Text 1 – 2.4)**
Statistical Channel Model of a Broadband Fading Channel
(Text 1 – 2.5.1)
The Cellular Concept – Cellular Concept , Analysis of Cellular Systems, Sectoring
(Text 1- 2.3) **L1, L2**

Module-2

GSM and TDMA Technology
GSM System overview – Introduction, GSM Network and System Architecture, GSM Channel Concept.

GSM System Operations – GSM Identities, System Operations –Traffic cases, GSM Infrastructure Communications (Um Interface)
(Text 2, Part1 and Part 2 of Chapter 5) **L1,L2,L3**

Module-3

CDMA Technology
CDMA System Overview – Introduction, CDMA Network and System Architecture
CDMA Basics – CDMA Channel Concepts, CDMA System (Layer 3) operations, 3G CDMA
(Text 2-Part 1, Part2 and Part 3 of Chapter 6) **L1,L2,L3**

Module-4

LTE – 4G
Key Enablers for LTE 4G – OFDM, SC-FDE, SC-FDMA, Channel Dependant Multiuser Resource Scheduling, Multi-Antenna Techniques, Flat IP Architecture, LTE Network Architecture. **(Text 1, Sec 1.4)**
Multi-Carrier Modulation – Multicarrier concepts, OFDM Basics, OFDM in LTE, Timing and Frequency Synchronization, Peak to Average Ration, SC-Frequency Domain Equalization, Computational Complexity Advantage of OFDM and SC-FDE.
(Text 1, Sec 3.1 – 3.7) **L1,L2,L3**

Module-5

LTE - 4G
OFDMA and SC-FDMA – Multiple Access for OFDM Systems, OFDMA, SCFDMA, Multiuser Diversity and Opportunistic Scheduling, OFDMA and SC-FDMA in LTE, OFDMA system Design Considerations.
(Text 1, Sec 4.1 – 4.6)
The LTE Standard – Introduction to LTE and Hierarchical Channel Structure of LTE, Downlink OFDMA Radio Resources, Uplink SC-FDMA Radio Resources.
(Text 1, Sec 6.1 – 6.4) **L1, L2,L3**

Course Outcomes: After studying this course, students will be able to:

1. Understand the Communication theory both Physical and networking associated with GSM, CDMA & LTE 4G systems.
2. Explain concepts of propagation mechanisms like Reflection, Diffraction, Scattering in wireless channels.
3. Develop a scheme for idle mode, call set up, call progress handling and call tear down in a GSM cellular network.

4. Develop a scheme for idle mode, call set up, call progress handling and call tear down in a CDMA cellular network.
5. Understand the Basic operations of Air interface in a LTE 4G system.

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Books:

1. "Fundamentals of LTE" Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, Pearson education (Formerly Prentice Hall, Communications Engg and Emerging Technologies), ISBN-13: 978-0-13-703311-9.
2. "Introduction to Wireless Telecommunications Systems and Networks", Gary Mullet, First Edition, Cengage Learning India Pvt Ltd., 2006, ISBN -13: 978-81-315-0559-5.

Reference Books:

1. "Wireless Communications: Principles and Practice" Theodore Rappaport, 2nd Edition, Prentice Hall Communications Engineering and Emerging Technologies Series, 2002, ISBN 0-13-042232-0.
2. LTE for UMTS Evolution to LTE-Advanced' Harri Holma and Antti Toskala, Second Edition - 2011, John Wiley & Sons, Ltd. Print ISBN: 9780470660003. 2

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NETWORK SECURITY

Course Code	: 18EC821	CIE Marks	: 40
Lecture Hours/Week	: 3	SEE Marks	: 60
Total Number of Lecture Hours : 40 (08 Hrs / Module)		Exam Hours	: 03
CREDITS – 03			

Course Learning Objectives: This course will enable students to:

- Describe network security services and mechanisms.
- Understand Transport Level Security and Secure Socket Layer
- Know about Security concerns in Internet Protocol security
- Discuss about Intruders, Intrusion detection and Malicious Software
- Discuss about Firewalls, Firewall characteristics, Biasing and Configuration

Module-1

Attacks on Computers and Computer Security: Need for Security, Security Approaches, Principles of Security Types of Attacks.
(Chapter1-Text2) **L1, L2**

Module-2

Transport Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Secure Shell (SSH)
(Chapter15- Text1) **L1,L2**

Module-3

IP Security: Overview of IP Security (IPSec),IP Security Architecture, Modes of Operation, Security Associations (SA), Authentication Header (AH), Encapsulating Security Payload (ESP), Internet Key Exchange.
(Chapter19-Text1) **L1,L2**

Module-4

Intruders, Intrusion Detection.**(Chapter20-Text1)**
MALICIOUS SOFTWARE: Viruses and Related Threats, Virus Counter measures,
(Chapter21-Text1) **L1,L2**

Module-5

Firewalls: The Need for firewalls, Firewall Characteristics, Types of Firewalls, Firewall Biasing, Firewall location and configuration
(Chapter22-Text 1) **L1, L2**

Course Outcomes: After studying this course, students will be able to:

1. Explain network security services and mechanisms and explain security concepts
2. Understand the concept of Transport Level Security and Secure Socket Layer.
3. Explain Security concerns in Internet Protocol security
4. Explain Intruders, Intrusion detection and Malicious Software
5. Describe Firewalls, Firewall Characteristics, Biasing and Configuration

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

TEXT BOOKS:

1. Cryptography and Network Security Principles and Practice , Pearson Education Inc., William Stallings, 5th Edition, 2014, ISBN: 978-81-317- 6166-3.
2. Cryptography and Network Security, Atul Kahate, TMH, 2003.

REFERENCE BOOKS:

1. Cryptography and Network Security, Behrouz A. Forouzan, TMH, 2007.

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BIOMEDICAL SIGNAL PROCESSING

Course Code	: 18EC825	CIE Marks	: 40
Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40 (8 Hrs /Module)	Exam Hours	: 03
CREDITS – 03			

Course Learning Objectives:

This course will enable students to:

- Describe the origin, properties and suitable models of important biological signals such as ECG and EEG.
- Know the basic signal processing techniques in analysing biological signals.
- Acquire mathematical and computational skills relevant to the field of biomedical signal processing.
- Describe the basics of ECG signal compression algorithms.
- Know the complexity of various biological phenomena.
- Understand the promises, challenges of the biomedical engineering.

Module -1

Introduction to Biomedical Signals: The nature of Biomedical Signals, Examples of Biomedical Signals, Objectives and difficulties in Biomedical analysis.

Electrocardiography: Basic electrocardiography, ECG leads systems, ECG signal characteristics.

Signal Conversion :Simple signal conversion systems, Conversion requirements for biomedical signals, Signal conversion circuits

(Text-1) **L1,L2**

Module -2

Signal Averaging: Basics of signal averaging, signal averaging as a digital filter, a typical averager, software for signal averaging, limitations of signal averaging.

Adaptive Noise Cancelling: Principal noise canceller model, 60-Hz adaptive cancelling using a sine wave model, other applications of adaptive filtering

(Text-1) **L1,L2,L3**

Module -3

Data Compression Techniques: Turning point algorithm, AZTEC algorithm, Fan algorithm, Huffman coding, data reduction algorithms The Fourier transform, Correlation, Convolution, Power spectrum estimation, Frequency domain analysis of the ECG **(Text-1)** **L1,L2, L3**

Module -4

Cardiological signal processing:
Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG signal characteristics (parameters and their estimation), Analog filters, ECG amplifier, and QRS detector, Power spectrum of the ECG, Bandpass filtering techniques, Differentiation techniques, Template matching techniques, A QRS detection algorithm, Real-time ECG processing algorithm, ECG interpretation, ST segment analyzer, Portable arrhythmia monitor.
(Text -2) **L1,L2, L3**

Module -5

Neurological signal processing: The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics (EEG rhythms, waves, and transients), Correlation.
Analysis of EEG channels: Detection of EEG rhythms, Template matching for EEG, spike and wave detection
(Text-2)
L1,L2, L3

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

1. Possess the basic mathematical, scientific and computational skills necessary to analyse ECG and EEG signals.
2. Apply classical and modern filtering and compression techniques for ECG and EEG signals.
3. Develop a thorough understanding on basics of ECG and EEG feature extraction.
4. Evaluate various event detection techniques for the analysis of the EEG and ECG
5. Develop algorithms to process and analyze biomedical signals for better diagnosis.

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Books:

1. **Biomedical Digital Signal Processing-** Willis J. Tompkins, PHI 2001.
2. **Biomedical Signal Processing Principles and Techniques-** D C Reddy, McGraw- Hill publications 2005.

Reference Book:

- **Biomedical Signal Analysis-**Rangaraj M. Rangayyan, John Wiley & Sons 2002.

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