ESTD: 1980

SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE (AUTONOMOUS)

(Affiliated to JNTUK, Kakinada), (Recognized by AICTE, New Delhi)
Accredited by NAAC with 'A' Grade, All UG Programmes are Accredited by NBA
Recognised as Scientific and Industrial Research Organisation
CHINNA AMIRAM (P.O):: BHIMAVARAM :: W.G.Dt., A.P., INDIA :: PIN: 534 204

SCHEME OF INSTRUCTION & EXAMINATION

(Regulation R17)

IV/IV B.TECH

(With effect from **2017-2018**Admitted Batch onwards**)**

ELECTRONICS & COMMUNICATION ENGINEERING

(Accredited by NBA)

I-SEMESTER

Code No.	Name of the Subject	Credits	Lecture Hrs	Tutorial Hrs	Lab Hrs	Contact Hrs/ Week	Internal Marks	External Marks	Total Marks
B17 EC 4101	Wireless Communications & Networks	3	3	1	--	4	30	70	100
B17 EC 4102	Digital Image Processing	3	3	1	--	4	30	70	100
B17 EC 4103	Fiber Optic Communications	3	3	1	--	4	30	70	100
B17 EC 4104	Embedded Systems & Internet Of Things	3	3	1	--	4	30	70	100
#ELE-I	ELECTIVE-I	3	3	1	--	4	30	70	100
B17 EC 4108	Digital Signal Processing Lab	2	--	--	3	3	50	50	100
B17 EC 4109	IOT Lab	2	--	--	3	3	50	50	100
Total		**19**	**15**	**5**	**6**	**26**	**250**	**450**	**700**

#ELE - I	B17 EC 4105	Information Theory and Coding
	B17 EC 4106	Satellite Communications & GPS
	B17 EC 4107	Analog IC Design

Code: B17EC4101

WIRELESS COMMUNICATIONS & NETWORKS

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives:
Students should
1. Analyze the design challenges, constraints of wireless communication systems
2. An ability to explain functioning, protocols, capabilities and application of wireless communication networks.
3. To get acquainted with recent technologies for wireless communication

Course Outcomes:
On the completion of this course, the students will be able to:

S. No	Out Come	Knowledge Level
1	Demonstrate the understanding on the functioning of wireless communication systems and evolution of different wireless communication standards.	**K3**
2	Explain the functioning, protocols, capabilities and application of various wireless communication systems.	**K2**
3	Ability to apprehend various propagation mechanisms and challenges in Wireless Communication.	**K4**
4	Demonstrate an ability to evaluate design challenges, constraints in wireless networks.	**K2**

SYLLABUS

UNIT-I: Introduction to Wireless Communication Systems
Evolution of Wireless communications, Types of Wireless communication System 2G and 3G, Basic Propagation Mechanisms, Multipath channel, large scale path loss, Path loss models: Free Space and Two-Ray models, Link Budget design.

UNIT-II: Wireless Channels
Small scale fading, Parameters of mobile multipath channels, Time dispersion parameters, Coherence bandwidth, Doppler spread & Coherence time, fading due to Multipath time delay spread, flat and frequency selective fading, fast and slow fading, Jakes model, Rayleigh channel, BER performance under wireless channels, MATLAB examples of wireless channels.

UNIT-III: Diversity and Equalization
Fundamentals of Equalization, Generic Adaptive Equalizer, Linear Equalizers, Nonlinear Equalization, Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Zero Forcing Algorithm, Diversity order, Selection diversity, Maximal Ratio Combining and Equal Gain Combining, RAKE Receiver, BER with Diversity, MATLAB Equalization Examples

UNIT-IV: Wireless Networks

Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11, IEEE 802.11 Medium Access Control, Comparison of IEEE 802.11 a,b,g and n standards, HiperLAN.

UNIT-V: Recent Trends in Wireless Communications

Basic principles of OFDM, Block diagram & operation, Cyclic prefix, Introduction to Wi-Fi, WiMAX, ZigBee Networks, Bluetooth, Software Defined Radio, Cognitive Radio, Wireless Ad Hoc Network and Mobile Portability, MATLAB OFDM example.

Text Book:

1. Wireless Communications, Principles, Practice — Theodore, S.Rappaport, 2nd Ed., 2002, PHI
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.

Reference Books:

1. Principles of Mobile Communications – Gordon L. Stuber, Springer International 2nd Edition, 2007
2. MIMO- OFDM Wireless Communications with MATLAB-Yong Soo Cho

Code: B17 EC4102

DIGITAL IMAGE PROCESSING

Lecture	**: 3 Periods**	**Int. Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course objectives: Students should learn

1. Recall and summarize the digital image fundamentals and to be exposed to basic image processing techniques.
2. Be familiar with image segmentation and compression techniques.
3. Illustrate the representation of color images in the form of features.

Course outcomes: On the completion of this course, the students will be able to:

S. No	Out Come	Knowledge Level
1	Explain digital image fundamentals and basic image processing techniques.	**K2**
2	Evaluate the techniques for image enhancement and restoration.	**K5**
3	Define the need for image compression and to analyze various image compression methods.	**K4**
4	Experiment the Partition of a digital image into multiple objects using various techniques.	**K3**
5	Illustrate the use of different color models to represent an image.	**K2**

SYLLABUS

UNIT-I: Digital Image Fundamentals
Introduction - Origin of Digital Image Processing - Fundamental Steps in Digital Image Processing - Elements of Visual Perception - Image Sensing and Acquisition - Image Sampling and Quantization - Basic Relationships between pixels. MATLAB Demos.

UNIT- II: Image Enhancement
Intensity Transformations: Basic intensity transformations, Histogram processing - Basics of Spatial Filtering: Smoothing and Sharpening of Spatial Filtering - Filtering in Frequency Domain: Introduction to 2D DFT, Image Smoothing and Sharpening using frequency domain filters. MATLAB Demos.

UNIT – III: Image Restoration
Fundamentals of Image Restoration - Noise models - Mean Filters, Order-Statistic Filters, Adaptive filters - Periodic Noise Reduction by Frequency Domain Filters: Band reject Filters, Band pass Filters, Notch Filters - Inverse Filtering - Wiener Filtering. MATLAB Demos.

UNIT – IV: Image Compression
Fundamentals: Coding Redundancy, Spatial and Temporal Redundancy, Irrelevant Information Basic Image Compression model - Basic Compression methods: Huffman Coding, Run Length Coding, Block Transform Coding-JPEG Standard, MATLAB demos.

UNIT – V: Color Image Processing And Image Segmentation

Color fundamentals - Color Models - Color transformations: Color Complements, Color slicing, Tone and Color corrections- Image Segmentation: Fundamentals - Point, Line and Edge Detection: Detection of isolated points, Line Detection, Edge Models, Basic Edge Detection - Thresholding: Intensity Thresholding, Basic Global Thresholding - Region based Segmentation: Region Growing, Region Splitting and Merging.

Text books:

1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010
2. Digital Image Processing by S Jayaraman, S Esakkirajan, T Veerakumar , Tata McGraw-Hill Education

Reference Books:

1. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011
2. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata McGraw Hill Pvt. Ltd., 2011.

Web Links:

1. https://nptel.ac.in/courses/117/104/117104069/
2. https://ocw.mit.edu/resources/res-2-006-girls-who-build-cameras-summer-2016/image-processing/

Code: B17 EC4103

FIBER OPTIC COMMUNICATIONS

Lecture	**: 3 Periods**	**Int. Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives: Students should learn

1. To expose the students to the basics of optical fibers and their impairments, components & devices, propagation and elementary system design.

Course Outcomes: On the completion of this course, the students will be able to

S. No	Out Come	Knowledge Level
1	Summarize the basic concepts of optical communication and demonstrate its components.	**K2**
2	Apply basic concepts of optical communication components and systems.	**K3**
3	Gain the knowledge of different sources of light as well as detectors and their comparative study.	**K4**
4	Analyze concepts of optical communication systems for the basic design of optical communication links	**K4**

SYLLABUS

UNIT-I- Overview of optical fiber communication:
Telecommunications, A Fiber-optic communication system: The Basic blocks, Historical notes, EM Waves, Refractive Index, A stream of photons, How optical fibers conduct light, Attenuation, intermodal and chromatic dispersion, Bit rate and bandwidth, More about total internal reflection, more about modes, Single mode fibers, Attenuation, Dispersion and bandwidth, multimode fibers, related problems.

UNIT-II- Fabrication, Cabling, Installation &Fiber connectors, coupling:
Fabrication: Two major stages, vapour phase deposition methods, coating, Fiber optic cables, Installation: classification, installation procedure. Splicing: connection loss, splicing procedure. Fiber connectors- Connector- A basic structure, Major characteristics

UNIT-III- Optical Sources & Detectors-
LEDs: Materials, Quantum efficiency, Power, LED structure, Characteristics, Modulation.
LASERS: Basics, Semiconductor Injection Laser Diodes, Injection laser structures, Injection laser Characteristics.
Optical detectors: Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors, Related problems.

UNIT-IV-Power launching and coupling:
Output patterns, Power coupling, Power launching vs Wavelength, Equilibrium Numerical Aperture, Laser diode to fiber coupling.
Optical receiver operation: Fundamental receiver operation, Digital receiver performance, Eye diagram, Analog receivers

UNIT-V- Optical system design:
Point-to- point links- Link power budget, Rise time budget with examples, WDM concepts and components: Operation principles of WDM.

Text books:

1. Fiber Optic Communications Technology – D.K. Mynbaev and Lowell L. Scheiner, Pearson Education, 2009. [Unit-I, Unit-II].
2. Optical Fiber Communications – John M. Senior, PHI, 3rd Edition. [Unit-III].
3. Optical Fiber Communications – Gerd Keiser, McGraw-Hill International edition, 4th Edition, 2000. [Unit-IV, & Unit-V]

Reference Books:

1. Text Book on Optical Fiber Communication and its Applications – S.C.Gupta, PHI, 2005.
2. Fiber Optic Communications – Joseph C. Palais, 4th Edition, Pearson Education, 2004

Web Recourses:

1. https://www.thefoa.org/tech/ref/basic/fiber.html
2. https://media.wiley.com/product_ancillary/17/04705051/DOWNLOAD/Fiber_Optic_Communication_Systems.pdf

Code: B17EC4104

EMBEDDED SYSTEMS & INTERNET OF THINGS

Lecture	**: 3 Periods**	**Int. Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives: Students should learn

1. To make students familiar with the basic concepts of embedded system architecture and Communication protocols.
2. Expose the students to the concepts of interconnections between the physical devices and cloud.
3. Students should be educated to design & develop IoT Devices for addressing real time solutions.

Course Outcomes: On the completion of this course, the students will be able to

S. No	Out Come	Knowledge Level
1	Get familiarity with architecture and communication protocols of embedded systems and IoT.	**K2**
2	Apply the knowledge of embedded systems in understanding the concepts of IoT.	**K3**
3	Apply the knowledge of different protocols of IoT.	**K3**
4	Analyze data from physical devices through the cloud using data analytics.	**K4**

SYLLABUS

UNIT-I: Introduction to Embedded systems

Introduction to Embedded systems, processor embedded into a system, Embedded hardware units and Devices in a system, Embedded software in a system, Examples of embedded systems, embedded system-on-chip (SOC) and use of VLSI circuit design technology.

UNIT-II: Processor Architectures and Communication Devices

Real world interfacing, Introduction to advanced architectures, Processor and memory organization, I/O types and examples, Serial Bus communication protocols, Parallel bus device protocols, Internet enabled systems.

UNIT-III: Introduction to IoT& M2M

IoT definition, Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Protocols, M2M, Differences and Similarities between M2M and IOT, SDN and NFV for IoT.

UNIT-IV: IoT Physical Devices & Endpoints

Basic building blocks of an IoT Device, Exemplary Device: Raspberry Pi and IoT devices, Sensors like ultrasonic, IR sensor, temperature & humidity etc., communication modules like Bluetooth, zigbee, Wi-Fi & WSN, Lora WAN 6LoWPAN.

UNIT-V: IOT Physical Servers, Cloud Offerings & Data Analytics for IOT

Web Application Messaging Protocol (WAMP), Cloud based communication, Data Analytics, IoT Design Methodology with a use.

Text Books:

1. Embedded System Architecture Programming and Design, Raj Kamal, 2nd Edition, McGraw Hill.
2. Internet of Things: A Hands-On Approach, ArshdeepBahga, Vijay Madisetti

Reference Books:

1. Embedded Software Primer, David Simon, Pearson.
2. Internet of Things: Principles and Paradigms by RajkumarBuyya, Amir VahidDastjerdi.

Web links:

1. https://nptel.ac.in/courses/106/105/106105166/
2. https://nptel.ac.in/courses/108/102/108102169/

Code: B17EC 4105

INFORMATION THEOTRY AND CODING
(Elective – I)

Lecture	**: 3 Periods**	**Int. Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives:

Students should learn

1. To introduce students to the basic concepts of information theory & and applications of coding for information compression & channel protection, entropy, source coding and the fundamental limits of data compression
2. To study mutual entropy & channel capacity to understand the fundamental limits of information transmission, channel coding & decoding techniques for error control and means to achieve it
3. To give a foundation for studying modern wireless communications & information security

Course Outcomes: On the completion of this course, the students will be able to

S. No	Out Come	Knowledge Level
1	**Appreciate** the mathematical concept of information (uncertainty) via probability, **compute** the entropy of a source &**Understand** the need of source coding & variable length codes.	**K3**
2	**Device** source codes using Shannon-Fano & Huffman algorithms, **calculate** the efficiency of a code.	**K3**
3	**Compute** mutual entropy of a channel, understand the **concept** of channel capacity, **State** Shannon's noisy channel coding theorem which creates the field of channel coding, **compute** channel capacity of BSC & AWGN channels, **define** characteristics of an ideal communication system.	**K4**
4	**Realize** the need & benefits of channel coding, **Understand** Linear block codes structure, theory &**use** syndrome technique for **decoding** for linear block codes, **Study** cyclic codes (BCH, RS and CRC) structure, theory, implementation & decoding of cyclic codes, **differentiate** source coding and channel coding &**learn** applications of coding.	**K4**
5	**Study** Convolutional codes representation, generation & decoding of convolutional codes using Viterbi algorithm, get **acquainted** with concatenated codes to increase coding gain & Trellis Coded Modulation (TCM), **Know modern codes & pursue** modern wireless communications & information security courses.	**K2**

SYLLABUS

UNIT-I: Information Theory and Source Coding:

Discrete memory less sources, Information measure, Entropy and Information rate, Shannon's source coding theorem, Coding for a discrete memory less source, Shannon-Fano & Huffman algorithms, Predictive coding for sources with memory.

UNIT-II: Information Transmission:
Mutual information, Mutual entropy, Discrete channel capacity, Shannon's channel coding theorem, Coding for the Binary Symmetric Channel, Continuous channels: Continuous information, Entropy, Entropy maximization, AWGN channel capacity, Ideal communication system.

UNIT-III: Channel Coding: Block Codes & Cyclic Codes:
Rationale for coding, Types of codes, Discrete memory less channels, Linear block codes, Syndrome decoding, Cyclic codes, Properties of BCH, RS and CRC codes.

UNIT-IV: Convolutional Codes & Trellis codes:
Representation & generation, Decoding Convolutional codes, Exhaustive search method, Maximum Likelihood decoding of Convolutional codes, Viterbi Algorithm, Sequential decoding, Trellis codes, Burst error correction, Interleaving, Automatic Repeat Request (ARQ) schemes.

UNIT-V: Modern Codes:
Applications of coding, Concatenated coding, Turbo codes, Non-recursive and Recursive Systematic Convolutional(RSC) Encoders, Turbo Encoder, Low Density Parity Check(LDPC) Codes, Properties, Parity Check Matrix H, Tanner Graphs, MIMO System, Space–Time-Coded MIMO System, Space–Time Block Codes (STBC), Alamouti 2-transmit Code (2-Transmit, 1- Receive).

Textbooks:
1. Communication Systems, 3/e, by A.B. Carlson, Mcgraw Hill Publishers (Part-I).
2. Digital Communications by Simon Haykin, John Wiley & Sons (Part-I & II).

Reference Books:
1. Channel Coding Techniques for Wireless Communications, by K.DeerghaRao, Springer publications (part-II)
2 Information Theory, Coding and Cryptography – Ranjan Bose, 2nd Ed, 2009, TMH

Web Links:
1. https://nptel.ac.in/courses/117/101/117101053/

Code: B17 EC4106

SATELLITE COMMUNICATIONS & GPS
(Elective – I)

Lecture	**: 3 Periods**	**Int. Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course objectives: Students should learn

1. An ability to apply the fundamentals of Kepler's planetary motion in satellite communication and GPS.
2. An ability to analyze the space segment of satellite communication systems and multiple access techniques
3. An ability to design link parameters of satellite uplink and downlink budget.

Course outcomes: On completion of the course the student will be able to

S. No	Out Come	Knowledge Level
1	Apply fundamentals of Kepler's planetary motion in satellite communication and GPS.	**K3**
2	Analyze and build the space segment, depending upon the requirement	**K4**
3	Design link margin for various applications.	**K4**
4	Choose the correct multiple access technique for better communication.	**K2**

SYLLABUS

UNIT-I: Satellite Orbits
Kepler's Laws, orbital parameters, orbital perturbations, station keeping, geo-stationary and non-Geo-stationary orbits, Look Angle Determination, Limits of visibility, eclipse, Sub satellite point, Sun transit outage, Launching Procedures ,launch vehicles and propulsion

UNIT-II: Space Segment
Spacecraft Technology, Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command

UNIT-III: Earth Segment
The Earth station, HPA, Downlink, Output back off, Satellite TWTA output, Effects of rain, G/T ratio, combined uplink and downlink C/N ratio.

UNIT-IV: Satellite Access
Modulation and Multiplexing: Voice, Data, Video, Analog, digital transmission system, Digital video Broadcast, multiple access: FDMA,TDMA,CDMA, Channel Assignment Methods, SPADE system, Spread Spectrum communication.

UNIT-V: Global Positioning System
Overview of GPS: Basic concept, system architecture, space segment, user segment, GPS Working Principle, GAGAN, GPS Signal structure, Fundamentals of other Global Navigational Systems (GLONASS, GALILEO).

Text Books:

1. Satellite Communication, by Timothy Pratt, Charles Bostian, Jeremy Allnutt(Second Edition), John Wiley & Sons
2. Global Navigation Satellite Systems with Essentials of Satellite Communication—G.S.RAO

Reference Books:

1. Satellite Communications, by Dennis Roddy (Fourth edition), McGraw Hill.
2. Satellite Communication Systems Engineering, by Wilbur L. Pritchard, Henri G. Suyderhoud, Robert A. Nelson (Second Edition), Pearson.

Web Links:

1. https://www.isro.gov.in/applications/satellite-communication
2. https://www.isro.gov.in/spacecraft
3. https://www.isro.gov.in/launchers

Code: B17 EC 4107

ANALOG IC DESIGN
(Elective – I)

Lecture	**: 3 Periods**	**Int. Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course objectives: Students should

1. Outline the behaviour of MOS Devices and Small-Signal & Large-Signal Modeling of MOS Transistor and Analog Sub-Circuits
2. Analyze CMOS Amplifiers like Differential Amplifiers, Cascode Amplifiers, Output Amplifiers, and Operational Amplifiers
3. Design and develop the Analog CMOS Circuits for different Analog operations

Course outcomes: On completion of the course the student will be able to

S. No	Out Come	Knowledge Level
1	Outline the concepts of MOS Devices ,MOS device characteristics, MOS device modeling, CMOS amplifiers, Open-Loop Comparators and different types of oscillators	**K2**
2	Analyze Analog CMOS Sub circuits and Complex Analog Circuits	**K4**
3	Design Analog CMOS Sub circuits, CMOS amplifiers, CMOS op-amps and Complex Analog Circuits	**K4**
4	Extend the analog circuit design to different applications.	**K4**

SYLLABUS

UNIT-I MOS Devices and Modeling:
The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub threshold MOS Model.

UNIT-II Analog CMOS Sub circuits:
MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference**.**

UNIT-III CMOS Amplifiers:
Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

UNIT-IV CMOS Operational Amplifiers:
Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power-Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

UNIT-V Comparators: Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators**.**

Text Books:

1. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition.
2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

Reference Books:

1. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition, 2010.
2. Analog Integrated Circuit Design- David A.Johns, Ken Martin, Wiley Student Edn, 2013.

Web Links:

1. https://nptel.ac.in/courses/117/106/117106030/

Code: B17 EC 4108

DIGITAL SIGNAL PROCESSING LAB

Lab : 3 Periods	**Int. Marks : 50**
Exam : 3Hrs.	**Ext. Marks : 50**
	Credits : 2

Course objectives: Students should learn

1. To implement Convolution and Transform techniques on a given sequence
2. To analyze frequency response of Discrete Time Signals and Systems
3. To design different Digital filters.
4. To implement basic Image Processing techniques

Course outcomes: On completion of the course the student will be able to

S. No	Out Come	Knowledge Level
1	Make use of MATLAB simulation tool for performing various operations on discrete signals.	**K6**
2	Make use of MATLAB simulation tool to verify different DSP algorithms.	**K6**
3	Make use of MATLAB simulation tool to perform various operations on an Image	**K6**

LIST OF EXPERIMENTS

1. Verification of Sampling Theorem
2. Generation of Discrete Time (DT) Sequences and Signals
3. Sampling & Quantization of Speech & Image Signals
4. Linear Convolution & Circular Convolution
5. Frequency Domain Analysis of DT Signals & Systems using DTFT
6. LTI System Simulation
7. Design and Verification of IIR Digital Filters
8. Design and Verification of FIR Digital Filters using Windows
9. Spectrum Analysis using Fast Fourier Transform (FFT)
10. LTI Filtering of Signals
11. Multirate Upsampling & Downsampling
12. Design and Simulation of Interpolation & Decimation Filters
13. Generation & Detection of DTMF Signals
14 Histogram Equalization of Images
15 Edge Detection using Sobel, Roberts & Prewitt Operators
16 Image Adjustments for Resizing, Brightness & Contrast
17 Deblurring of Images Using Wiener Filter
18 Basic Arithmetic and Logical Operations of image processing

References:

LAB Manual

Web links:

1. https://www.mathworks.com/matlabcentral/fileexchange/68840-dsp-ece-lab-matlab
2. https://www.slideshare.net/UR11EC098/digital-signal-processing-lab-manual-ece-students

Code: B17 EC4109

INTERNET OF THINGS LAB

Lab : 3 Periods	**Int. Marks : 50**
Exam : 3Hrs.	**Ext. Marks : 50**
	Credits : 2

Course Objectives: Students should learn

1. To design a IOT application prototypes with the knowledge of IOT.
2. This lab course enables students to get practical experience in interfacing IOT Modules with cloud.

Course Outcomes: On the completion of this course, the students will be able to:

S. No	Out Come	Knowledge Level
1	Able to acquire knowledge on interfacing different sensors and communication modules with the System on Chip Modules.	**K3**
2	Able to connect SOC devices with the cloud for accessing and analyzing the data.	**K4**

LIST OF EXPERIMENTS

1. Introduction to Aurdino and raspberry-pi and its applications like interfacing LED and Buzzer
2. Interfacing Push Button and DHT Sensors
3. Introduction to Communication Modules like IR and Bluetooth.
4. Interfacing Ultrasonic sensor
5. Interfacing OLED to display text and received data from sensors
6. Interfacing with TSL2561(Luminosity Sensor)
7. Establishing Serial Communication
8. Creating account in cloud and pushing data to cloud
9. MQTT Client Publish and MQTT Client subscribe
10. Assignment (Design Application)
11. Assignment (Design Application)
12. Assignment (Design Application)

Reference Books:

1. Lab Manual

Web Links:

1. http://www.etilabs.com/products/iot-board/

SCHEME OF INSTRUCTION & EXAMINATION
(Regulation R17)
IV/IV B.TECH
(With effect from **2017-2018**Admitted Batch onwards**)**

ELECTRONICS & COMMUNICATION ENGINEERING
(Accredited by NBA)
II-SEMESTER

Code No.	Name of the Subject	Credits	Lecture Hrs.	Tutorial Hrs.	Lab Hrs.	Contact Hrs./ Week	Internal Marks	External Marks	Total Marks
B17 EC 4201	Cellular and Mobile Communications	3	3	1	--	4	30	70	100
#ELE-II	ELECTIVE - II	3	3	1	--	4	30	70	100
B17 EC 4205	Advanced Communication Lab	2	--	--	3	3	50	50	100
B17 EC 4206	Seminar	2	--	--	--	--	50	--	50
B17 EC 4207	Project	10	--	--	6	6	60	140	200
Total		**20**	**6**	**5**	**9**	**20**	**220**	**330**	**550**

#ELE - II	B17 EC 4202	AI & Machine Learning
	B17 EC 4203	Network Security and Cryptography
	B17 EC 4204	Digital Signal Processors and Architectures

Code: B17EC4201

CELLULAR & MOBILE COMMUNICATIONS

Lecture	**: 3 Periods**	**Int. Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives: Students should learn

1. To make students familiar with the fundamentals of mobile communication systems.
2. An ability to understand and explain the services of mobile communication systems, multiple access techniques and architecture of GSM.
3. To have an insight into the various propagation models and different path loss strategies.

Course Outcomes: On the completion of this course, the students will be able to:

S. No	Out Come	Knowledge Level
1	Applying the fundamentals of mobile communication systems, cellular concepts and Handoff calculate the amount of interference, frequency reuse distance and capacity of a cellular system.	**K3**
2	Demonstrate an ability to explain multiple access techniques for Wireless Communication	**K2**
3	Able to understand the basics of GSM mobile communication standard, its architecture.	**K1**
4	Apply knowledge of reflection, diffraction and scattering to calculate link budget using path loss models	**K3**

SYLLABUS

UNIT – I: Introduction to Mobile and Cellular Communication Systems:
Introduction to wireless communications, examples of wireless communication systems, the cellular concept and system design fundamentals.

UNIT – II: Elements of Cellular Radio Systems and Handoff Technologies:
Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trunk and grade services, Methods for improving coverage and capacity in cellular systems.

UNIT – III: Multiple Access Techniques
Multiple access techniques for wireless communications FDMA, TDMA, Spread Spectrum techniques, SDMA, Packet Radio, CSMA, capacity of Cellular CDMA and capacity of SDMA.

UNIT – IV: GSM
Wireless systems and standards, AMPS, GSM traffic, Examples of GSM cells, Frame structure of GSM, GSM Architecture, GSM Channel types.

UNIT – V: Mobile Radio Propagation:
Introduction to mobile radio propagation, free space propagation models, Reflection, Diffraction, Scattering, Outdoor and Indoor propagation models.

Text Books:

1. Wireless Communications Principles and Practice, Second Edition, THEODORE S.RAPPAPORT.
2. Wireless and Cellular Communications by WILLIAM.C.Y.LEE.

Reference Books:

1. Wireless digital Communications, DR. KAMILO FEHER.
2. Electronic Communication system, WAYNE TOMASI.

Web Links:

1. https://nptel.ac.in/courses/106/106/106106167/
2. https://www.youtube.com/watch?v=whYljse4Abc
3. https://www.youtube.com/watch?v=f2wlHL1Sok8

Code: B17EC4202

AI & MACHINE LEARNING
(Elective – II)

Lecture	**: 3 Periods**	**Int. Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course objectives:
The student should
1. Be familiar basic concepts of artificial intelligence & machine learning and their applications.
2. Be familiar with types of machine learning methods and learn various techniques to apply them.
3. Illustrate the fundamentals of neural networks and its learning process.

Course Outcomes: On the completion of this course, the students will be able to

S. No	Out Come	Knowledge Level
1	Summarize the basic concepts of artificial intelligence and its applications.	**K2**
2	Classify the regression and classification techniques	**K2**
3	Characterize machine learning algorithms as supervised and unsupervised	**K4**
4	Understand and apply classification and clustering techniques.	**K3**
5	Interpret concepts of neural networks and their architectures.	**K3**

SYLLABUS

UNIT-I- Introduction to Artificial Intelligence:

About Artificial intelligence-Brain science & problem solving-Turing test-History of AI-Agents-Knowledge based systems

UNIT-II- Introduction to Machine Learning:

Definition - Examples of ML Applications – Basics of Different types of learning- classification-regression-Hypothesis Space –Bias & Variance- Under fitting & over fitting- Evaluation & Cross Validation

UNIT-III -Supervised Learning:

Introduction to Supervised learning-Classification-Binary classification-confusion matrix-k Nearest Neighbor Algorithm-Decision trees-logistic regression- Simple linear regression

UNIT-IV-Unsupervised Learning:

Introduction to Supervised learning- Unsupervised vs. Supervised Learning-Applications of unsupervised learning –Clustering-Clustering as a machine learning task- Different types of clustering techniques: partitioning methods

UNIT-V - Neural Networks:

Introduction-Types of Activation Functions-Architectures of Neural Network: Single-layer feed forward network, Multi-layer feed forward network, Recurrent Network-Learning Process in ANN.

Text Books:

1. Introduction to Artificial Intelligence-Wolfgang Retell, Springer
2. Machine Learning-Tom Mitchell**.**
3. Deep Learning-Ian Good fellow, Joshua Bagnio, Aaron Carville.
4. Machine Learning-Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das

Reference Books:

1. Machine Learning: The Art and Science of algorithms that make sense of data-Peter Flach
2. Pattern Recognition and Machine Learning-Bishop.
3. Introduction to machine learning -Ethem Alpaydin.

Web Links:

1. https://nptel.ac.in/courses/106/105/106105152/
2. "Machine Learning" course by Andrew Ng on Coursera.

Code: B17EC4203

NETWORK SECURITY & CRYPTOGRAPHY
(Elective – II)

Lecture	**: 3 Periods**	**Int. Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives:
The student should be
1. Solve problems using algorithm design methods such as the RSA, DES, AES.
2. Analyze the performance of algorithms.
3. Demonstrate a familiarity with major algorithms and Approaches.

Course Outcomes: On the completion of the course, Students should have to

S. No	Out Come	Knowledge Level
1	Analyze the algorithms on security problems.	**K4**
2	Understand and apply symmetric and asymmetric approaches.	**K3**
3	Understand, apply and analyze security measurements.	**K3**
4	Understand, apply and analyze various malicious Software's.	**K3**
5	Be familiar with some internet security protocols and standards.	**K2**

SYLLABUS

UNIT – I: Introduction:
The need for security-Security approaches, principles of security, plaintext and cipher Text- Types of attacks –substitution and Transportation Techniques –Encryption Techniques –Encryption and Decryption- Symmetric and Asymmetric Cryptography – Stenography-KDC.
Symmetric Key Cryptographic Algorithms: Feistel Cipher Structure, Data encryption standard, Triple DES, AES, Stream Ciphers and RC4.

UNIT – II: Asymmetric Key Cryptographic Algorithms:
Overview of Asymmetric key cryptography, Diffiehellman key change - RS Algorithm, Symmetric and asymmetric key cryptography together - message digest, MAC, HMAC- Digital signature.

UNIT – III Public Key Infrastructure:
Introduction - Digital Certificates-Private Key management-The PKIX model.
User Authentication Mechanisms: Introduction-Authentication basics-passwords-authentication tokens-certificate based authentication-biometrics authentication-Kerberos.

UNIT – IV Internet Security Protocols:
Basic concepts -SSL-SHTTP-TSP-SET- SSL versus SET-3D secure protocol -Email security-WAP security -security in GSM – 3G Securities, Introduction To Firewalls-IP security-Virtual Private Networks.

UNIT – V: Malicious Software:
Types of Malicious Software, Viruses, Viruses countermeasures, Warms, Bots, and Honey pots, Denial of Service Attacks and Flooding Attacks.

Text Books:

1. Cryptography and Network security, AtulKahate, Tata Mc Graw-Hill Pub companyLtd, NewDelhi.
2. Computer Security by William Stallings and Lawrie Brown, Pearson Pub

Reference Books:

1. Network Security Private Communication in a public world, Charlie Kaufman, Radia Perlman &Mike Speciner, Prentice Hall of India Private Ltd., New Delhi.
2. Network Security:The Complete Reference by Roberta Bragg, Mark Phodes- Ousley, Keith Strass berg TataMcgraw-Hill.

Code: B17EC4204

DIGITAL SIGNAL PROCESSORS AND ARCHITECTURES
(Elective - II)

Lecture	**: 3 Periods**	**Int. Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives: The student should be

1. The basic DFT, FFT and rate conversion algorithms.
2. The number format, dynamic range and sources of errors in DSP systems
3. About TMS programmable DSPs and their programming capabilities.
4. The basic DSP algorithms on TMS processors
5. The FFT algorithms on TMS320C54XX DSP device.

Course Outcomes: On the completion of the course, Students should have the

S. No	Out Come	Knowledge Level
1	Implement the DFT and FFT on signals and different types of computations of DSP with basic mathematics.	**K2,K3**
2	Able to deal with the basic architecture and different design issues in DSP processors.	**K2**
3	Able to perform the operations with different families of commercially available DSP processors.	**K2,K4**
4	Connect the DSP processors to different interfacing devices.	**K2**

SYLLABUS

UNIT-I: Introduction to Digital Signal Processing and Computational Accuracy in DSP Implementations:

Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation.

Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT-II: Architectures for Programmable DSP Devices:
Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation UNIT, Programmability and Program Execution, Speed Issues, Features for External interfacing.

UNIT-III: Programmable Digital Signal Processors:
Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX

Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline operation of TMS320C54XX Processors.

UNIT-IV: Analog Devices Family of DSP Devices:

Analog Devices Family of DSP Devices – ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP 2100, ADSP-2181 high performance Processor.

Introduction to Blackfin Processor - The Blackfin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory, Basic Peripherals.

UNIT-V: Interfacing Memory and I/O Peripherals to Programmable DSP Devices:
Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA)

Text Books:

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. A Practical Approach to Digital Signal Processing - K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, New Age International, 2006/2009

Reference Books:

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkataramani and M. Bhaskar, 2002, TMH.
2. Digital Signal Processing –Jonatham Stein, 2005, John Wiley.

Code: B17EC4205

ADVANCED COMMUNICATIONS LABORATORY

Lab : 3 Periods	**Int. Marks : 50**
Exam : 3Hrs.	**Ext. Marks : 50**
	Credits : 2

C**ourse Objectives: The aim of the course is to**

1. Study the design and verification of the concepts of modern digital communication systems that operate from MHz-GHz range.'
2. Simplify the practical illustrations of various Digital Modulation and demodulation techniques.
3. Expose to the challenges and characteristics of communication over an OFC channel.
4. Study the basic antenna types and their radiation patterns.
5. Study the fundamentals of microwave communication and challenges.

Course out Comes: after the completion of the course, students will be able to:

S. No	Out Come	Knowledge Level
1	Comprehend the microwave signal measurement using VSWR and frequency meter.	**K4**
2	Comprehend the design, application and practical implementation of various Digital Modulation techniques.	**K5**
3	Identify the challenges in practical implementation of Microwave Communication systems.	**K4**
4	Apply the knowledge of antennae to plot the characteristics of various antennae and its coverage area.	**K3**
5	Comprehend the characteristics and various losses associated with OFC channels.	**K4**

LIST OF EXPERIMENTS

1. Sampling Theorem – Verification **(Hardware and Simulation)**
2. Time Division Multiplexing **(Simulation)**
3. Quantization of Signals **(Simulation)**
4. Pulse Code Modulation **(Hardware and Simulation)**
5. Differential PCM & Delta Modulation **(Hardware and Simulation)**
6. Digital Modulation Techniques **(Hardware and Simulation)**
7. BPSK Data Transmission over AWGN Channel & BER Performance **(Simulation)**
8. Spread Spectrum Modulation & Demodulation **(Simulation)**
9. Code Division Multiple Access **(Simulation)**
10. Study of The Characteristics of Reflex Klystron: Measurement of Frequency and Guide Wavelength **(Hardware)**
11. Measurement of Standing Wave Ratio and Reflection Coefficient **(Hardware).**
12. Study of Gunn Diode Characteristics **(Hardware).**
13. Measurement of Unknown Load Impedance **(Hardware).**
14. Study of Dipole Antenna **(Hardware).**

15. Measurement of Numerical Aperture **(Hardware)**

Reference:

1. Lab Manual

Web Links:

https://nitdelhi.ac.in/wp-content/uploads/2017/08/Advanced-Communication-Laboratory.pdf

Code: B17 EC 4206

SEMINAR

Lecture	**: --**	**Int. Marks**	**: 50**
Tutorial	**: --**	**Ext. Marks**	**: --**
Exam	**: --**	**Credits**	**: 2**

For the seminar, each student has to be evaluated based on the presentation of any latest topic with report of 10-15 pages and a PPT of minimum 10 slides. The student shall collect the information on a specialized topic and prepare a technical report, showing his understanding over the topic, and submit to the department, which shall be evaluated by the Departmental committee consisting of Head of the department, seminar supervisor and a senior faculty member.

NOTE: Minimum of 50 % of marks is required to pass in seminar. If a student fails to get those minimum marks he/she has to again present the same topic within 2 weeks from the date of earlier presentation.

Code: B17 EC 4207

PROJECT WORK

Lab	**: 3 Hrs.**	**Int. Marks**	**: 60**
Tutorial	**: --**	**Ext. Marks**	**: 140**
Exam	**: --**	**Credits**	**: 10**

Course Outcomes: At the end of the Project Work students will be able to

S.No	Out Come	Knowledge Level
1	Identify a current problem through literature/field/case studies	K3
2	Identify the background objectives and methodology for solving the same.	K3
3	Design a technology/ process for solving the problem.	K6
4	Develop a technology/ process for solving the problem.	K6
5	Evaluate that technology/ process at the laboratory level.	K5

Format for Preparation of Project Thesis for B. Tech:

1. Arrangement of Contents: The sequence in which the project report material should be arranged and bound should be as follows:

1. Cover Page & Title Page.
2. Bonafide Certificate
3. Abstract.
4. Table of Contents
5. List of Tables
6. List of Figures
7. List of Symbols, Abbreviations and Nomenclature
8. Chapters
9. Appendices
10. References

*The table and figures shall be introduced in the appropriate places.

Note:

Out of a total of 200 marks for the project work, 60 marks shall be for Internal Evaluation and 140 marks for the end semester examination. The end semester examination (VivaVoce) shall be conducted by the committee. The committee consists of an external examiner, Head of the Department and Supervisor of the Project. The evaluation of project work shall be conducted at the end of the IV year. The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project and evaluated by an internal committee.