Guru Nanak Dev Engineering College, Ludhiana

Department of Electronics and Communication Engineering
B. Tech. (Electronics and Communication Engineering)

Subject Code: PCEC-115
Subject Name: Digital Communication Systems

Programme: B.Tech.	**L:** 3 **T:** 0 **P:** 0
Semester: 6	**Teaching Hours:** L:39
Theory/Practical: Theory	**Credits:**3
Internal Marks: 40	**Percentage of Numerical/Design Problems:** 30%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hours
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: Fundamentals of analog communication system.
Additional Material Allowed in ESE: Scientific calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes
1.	Comprehend the basic concept of signal processing sub-systems in digital communications.
2.	Apply the knowledge of working principles of various signal processing operations for conversion of signals from analog to digital.
3.	Demonstrate the basic concept of source coding theorem, sampling theorem, Nyquist's criterion and applying them for the designing of digital communication system.
4.	Select and utilize tools to analyze the performance of digital communication system.
5.	Demonstrate the basic concept of Noise in Pulse Code & Delta Modulation Systems
6.	Engage in self-learning of advanced concepts and application of Digital Communication.

Detailed Contents:

Part -A

Introduction: **5 hours**
Block Diagram of Digital Communication System, Advantages & disadvantages of Digital communication system, Applications, Sampling theorem, Aliasing.

Analog to Digital Conversion: **7 hours**
The sampling Theorem, low pass signals and band pass signals, pulse Amplitude modulation, channel bandwidth for a PAM signal, signal recovery & holding, Quantization

of signal, Quantization error, pulse code modulation (PCM), Differential pulse code modulation, Delta Modulation, adaptive delta modulation.

Digital Modulation Techniques: 8 hours

Amplitude Shift Keying (ASK), ASK Spectrum, ASK Modulator, Coherent ASK Detector, Noncoherent ASK Detector, Frequency Shift Keying (FSK), FSK Bit Rate and Baud, FSK Transmitter, Non-coherent FSK Detector, Coherent FSK Detector, FSK Detection Using PLL, Quadrature Phase Shift Keying (QPSK), Binary Phase Shift Keying, Quadrature Amplitude Modulation (QAM), Differential PSK

Part-B

Data Transmission: 6 hours

Base band signal receiver, the optimum filter, the matched filter, correlation, correlative coding, Intersymbol interference, Nyquist's criterion for distortion less baseband binary transmission, correlative coding, , adaptive equalization for data transmission.

Noise in Pulse Code & Delta Modulation Systems: 7 hours

Calculation of quantization noise, the O/P signal power in PCM, the effect of thermal noise, O/P signal to noise ratio in PCM, Delta Modulation, Quantization noise in delta modulation, the O/P signal to quantization noise ratio in delta modulation, O/P signal to noise ratio in delta modulation.

Elements of Information Theory: 6 hours

Basic signal processing operations in digital communications, uncertainty, information and entropy, source coding theorem, Huffman coding, discrete memory less channels, mutual information, channel capacity, channel coding theorem, differential entropy, channel capacity theorem,

Text Books:

1. S. Haykin, "Digital Communications", Wiley publication, 2012.
2. W. Tomasi, "Advanced Electronic Communication System", PHI, 6th Edition, 2015.

Reference books and other resources:

1. G. M. Miller, "Modern Electronic Communication", Prentice-Hall, 6th edition, 1999.
2. F. G. Stremler, "Introduction to Communication Systems", Addison- Wesley, 1990.
3. E.A. Lee and D.G. Messerschmitt, "Digital Communication", Kluwer Academic Publishers,1994.
4. H. Meyr, M. Moeneclaey, and S.A. Fechtel, "Digital Communication Receivers", Wiley, 1998.
5. J. G. Proakis, "Digital communications", McGraw-Hill Education, 4th edition, 2001.

E books and online learning materials:

1. http://nptel.ac.in/courses/Webcoursecontents/IIScBANG/Data%20Communication/Learning%20Material%20%20DataCommunication.pdf

2. http://home.iitk.ac.in/~vasu/book0.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114101051/3
2. http://nptel.ac.in/courses/114101051/6

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Department of Electronics and Communication Engineering
B. Tech. (Electronics and Communication Engineering)

Subject Code: PCEC-116
Subject Name: Microwave and Radar Engineering

Programme: B.Tech.	**L:** 3 **T:** 0 **P:** 0
Semester: 6	**Teaching Hours:** L: 39
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design Problems:** 15%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hours
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: Fundamentals of electromagnetics
Additional Material Allowed in ESE: Scientific calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes
1.	Describe and analyze microwave components using S parameters.
2.	Explain the various techniques of measurement at microwave frequencies.
3.	Demonstrate the basic principle of RADAR System and describe the operation of different types of radar.
4.	Analyze scanning and tracking techniques in radar.
5.	Develop systems using microwave devices with concern to public health and safety.
6.	Design and develop radar solutions to meet societal and environmental needs.

Detailed Contents:

Part -A

Microwave Tubes: 5 hours

Introduction to Microwaves: Characteristic features, advantages and applications, Limitations of conventional tubes, Frequency allocations, Construction, operation and properties of Klystron Amplifier, Reflex Klystron, Magnetron, Travelling Wave Tube (TWT), Backward Wave Oscillator (BWO), Crossed field amplifiers.

Microwave Solid State Devices: 8 hours

Limitation of conventional solid state devices at Microwaves, Transistors (Bipolar, FET), Diodes (Tunnel, Varactor, PIN), Transferred Electron Devices (Gunn diode), Avalanche transit time effect (IMPATT, TRAPATT, SBD), Microwave Amplification by Stimulated Emission of Radiation (MASER), Microwave integrated circuit and it's classification techniques.

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Microwave passive devices & components: **7 hours**

Scattering matrix- Concept of N port scattering matrix representation- Properties of S matrix- S matrix formulation of two-port junction. Passive microwave devices- T junctions- H plane, E plane and EH plane Tee junctions, its S matrix and properties, Directional coupler, Bends and Corners, Microwave posts, Attenuators, Phase shifter, Ferrite devices (Isolator, Circulator, Gyrator),Cavity resonator, Matched termination.

Microwave Measurements: **4 hours**

Power measurements using calorimeters and bolometers, Measurement of Standing Wave Ratio (SWR), Frequency and wavelength, Microwave bridges.

Part-B

Introduction to Radar Systems: **3 hours**

Basic Principle: Block diagram and operation of Radar, Radar range Equation, Pulse Repetition Frequency (PRF) and Range Ambiguities, Applications of Radar.

Doppler Radars: **5 hours**

Doppler determination of velocity, Continuous Wave (CW) radar and its limitations, Frequency Modulated Continuous Wave (FMCW) radar, Basic principle and operation of Moving Target Indicator (MTI) radar, Delay line cancellers, Blind speeds and staggered PRFs.

Scanning and Tracking Techniques: **7 hours**

Various scanning techniques (Horizontal, vertical, spiral, palmer, raster, nodding), Angle tracking systems (Lobe switching, conical scan, monopulse), Range tracking systems, Doppler (velocity) tracking systems. Direction finders- Instrument Landing System- Radio ranges. Navigation- Hyperbolic navigation-LORAN. Satellite navigation- Doppler navigation – Global positioning system.

Text Books:

1. S. Liao, “Microwave devices and circuits”, 3rd edition,PHI.
2. M.I. Skolnik, “Introduction to radar systems”, McGraw Hill .
3. R.E. Collin, “Foundation of Microwave Engg”, 2nd edition McGraw Hill, 1992.

Reference Books:

1.M.Kulkarni, “Microwave devices and Radar Engg”, Umesh Publications.
2.K.C Gupta, “Microwave Engg”, Tata McGraw-Hill, 7thEdition, 2007.
3.D.Pozar, “Microwave Engineering”, John Wiley & Sons, New York, 1998.
4. Radar systems and radio aids to navigation — A K Sen & A B Bhattacharya, Stylus Publishing, LLC, 2018.

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E books and online learning materials:

1.https://www.tutorialspoint.com/microwave_engineering/microwave_engineering_tutorial.pdf

2.https://ecedmans.files.wordpress.com/2014/10/microwave-devices-and-circuits-samuel-liao.pdf

MOOCS and Video Course:

1.http://nptel.ac.in/courses/114105130/2

2.http://nptel.ac.in/courses/114105130/9

Guru Nanak Dev Engineering College, Ludhiana

Department of Electronics and Communication Engineering
B. Tech. (Electronics and Communication Engineering)

Subject Code: LPCEC-111
Subject Name: Digital Communication Systems Laboratory

Programme: B.Tech.	**L: 0 T:** 0 **P:** 2
Semester: 6	**Teaching Hours: 26**
Theory/Practical: Practical	**Credits:**1
Internal Marks: 30	**Percentage of Numerical/Design Problems:** NA
External Marks: 20	**Duration of End Semester Exam (ESE):** NA
Total Marks: 50	**Elective Status:** Compulsory

Prerequisites: Fundamentals of Communication Systems.

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes
1.	Comprehend the concept of Time division multiplexing using communication system modules
2.	Demonstrate the various pulse coding and decoding techniques
3.	Illustrate the modulation and demodulation process for amplitude shift keying, frequency shift keying and phase shift keying.
4.	Conduct experiments using system modules to demonstrate the operation of PCM and DM and analyze their performances.
5.	Apply hamming codes and demonstrate its use in detection and correction of errors.
6.	Select and utilize tools like SIMULINK to model delta modulation and binary phase shift keying

Detailed Contents:

Experiment 1. To demonstrate time division multiplexing system.
Experiment 2. To demonstrate pulse code modulation and demodulation.
Experiment 3. To demonstrate adaptive delta modulation and demodulation.
Experiment 4. To study pulse data coding and decoding techniques for various formats.
Experiment 5. To study of amplitude shift keying modulator and demodulator.
Experiment 6. To study of frequency shift keying modulator and demodulator.
Experiment 7: To study of phase shift keying modulator and demodulator.
Experiment 8. To study of quadrature phase shift keying modulator and demodulator.
Experiment 9. To demonstrate error detection & correction using Hamming Code.
Experiment 10. To simulate delta modulation and demodulation using MATLAB SIMULINK.
Experiment 11. To simulate amplitude shift keying using MATLAB SIMULINK.

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Experiment 12. To simulate binary phase shift keying using MATLAB SIMULINK.

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114101051/30
2. http://nptel.ac.in/courses/114101051/31

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B. Tech. (Electronics and Communication Engineering)

Subject Code: LPCEC-112

Subject Name: Microwave and Radar Engineering Laboratory

Programme: B.Tech.	**L:** 0 **T:** 0 **P:** 2
Semester: 6	**Teaching Hours:** 26 Hours
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design Problems:** NA
External Marks: 20	**Duration of End Semester Exam (ESE):** NA
Total Marks:100	**Elective Status:** Compulsory

Prerequisites: Fundamentals of Electromagnetics.

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes
1.	Conduct experiments using microwave devices to investigate characteristics.
2.	Demonstrate the measurement and interpretation of radiation parameters of antenna using network analyzer.
3.	Identify and formulate microwave components and their characteristics.
4.	Develop communication systems using horn antennas.
5.	Apply the knowledge of S-parameters to solve complex engineering systems.
6.	Use knowledge of microwave components and devices to develop systems for societal needs.

Detailed Contents:

Experiment 1. Study of microwave components and instruments.

Experiment 2. Measurement of crystal characteristics and proof of the square law characteristics of the diode.

Experiment 3. Measurement of klystron characteristics.

Experiment 4. Measurement of VSWR and standing wave ratio.

Experiment 5. Measurement of Dielectric constants of a given material.

Experiment 6. Measurement of directivity and coupling coefficient of a directional coupler.

Experiment 7. Demonstration of characteristics of the circulator.

Experiment 8. Measurement of Q of a cavity.

Experiment 9. Calibration of the attenuation constant of an attenuator.

Experiment 10. Determination of the radiation characteristics of Horn antenna.

Experiment 11. Determination of the phase-shift of a phase shifter.

Experiment 12. Measurement of return loss of patch antenna using Vector Network Analyzer.

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

1.http://nptel.ac.in/courses/114101119/6
2.http://nptel.ac.in/courses/114101119/16

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Department of Electronics and Communication Engineering
B. Tech. (Electronics and Communication Engineering)

Subject Code: PEEC-101
Subject Name: Optical Communication

Programme: B.Tech.	**L:** 3 **T:** 1 **P:** 0
Semester: 6	**Teaching Hours:** 39+13(T)= 52 hours
Theory/Practical: Theory	**Credits:** 4
Internal Marks: 40	**Percentage of Numerical/Design Problems:** 20%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hours
Total Marks: 100	**Elective Status:** Elective-I

Prerequisites: Fundamentals of electronic devices and communication.
Additional Material Allowed in ESE: Scientific calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes
1.	Apply the knowledge of engineering fundamentals for the concept of optical fiber communication.
2.	Demonstrate the basic concept of degradation, fabrication and measurement techniques.
3.	Design system components of optical sources and detectors and derive the expression for their efficiency.
4.	Select electronic components to describe the concept of Optical link design.
5.	Analyze the performance of different optical amplifiers and integrated optical devices.
6.	Use research-base knowledge to describe the concepts advanced optical communication technologies.

Detailed Contents:

Part A

Introduction: **7+2(T)=9 hours**

Elements of an optical fiber transmission link, introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

Optical Fibers: **10+4(T)=14 hours**

Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation in optical waveguides due to dispersion and attenuation, pulse broadening in graded-index waveguides, mode coupling, Non linear effects: Stimulated Brillion and Raman scattering,

Self and Cross phase modulation, Four wave mixing, fiber fabrication: vapor-phase axial deposition, plasma-activated chemical deposition and double-crucible method. Measurement techniques: optical spectrum analyzers, optical time domain reflectometer (OTDR).

Part-B

Optical Sources and Detectors: 7+3(T)=10 hours

Optical sources - LEDs and Lasers, Photo-detectors - pin-detectors, Avalanche photodiode, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.

Optical Amplification and Integrated Optics: 7+2(T)=09 hours

Optical amplifiers – semiconductor optical amplifier, EDFA, Raman amplifier, Integrated optical devices: directional couplers, electro-optic switches, modulator, polarization transformer, frequency translators.

Advances in Optical communication: 9+2(T)=10 hours

Introduction of Free Space Optical Communication and its applications, High speed light wave links, DWDM, Photonics Microwave.

Text Books:

1. G. Keiser, "Optical Fiber communications", McGraw Hill Education, 3rd Edition, 2000.
2. J. M. Senior, "Optical Fiber Communications, Principles and Practices", Pearson Education, 3rd Edition, 2010.
3. Arun Majumdar "Optical Wireless Communications for Broadband Global Internet Connectivity'' 1st edition

Reference Books:

1. J.E. Midwinter, "Optical Fibers for Transmission", John Wiley, 1979.
2. J. Gowar, "Optical Communication Systems", Prentice Hall India, 1987.
3. G. Agrawal, "Nonlinear Fibre Optics", Academic Press, 2nd Edition 1994.
4. G. Agrawal, "Fiber Optic Communication Systems", John Wiley and Sons, New York, 1992
5. Djafar K. Mynbaev, "Fiber optic communications technology", Pearson, 2001.

E books and online learning materials:

1. https://eceagmr.files.wordpress.com/2014/09/optical-fiber-communications-principles-and-pr.pdf
2. https://www.utdallas.edu/~torlak/courses/ee4367/lectures/FIBEROPTICS.pdf.
3. https://www.sciencedirect.com/topics/physics-and-astronomy/free-space-optical-communication
4. https://link.springer.com/article/10.1007/s11277-018-5870-7

5. https://ieeexplore.ieee.org/document/4063431
6. https://ieeexplore.ieee.org/book/5361049
7. https://ieeexplore.ieee.org/document/6320333

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117101002/34
2. http://nptel.ac.in/courses/117101002/38

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Department of Electronics and Communication Engineering
B. Tech. (Electronics and Communication Engineering)

Subject Code: PEEC-102
Subject Name: ARM based Embedded System

Programme: B.Tech.	**L:** 3 **T:** 1 **P:** 0
Semester: 6	**Teaching Hours:** 39+13(T)=52 hours
Theory/Practical: Theory	**Credits:** 4
Internal Marks: 40	**Percentage of Numerical/Design Problems:** 20%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hours
Total Marks: 100	**Elective Status:** Elective-I

Prerequisites: Digital Electronics, Knowledge of Microprocessor and microcontroller.
Additional Material Allowed in ESE: Scientific calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes
1.	Develop the ability to understand the role of embedded system in industry.
2.	Explain the internal architecture of ARM.
3.	Apply the knowledge of instruction set for performing various operations on ARM.
4.	Illustrate programming concepts to interface peripheral devices with ARM.
5.	Demonstrate the ability to write the programs for ARM.
6.	Comprehend Real-Time Embedded System concepts.

Detailed Contents:

Part -A

Introduction to Embedded Systems: 7+1(T)=8 hours
Overview of Embedded systems, Embedded processors, Embedded hardware units and devices, Design parameters of an embedded system, present trends and applications of Embedded
systems.

ARM Processor Architecture: 8+2(T)=10 hours
Overview ARM processor families, the ARM design philosophy, ARM data flow architecture, Registers, Interrupts & vector table.

ARM Instruction Set: 10+5(T)=15 hours
Instruction Set: Data processing instructions, Load-store instructions, Branch instructions, Software interrupt instruction, Program status register instructions, Conditional execution.

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Part-B

Design Examples Using ARM7: 6+3(T)=9 hours

ARM7 I/O Port Description, Interfacing Programs for LED, LCD, Stepper motor and Relay.

Real-Time Embedded Systems Software: 8+2(T)=10 hours

Real-time Embedded Systems, Real-Time Operating Systems (RTOS)- Key characteristics, The Scheduler, Tasks, Semaphores, Message Queues.

Text Books:

1. R. Kamal, "Embedded Systems, Architecture Programming and Design", Second Edition, Tata McGraw Hill, 2008.
2. N. Sloss, D. Symes, C. Wright and J. Rayfield, "ARM System Developer's Guide, Designing and Optimizing System Software", Elsevier, 2004.

Reference books and other resources:

1. T. Martin, "The Insider's Guide to The Philips ARM7-Based Microcontrollers, An Engineer's Introduction to The LPC2100 Series", Hitex, 2005.
2. Q. Li, "Real Time Concepts for Embedded Systems", CMP Books, 2003.
3. UM10139 LPC214x User manual.
4. Website: www.arm.com.

E books and online learning materials:

1. http://web.eecs.utk.edu/~roberts/ECE342/AnalogCommunicationSystems.pdf
2. http://www.ee.iitm.ac.in/~giri/pdfs/EE4140/textbook.pdf

MOOCS and Video Course:

1. https://nptel.ac.in/courses/117105143/
2. https://nptel.ac.in/courses/117102059/

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Department of Electronics and Communication Engineering
B. Tech. (Electronics and Communication Engineering)

Subject Code: PEEC-103
Subject Name: Mobile Communication and Networks

Programme: B.Tech.	**L:** 3 **T:** 1 **P:** 0
Semester: 6	**Teaching Hours:** 39+13(T)=52 hours
Theory/Practical: Theory	**Credits:**4
Internal Marks: 40	**Percentage of Numerical/Design Problems:** 20%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hours
Total Marks: 100	**Elective Status:** Elective-II

Prerequisites: Fundamentals of analog and digital communication system.
Additional Material Allowed in ESE: Scientific calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes
1.	Comprehend the basics and parameters of cellular systems.
2.	Describe different types of interferences.
3.	Analyze handoffs and dropped calls
4.	Explain functioning of wireless communication system and evolution of different wireless communication systems and standards.
5.	Describe working of various intelligent networks.
6.	Identify the requirements of mobile communication as compared to static communication.

Detailed Contents:

Part -A

Cellular Systems: **8+2(T)=10 hours**

Basic cellular systems, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, concept of frequency reuse channels, handoff mechanism, cell splitting, cell sectoring, consideration of the components of cellular systems

Interference in Mobile Systems: **10+4(T)= 14 hours**

Cochannel interference, cochannel interference reduction factor, desired C/I from a normal casein an omnidirectional antenna system, exploring cochannel interference areas in a system, real time cochannel interference measurement at mobile radio transceivers, design of an omnidirectional antenna system in the worst case, adjacent-channel interference, near-end–far end interference.

Handoffs and dropped calls: 8+2(T)=10 hours

Value of implementing handoffs, initiation of a hard handoff, delaying a handoff, forced handoffs, queuing of handoffs, power-difference handoffs, mobile assisted handoff (maho) and soft handoff, cell-site handoff only, intersystem handoff, introduction to dropped call rate, formula of dropped call rate.

Part B

2G, 3G and 4G systems: 8+2(T)=10 hours

2G systems: GSM Architecture and channels, 3G systems, WCDMA-UMTS (UTRA-FDD) physical layer, WCDMA-ARIB physical layer, WCDMA-TDD physical layer UMTS network architecture, CDMA2000 physical layer, CDMA2000 network, 4G – LTE: LTE Network architecture.

Intelligent Network for wireless communication: 6+2(T)=8 hours

Advanced intelligent network (AIN), SS7 network and ISDN for AIN, AIN for mobile communication, asynchronous transfer mode (ATM) technology, IP Network, future of IP networks, an intelligent system: future public land mobile telecommunication system (FPLMTS), wireless information superhighway

Text Books:

1. W. C. Lee, "Wireless and Cellular Communications". 3rd Edition, McGraw Hill.
2. T.S. Rappaport, Wireless Communication-Principles and practice, Pearson Publications,Second Edition.
3. Misra, Wireless Communication & Network: 3G & Beyond, McGraw Hill Education
4. T L Singal ,Wireless Communications , McGraw Hill Education.

Reference books and other resources:

1. Jochen H. Schiller, "Mobile Communications", Second Edition, Pearson Education.
2. IEEE Communication Magazine

E books and online learning materials:

1. https://www.bharathuniv.ac.in/colleges1/downloads/courseware_ece/notes/BEC703%20%20-CELLULAR%20MOBILE%20COMMUNICATION.pdf
2. IEEE Communication Magazine

MOOCS and Video Course:

1. https://nptel.ac.in/courses/117/102/117102062/
2. https://nptel.ac.in/courses/117/104/117104099/

Guru Nanak Dev Engineering College, Ludhiana

Department of Electronics and Communication Engineering
B. Tech. (Electronics and Communication Engineering)

Subject Code: PEEC-104
Subject Name: Multimedia Signal Processing

Programme: B.Tech.	**L:** 3 **T:** 1 **P:** 0
Semester: 6	**Teaching Hours:** 39+13(T)=52 hours
Theory/Practical: Theory	**Credits:** 4
Internal Marks: 40	**Percentage of Numerical/Design Problems:** 20%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hours
Total Marks: 100	**Elective Status:** Elective-II

Prerequisites: Fundamentals of Signal Processing.
Additional Material Allowed in ESE: Scientific calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes
1.	Comprehend the representation of various multimedia information.
2.	Describe the basic techniques of multimedia data compression.
3.	Make use of audio signals in development of various audio coding standards.
4.	Explain the standards defined for storage of image data.
5.	Demonstrate the concept of compression and temporal redundancy in video signals.
6.	Apply the concept of motion compensation and estimation in video coding standards.

Detailed Contents:

Part -A

Multimedia Information Representation: 7+2(T)=9 hours
Digitization Principles, Digital representation of multimedia signals: Text and Images; Audio – PCM Speech, CD-quality audio, Synthesized audio; Video – Broadcast television, digital video and its formats, PC video.

Multimedia Data Compression: 7+2(T)=9 hours
Lossless compression Algorithms: Run-length Coding, Variable-Length Coding, Dictionary based Coding, Arithmetic Coding. Lossy Compression: Distortion Measures, Rate-Distortion Theory, Quantization, Transform coding - K-L Transforms, Discrete Cosine Transform, Wavelet-Based Coding, SPIHT.

Audio Coding: 7+2(T)=9 hours

Audio-Compression Theory, Audio as a Waveform: DPCM, DM, ADPCM, Logarithmic Quantization Scales. Audio Compression using Psychoacoustic, Audio Coding Standards: MPEG-1, MPEG-2, Dolby AC-2 and AC-3, MPEG-4, MIDI.

Part-B

Image Compression Standards: 8+3(T)=11 hours

JPEG Standard: Encoding and its mode, JPEG 2000 Standard: Adapting EBCOT to JPEG2000, Regions of Interest Coding, Comparison of JPEG and JPEG2000 Performance, JPEG-LS Standard, Bi-level Image Compression Standards: JBIG and JBIG2.

Motion Estimation and Video Coding: 10+4(T)=14 hours

Theory of Video Compression: Temporal redundancy, Block based frame prediction, motion vectors, macro blocks, Motion Compensation, Types of Predictions, Video Coding standards: H.261 and H.263, MPEG-1, MPEG-2, MPEG-4.

Text Books:

1. Halsall F., "Multimedia Communications: Applications, Networks, Protocols, and Standards", Pearson, 2004.
2. Li Z., Drew M. S., Liu J., "Fundamentals of Multimedia", Springer, 2014.
3. Havaldar P. and Medioni G., "Multimedia Systems - Algorithms, Standards, and Industry Practices, Pearson, 2009.

Reference Books:

1. Stankovic S., Orovic I. & Sedjic E., "Multimedia Signals and Systems", Springer US, 2012.
2. Sanders A., "Multimedia Signals: Image, Audio and Video Processing", NY Research Press, 2017.
3. Ohm J-R., "Multimedia Signal Coding and Transmission", Springer Berlin Heidenberg, 2015.
4. Guan L., He Y. & Kung S-Y., "Multimedia Image and Video Processing", CRC Press, 2012.
5. Vaseghi S.V., "Multimedia Signal Processing: Theory and Applications in Speech, Music and Communications", John Wiley & Sons, Ltd., 2007.

E books and online learning materials:

1. http://classweb.ece.umd.edu/enee408g.S2013/index.xml
2. http://staff.um.edu.mt/csta1/courses/lectures/csa3020/index.html

MOOCS and Video Course:

1. https://nptel.ac.in/courses/117/105/117105083/
2. https://www.coursera.org/lecture/digital/on-video-compression-standards-LluJC

Guru Nanak Dev Engineering College, Ludhiana

Department of Electronics and Communication Engineering
B. Tech. (Electronics and Communication Engineering)

Subject Code: OEEC-101
Subject Name: Signals and Systems

Programme: B.Tech.	**L:** 3 **T:** 0 **P:** 0
Semester: 6	**Teaching Hours:** L:39
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design Problems:** 40%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hours
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: Mathematics, Function Plotting.
Additional Material Allowed in ESE: Scientific calculator.

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes
1.	Apply various operations on the signals and classify signals and systems on the basis of characteristics.
2.	Make use of various tools like Fourier series, Fourier transform and Z-transform for the analysis of continuous and discrete time signals.
3.	Analyze the response of LTI systems and solve difference and differential equations used for the mathematical representation of systems.
4.	Predict the behavior of random signals using probability theory.
5.	Examine the effect of noise sources on system performance.
6.	Test real-time systems using self-study and engage in life-long learning.

Detailed Contents:

Part -A

Classification of Signals and Systems: 8 hours

Introduction to Signals in engineering, Elementary signals in continuous and discrete domain, Operations on dependent and Independent variables, Role of Sampling, Classification of Continuous-time and Discrete-time signals, Overview of systems in engineering, Classification of Continuous-time and Discrete-time systems, Interconnection of systems.

Analysis of Continuous-time and Discrete-time signals: 11 hours

Representation of Continuous-time and discrete-time signals using Fourier series, Properties of Fourier Series, Aperiodic Continuous-time and discrete-time signal representation using Fourier Transform, Properties of Fourier Transform, Fourier Transform of Periodic Power Signals, Spectral Density, Parseval's Theorem and correlation,

Introduction to z-transform, Properties and Region of Convergence.

Part-B

Linear Time Invariant Systems: 7 hours

Definitions and Properties of LTI Systems, Causality and stability, Impulse and step response, Convolution integral, Transfer function, Differential equations for continuous-time systems, Impulse Response of Discrete-Time Systems, Convolution sum, Difference equations and analysis.

Probability Theory: 7 hours

Definitions related to Probability of Random Experiments, Properties of Probability, Joint and Conditional Probability, Random Variable, Cumulative distribution Function, Probability Density Function, Statistical Averages of Random Variable, Examples of Probability Density Functions, Random Process.

Noise Impact on Communication Systems: 6 hours

External sources of noise, Internal sources of noise, White Gaussian noise, Equivalent input noise, Signal to Noise Ratio (SNR), Noise Temperature, Noise equivalent Bandwidth, Noise Factor and noise figure, Determination of Noise Figure, Spectral components of noise.

Text Books:

1. Haykins S. & Veen B. V., "Signals and Systems", John Wiley & Sons, 2nd Edition, 2008.
2. Oppenheim A. V., Wilsky S. & Nawab S. H., "Signals and Systems", Pearson Education, 2007.
3. Haykin S., "Communication Systems", John Wiley & Sons, 3rd Edition, 2008.

Reference Books:

1. Hsu H. P., "Signals and Systems", McGraw Hill Education Pvt. Ltd., 2nd Edition, 2008.
2. Ramesh P. & Anandanatarajan R., "Signals and Systems", Scitech publishers, 4th Edition.
3. Roberts M. J., "Signals and Systems: Analysis using Transform Methods and MATLAB", Tata McGraw-Hill, 2nd Edition, 2012.
4. Sundararajan D., "A Practical Approach to Signals and Systems", John Wiley & Sons, 2008.
5. Ghosh S., "Signals and Systems", Pearson Education, 2006.
6. Etten W.V., "Introduction to Random Signals and Noise", John Wiley & Sons, 2005.
7. Kani N., "Signals and Systems", Tata McGraw-Hill, 2010.

E books and online learning materials:

1. http://www.di.univr.it/documenti/OccorrenzaIns/matdid/matdid744681.pdf
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-003-signals-and-systems-fall-2011/lecture-notes/

Guru Nanak Dev Engineering College, Ludhiana

Department of Electronics and Communication Engineering

B. Tech. (Electronics and Communication Engineering)

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117104074/1
2. https://www.edx.org/course/signals-and-systems-part-1

Guru Nanak Dev Engineering College, Ludhiana

Department of Electronics and Communication Engineering

B. Tech. (Electronics and Communication Engineering)

Subject Code: OEEC-102

Subject Name: Basics of Electronics and Communication

Programme: B.Tech.	**L:** 3 **T:** 0 **P:** 0
Semester: 6	**Teaching Hours:** L:39
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design Problems:** 20%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hours
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: Fundamentals of electronic devices
Additional Material Allowed in ESE: Scientific calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes
1.	Apply the knowledge of working principle of diode for utilization in different applications.
2.	Apply the knowledge of working principle of transistor for utilization in different applications.
3.	Understand the basic concept of feedback in amplifiers and applying for designing LC and RC oscillators.
4.	Comprehend the basic concept of Binary Number System and apply for Boolean problems.
5.	Analyze performance of different types of analog modulation techniques.
6.	Demonstrate the concepts of digital modulation techniques.

Detailed Contents:

Part -A

Introduction to Electronics **8 hours**

Semiconductors, Intrinsic Semiconductors, Extrinsic Semiconductor, P-N Junction Diode Operation, Junction Theory, V-I Characteristics of P-N Junction Diode, Ideal Diode, Diode Applications, Special Diodes- Zener diode as a voltage regulator, Light Emitting Diode, Photodiode.

Transistors and its applications **7 hours**

Introduction to Transistors, Construction and Working of a Transistor, Transistor as an amplifier, Basic configurations - Common Emitter, Common Base, Common Collector: characteristics and comparison, Need for Biasing, Operating point, Need for Bias

Stabilization,

Oscillators **4 hours**

Feedback in Amplifiers, Types of Feedback, Principle of Oscillators, LC and RC oscillators

Part -B

Fundamentals of Digital Electronics **7 hours**

Logic Gates: AND, OR, NOT, Universal Gates, Exclusive Gates, Boolean algebra, Binary Number System- Binary, Decimal, Octal, Hexadecimal, Number System Conversions, Binary Addition, Binary Subtraction-1's and 2's compliment, 7-Segment LCD Display.

Analog Communication **8 hours**

Elements of a communication system, Introduction to Modulation and Demodulation, Need of Modulation, Types of Modulation – Amplitude Modulation: Mathematical analysis, Modulation index; Frequency Modulation: Mathematical analysis, Frequency spectra, Modulation Index; Phase Modulation: Mathematical analysis, Applications in Engineering.

Digital Communication **5 hours**

Advantages of Digital Communication, Digital Modulation techniques – ASK, FSK, and PSK. Applications of Digital Modulation. M-ary modulation.

Text Books:

1. Jacob Milliman, Christos Halkias, Chetan Parikh, "Milliman's Integrated Electronics" Paperback, 2nd Edition.
2. Donald P. Leach, Albert Paul Malvino, Goutam Saha, "Digital Principles and Applications". McGraw Hill Education; Eighth Edition.
3. Kennedy Davis,"Electronics Communication Systems" Paperback, 4th Edition.

Reference Books:

1. N.N Bhargava, S.C. Gupta, D.C. Kulshreshtha " Basic Electronics and Linear Circuits", Tata McGraw-Hill Education.
2. R.P Jain, " Modern Digital Electronics", Tata McGraw Hill Publications, 4th edition.

E books and online learning materials:

1. http://web.eecs.utk.edu/~roberts/ECE342/AnalogCommunicationSystems.pdf
2. https://inst.eecs.berkeley.edu/~ee100/su07/handouts/DiodeTransistorNotes.pdf

MOOCS and Video Course:

1. NPTEL Course on: Basic Electronics and Lab
2. http:// nptel.ac.in/courses/122106025/

Guru Nanak Dev Engineering College, Ludhiana

Department of Electronics and Communication Engineering
B. Tech. (Electronics and Communication Engineering)

Subject Code: LPEEC-101
Subject Name: Optical Communication Laboratory

Programme: B.Tech.	**L:** 0 **T:** 0 **P:** 2
Semester: 6	**Teaching Hours:** 26 Hours
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design Problems:** NA
External Marks: 20	**Duration of End Semester Exam (ESE):** NA
Total Marks:50	**Elective Status:** Elective-I Laboratory

Prerequisites: Fundamentals of electronic devices and communication.

On successful completion of this course, the students should be able to:

CO#	Course Outcomes
1.	Demonstrate the working of optical fiber communication system and analyze the propagation and bending loss of fiber.
2.	Measure the numerical aperture, sensitivity and BER in optical fibers
3.	Demonstrate and measurement of sensitivity of the fiber optic link
4.	Comprehend the voice Transmission through optical fiber using PWM.
5.	Understand the V-I characteristics of LED and photo detector.
6.	Work in a team to demonstrate designing and analyze the free space optical communication using Optisystem.

Detailed Contents:

Experiment 1. To demonstrate fiber optic analog and digital link.
Experiment 2. To Study and measurement of propagation loss in optical fiber.
Experiment 3. To demonstrate and measurement of bending loss in optical fiber.
Experiment 4. To demonstrate and measurement of numerical aperture of optical fiber.
Experiment 5. To Measure the optical power using optical power meter.
Experiment 6. To demonstrate Voice Transmission through optical fiber using PWM.
Experiment 7. To measure the sensitivity of the fiber optic link.
Experiment 8. To demonstrate V-I characteristics of fiber optic LEDs.
Experiment 9. To demonstrate V-I characteristics of photo detector.
Experiment 10. To design free space optical communication using FSO channel in Optisystem and analyze the outputs using various optical analyzers.
Experiment 11. To demonstrate parametric effect on free space optical communication using Optisystem.
Experiment 12. To analyze Free space optical communication for different weather conditions in terms of BER and Q factor using Optisystem.

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117101002/2
2. http://nptel.ac.in/courses/117101002/12

Guru Nanak Dev Engineering College, Ludhiana

Department of Electronics and Communication Engineering
B. Tech. (Electronics and Communication Engineering)

Subject Code: LPEEC-102
Subject Name: ARM Based Embedded System Laboratory

Programme: B.Tech.	**L:** 0 **T:** 0 **P:** 2
Semester: 6	**Teaching Hours:** 26 Hours
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design Problems:** NA
External Marks: 20	**Duration of End Semester Exam (ESE):** NA
Total Marks:50	**Elective Status:** Elective-I Laboratory

Prerequisites: Fundamentals of digital systems, microprocessor and microcontroller.

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes
1.	Comprehend the working of ARM based development boards.
2.	Develop programs of ARM for performing mathematical operations.
3.	Illustrate programming concepts to interface peripheral devices with the ARM.
4.	Develop source codes for interfacing of peripherals devices.
5.	Design high end applications using ARM.
6.	Construct a project in a team or individual for given problem using ARM.

Detailed Contents:

Experiment 1. Study of ARM kits.
Experiment 2. Write programs for performing addition of any two numbers.
Experiment 3. Write programs for performing subtraction of any two numbers.
Experiment 4. Write programs for performing multiplication of any two numbers.
Experiment 5. Write programs for performing logical operations of any two numbers.
Experiment 6. Write a program to blink LED connected withARM7 microcontroller.
Experiment 7. Write a program to interface a relay with ARM7 microcontroller.
Experiment 8. Write a program to control the speed and direction of a stepper motor using ARM7 microcontroller.
Experiment 9. Write a program to interface DC motor with ARM7 microcontroller.
Experiment 10. Write a program to interface RFID module with ARM7 microcontroller.
Experiment 11. Write a program to interface LCD display with ARM Cortex microcontroller.
Experiment 12. Write a program to demonstrate the use of Real Time Clock using ARM Cortex microcontroller.

Reference Books and Other Resources:
Lab manuals available in lab.