

**ACHARYA NAGARJUNA UNIVERSITY**  
**SCHEME OF INSTRUCTION AND EXAMINATION, w.e.f. 2015-2016**  
**ELECTRONICS & COMMUNICATION ENGINEERING BRANCH**  
**IV/IV B.TECH - I SEMESTER**

Sl. No.	Course Details		Scheme of Instruction			Scheme of Examination			Credits
	Code No.	Subject Name	Periods per week			Maximum Marks		Total Marks	
			L	T	P	Internal	External		
1.	EC 411	Industrial Management	4	-	-	40	60	100	3
2.	EC 412	Digital Image Processing	4	-	-	40	60	100	4
3.	EC 413	Microwave Engineering	4	1	-	40	60	100	4
4.	EC 414	VLSI Design	4	1	-	40	60	100	4
5.	EC 415	Elective-I DSP Processors Neural Networks Speech Signal Processing Satellite Communications	4	1	-	40	60	100	4
6.	EC 416	Open Elective Applied Electronics Basic Communication	4		-	40	60	100	3
7.	EC 451	VHDL Lab	-	--	3	40	60	100	2
8.	EC 452	Microwave Lab	-	-	3	40	60	100	2
9.	EC 453	Project Work(Part A) & Internship	-	-	4	50		50	2
10.	EC 454	Internship						0	
	Total		24	3	10	370	480	850	28

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**SCHEME OF INSTRUCTION AND EXAMINATION, w.e.f. 2015-2016**  
**ELECTRONICS & COMMUNICATION ENGINEERING BRANCH**  
**IV/IV B.TECH - II SEMESTER**

Sl. No.	Course Details		Scheme of Instruction			Scheme of Examination			Credits
	Code No.	Subject Name	Periods/week			Maximum Marks		Total Marks	
			L	T	P	Internal	External		
1.	EC 421	Mobile and Cellular Communication	4	1	-	40	60	100	4
2.	EC 422	Optical Communication	4	1	-	40	60	100	4
3.	EC 423	Elective-III ➤ Telecommunication & Switching Networks ➤ Orthogonal Frequency Division Multiplexing ➤ Spread Spectrum Communication ➤ RF circuit Design ➤ Embedded Systems	4	1	-	40	60	100	4
4.	EC 424	Elective –IV ➤ Radar and Navigational Aids ➤ Wireless Communications ➤ Coding Theory and Techniques ➤ HDL programming	4	1	-	40	60	100	4
7.	EC 461	Optical Communication Lab	-	-	3	40	60	100	2
8.	EC 462	Project Work (Part B)	-	-	12	80	120	200	10
	Total		16	4	15	280	420	700	28

**UNIT – I****GENERAL MANAGEMENT:**

Principles of scientific management, Brief treatment of managerial functions.

**FORMS OF BUSINESS ORGANISATION:**

Salient features of sole proprietorship. Partnership, Joint Stock Company, private limited and public limited companies.

**UNIT – II****FINANCIAL MANAGEMENT:**

Concept of interest, compound interest, equivalent cash flow diagram

**ECONOMIC EVALUATION OF ALTERNATIVES:**

Basic methods, the annual equivalent method, present worth method, future worth method.

**DEPRECIATION:**

Purpose, types of depreciation, common methods of depreciation. The straight line method, declining balance method, the sum of the years digits method.

**UNIT – III****PERSONNEL MANAGEMENT:**

Functions of Personnel Management – Human Resources Planning, Brief treatment of Recruitment, Selection, Placement, Performance Appraisal, Career Development, Training and Development, Compensation. Staff role of Personnel Department, Organization for the Personnel Function. Goals and Plans of the Organization. Motivation and Leadership, Theories of Motivation and styles of Leadership.

**UNIT – IV****MATERIAL MANAGEMENT:**

Purchasing, Objective, Source Selection, Procurement Methods, Inventory Management –EOQ, EPQ, ABC Analysis.

**MARKETING MANAGEMENT:** Functions of Marketing, Product life cycle, Channels of distribution, Advertising & Sales promotion, Market Research.

**TEXT BOOKS:**

1. KK Ahuja, Industrial Management, Vol. I & II, Dhanpat Rai, 1978.
2. E.Paul Degarmo, John R Chanda, William G Sullivan, Engineering Economy, Mac Millan Publishing Co, 1979

**REFERENCE BOOKS:**

1. Philip Kotler, Marketing Management, 11th Edition, Pearson Education, 2004.
2. P. Gopalakrishnan, Hand Book of Materials Management, PHI, 1999  
Heinz Weirich and Harold Koontz, Management, 10th Edition, TMH, 2004

**UNIT – I****INTRODUCTION:**

Origin of Digital Image Processing, Fields that uses Digital Image Processing, Fundamental steps in Digital Image Processing, Components of an Image Processing System.

**DIGITAL IMAGE FUNDAMENTALS:**

Elements of Visual perception, Image sampling and Quantization, Basic relationships between Pixels, Linear and Non-linear operations.

**UNIT – II****IMAGE ENHANCEMENT IN SPATIAL DOMAIN:**

Some basic Grey level transformations, histogram processing, enhancement using Arithmetic/Logic operations, Smoothing Spatial Filters, Sharpening Spatial Filters.

**IMAGE ENHANCEMENT IN FREQUENCY DOMAIN:**

Introduction to Fourier Transform and the Frequency Domain, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters.

**UNIT – III****IMAGE RESTORATION:**

Noise models, Restoration in the presence of Noise, only Spatial Filtering, Periodic Noise reduction by Frequency Domain Filtering, Linear, Position- Invariant Degradations, Inverse Filtering, Wiener Filtering.

**IMAGE COMPRESSION:**

Fundamentals – Image Compression models – Error Free Compression, Lossy Compression.

**UNIT – IV****IMAGE SEGMENTATION:**

Detection of discontinuities, Thresholding, Edge based Segmentation and Region based Segmentation.

**IMAGE REPRESENTATION AND DESCRIPTION:**

Representation schemes, Boundary Descriptors, Regional Descriptors.

**TEXT BOOK:**

1. R C Gonzalez and Richard E Woods, Digital Image Processing, Pearson Education, Second Edition, 2002

**REFERENCE BOOKS:**

1. A K Jain, Digital Image Processing, PHI, 1989
2. B Chanda and D Dutta Majumder, Digital Image Processing and Analysis, PHI,
3. MilanSonka, Vaclav Hlavac and Roger Boyle, Image Processing Analysis and Machine Vision, Thomson learning, Second Edition, 2001.

**UNIT – I****Microwave Waveguides and Components:**

**Rectangular Waveguides:** Solutions of Wave Equations in Rectangular Coordinates, TE Modes in Rectangular Waveguides, TM Modes in Rectangular Waveguides, Power Transmission in Rectangular Waveguides, Power Losses in Rectangular Waveguides.

**Circular Waveguides :** Solutions of Wave Equations in Cylindrical Coordinates, TE Modes in Circular Waveguides, TM Modes in Circular Waveguides, TEM Modes in Circular Waveguides, Power Transmission in Circular Waveguides or Coaxial Lines, Power Losses in Circular Waveguides or Coaxial Lines.

**Microwave Cavities :** Rectangular-Cavity Resonator, Circular-Cavity Resonator, Q Factor of a Cavity Resonator. Microwave Hybrid Circuits: Waveguide Tees, Magic Tees (Hybrid Tees), Directional Couplers: Two-Hole Directional Coupler, S Matrix of a Directional Coupler, Circulators and Isolators: Microwave Circulators, Microwave Isolators.

**UNIT –III**

**MICROWAVE LINEAR-BEAM TUBES (O TYPE):** Limitations of Conventional Vacuum Tubes, Two Cavity Klystron: Reentrant Cavities, Velocity-Modulation Process, Bunching Process, Output Power and Beam Loading. Reflex Klystron: Velocity Modulation, Power Output and Efficiency, Electronic Admittance. Helix Traveling-Wave Tubes (TWTs): Slow-Wave Structures, Amplification Process. Magnetron Oscillators: Cylindrical Magnetron, Linear Magnetron.

**UNIT III:**

TRANSFERRED ELECTRON DEVICES (TEDs): **Introduction, Gunn-Effect Diodes-GaAs Diode,**

Gunn Effect, Modes of Operation, Criterion for Classifying the Modes of Operation, Gunn Oscillation

Modes, Limited-Space-Charge Accumulation (LSA) Mode.

**AVALANCHE TRANSIT-TIME DEVICES:** Read Diode, IMPATT Diodes, TRAPATT Diodes, BARITT Diodes, Microwave Tunnel Diodes.

**UNIT IV:**

**MICROWAVE MEASUREMENTS:** Power, Frequency and Impedance Measurement at Microwave Frequency, Network Analyser and Measurement of scattering parameters, Spectrum Analyser and measurement of spectrum of microwave signal, Noise at microwave frequency and measurement of noise figure, Measurement of Microwave antenna Parameters.

**TEXT BOOKS:**

1. Microwave Devices & Circuits By Samuel Y Liao , 3rd Edition , Pearson Education ,2003
2. Microwave Engineering by D. M. Pozor, 2nd Edition, John Willy & Sons.

**REFERENCE BOOKS:**

1. Foundations for Microwave Engineering By RE Collin, IEEE Press Series, 2003
2. Microwave Engineering By ML Sisodia and V.L. Gupta, New Age International, 2005
3. Principles of Microwave Engineering, Reich, Oudong and Others.
4. Engineering Electromagnetics, 7th Edition, William H. Hayt, Tata McGraw Hill Publishing Company Ltd., New Delhi
5. S. Ramo, J.R. Whinnery and T.V. Duzer, "Fields and Waves in Communication Electronics", Third Edition, Wiley India.

**UNIT- I**

**An introduction to MOS technology:** Introduction to IC technology, Basic MOS transistors, NMOS fabrication, CMOS fabrication and BICMOS technology. Basic Electrical Properties of MOS and BICMOS Circuits:  $I_{ds}$  versus  $V_{ds}$  relationships, threshold voltage  $V_t$ , Transconductance  $g_m$ , Figure of merit  $u_0$ , Pass transistor, NMOS inverter, Pull-up to pull-down ratio, CMOS inverter, BICMOS inverters, Latch-up in CMOS circuits.

**UNIT- II**

**MOS and BICMOS circuit Design processes:** MOS layers, Stick diagrams, Design rules and layout, Sheet resistance  $R_s$ , Standard unit of capacitance, The Delay unit, Inverter delays, Propagation delays, Wiring capacitances, Scaling models, Scaling factors for device parameters.

**UNIT- III**

**Subsystem design and layout:** Architectural issues, Switch logic, Gate Logic, examples of Structured Design (combinational logic).

**Design of an ALU subsystem:** Design of 4-bit adder, adder element requirements, a standard adder element, Implementing ALU functions with an adder. A further consideration of adders: Manchester carry chain, carry select adder, carry skip adder.

**UNIT- IV**

VLSI design flow, Introduction to ASICs, Full Custom ASICs, standard cell based ASICs, Gate array based ASICs, Programmable logic devices, PLAs, PALs, CPLDs and FPGAs.

**VHDL Hardware Description Language:** Program Structure, Types and Constants, functions and Procedures, Libraries and Packages, Structural Design Elements, Dataflow design Elements, Behavioral design Elements, The Time Dimension and Simulation, Synthesis.

**TEXT BOOKS:**

1. Douglas A.Pucknell and Kamran Eshraghian, Basic VLSI Design, Third edition, PHI, 2002.
2. Michael John Sebastian Smith, Application Specific Integrated Circuits, Addison Wesley, 2003.
3. J.Bhasker, A VHDL Primer, Pearson Education, Third edition, 1999.
4. John F Wakerly, Digital Design Principles & Practices, 3rd Edition, Pearson Education, 2002.

**REFERENCE BOOKS:**

1. Neil H E Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, A system perspective, 2nd Edition, Pearson Education, 2002.
2. Stephen Brown and Z Vonko Vranesic, Fundamentals of Digital Logic with VHDL Design, TMH, 2002.

**EC-415/A**

**DSP PROCESSORS**

**L T P M**  
**4 1 0 100**

**UNIT – I**

Realtime concepts, structural level of processing, digital signal processing and DSP systems, comparison between general purpose processors and DSP processors, examples of DSP processors, motivation for the specialized processors.

**UNIT – II**

Numeric representation and arithmetic fixed point versus floating point representation, native data word widths, relation between data word size and instruction word sizes, effects of finite word registers.

**UNIT – III**

Key features of TMS 320C6713 processor, architecture and addressing modes of 6713 processor, instruction set of TMS 320C6713 processor.

**UNIT – IV**

Programming the TMS 320 c 6713 processor, implementation of circular convolution, linear convolution , FFT algorithms,. FIR filters, IIR filters and multi rate filters on the DSP processor.

**Text Books:**

John G Ackenhusin, Realtime signal processing, Printice Hall of India, 1999.  
Phil Lapsly, Jeff Bier, Amit Sheham, dDSP processor fundamentals and architectures and features, S Chand & Co. New Delhi.

**References:**

TMX 32C 67133 User Guide.



**UNIT – I**

**Introduction:** History of Neural Networks, Structure and functions of biological and artificial neuron, Neural network architectures, Learning methods, evaluation of neural networks

**UNIT – II**

**Supervised Learning – I:** Single layer networks, McCulloch – Pitts Neuron Model, Perceptron learning, Delta learning, Widrow – Hoff learning rules, Linear separability, Adaline and modifications.

**UNIT – III**

**Supervised Learning – II:** Multi layer networks: Architectures, Madalines, Backpropagation algorithm, importance of learning parameter and momentum term, radial basis functions, polynomial networks.

**Unsupervised Learning:** Winner – Take – all learning, out star learning, learning vector quantizers, counter propagation networks, Kohonen self organizing networks, Grossberg layer, adaptive resonance theory, Hamming Net.

**UNIT – IV**

**Associative Memories:** Hebbian learning rule, continuous and discrete, Hopfield networks, recurrent and associative memory, Boltzman machines, Bi-directional associative memory.

**Applications of Neural Networks :** Optimization, Travelling Salesman, Problem solving simultaneous linear equations, Applications in pattern recognition and Image Processing

**TEXT BOOKS:**

1. Kishan Mehrotra, Chelkuri K. Mohan, Sanjav Ranka, elements of Artificial Neural Networks, Tenram International
2. J.M. Zurada Introduction to Artificial Neural Systems, Jaico Publications
3. B. Yegnanarayana, Artificial Neural Networks, PHI, New Delhi
4. Wasserman: Neural Computing – Theory and Practice.
5. S.N.Deepa S.N.Sivanandam, Principles of Soft Computing, Second Edition.

**UNIT – I****PRODUCTION AND CLASSIFICATION OF SPEECH SOUNDS:**

Anatomy and Physiology of Speech Production, Categorization of Speech Sounds. Acoustics of Speech Production: Physics of Sound, Uniform tube model, A Discrete-Time model based on Tube Concatenation.

Time-Domain Models for Speech Processing: Short-Time energy, average zero crossing rate, Pitch period estimation using autocorrelation.

**UNIT – II****SHORT TIME FOURIER TRANSFORM ANALYSIS AND SYNTHESIS:**

Short Time Analysis, Signal estimation from STFT, Frequency Domain Pitch Estimation, A Correlation based Pitch Estimator, Pitch estimation based on a Comb Filter.

**DIGITAL REPRESENTATIONS OF THE SPEECH WAVEFORM:**

Instantaneous quantization, Delta Modulation, DPCM.

**UNIT – III****HOMOMORPHIC SIGNAL PROCESSING:**

Homomorphic Systems for Convolution, Complex Cepstrum of Speech-like Sequences, Spectral root Homomorphic Filtering, Short-Time Homomorphic Analysis, Short-time Speech Analysis and Analysis/Synthesis Structures.

**UNIT – IV****SPEECH CODING:**

Linear Prediction, Error minimization, Autocorrelation method, Levinson Recursion, Lattice filter formulation of the inverse filter. Vector Quantization, Distortion Measure, Sub-band coding

**SPEAKER RECOGNITION:**

Spectral features for Speaker Recognition, Mel- Cepstrum, Speaker Recognition Algorithms, Minimum – distance classifier.

**TEXT BOOKS:**

1. Thomas F Quatieri, Discrete-Time Speech Signal Processing Principles and Practice, Pearson Education, 2002.
2. L R Rabiner and R W Schafer, Digital Processing of Speech Signals Pearson Education, 2002.

**UNIT – I****INTRODUCTION AND ORBITAL ASPECTS OF SATELLITE COMMUNICATIONS:**

A brief history of Satellite Communications, Types of Orbits, Orbital Mechanics: Developing the Equation of the orbit, Kepler's laws of planetary motion, locating the satellite in the orbit, locating the Satellite with respect to the Earth, Orbital elements, Look angle determination, Orbital perturbations, launch and launch vehicles, Orbital effects in Communication System performance.

**UNIT – II****SATELLITE SUBSYSTEMS:**

Introduction, Attitude and Orbit Control System (AOCS), Telemetry, Tracking, Command and Monitoring (TTC&M), Power Systems, Communication Subsystems, Satellite Antennas

**MULTIPLE ACCESS TECHNIQUES:**

Introduction, FDMA, TDMA, DAMA and CDMA Satellite Systems Encoder, Decoder, Comparison between FDMA, TDMA & CDMA.

**UNIT – III****SATELLITE LINK DESIGN:**

Basic transmission theory, System Noise Temperature and G / T ratio. Design of Uplink and Down link models, Design of Satellite links for specified C / N ratio.

**EARTH STATION TECHNOLOGY:**

Earth Station Design, Design of large antennas, Small earth station Antennas, Propagation Effects on Satellite: Quantifying Attenuation and Depolarization, Rain and Ice Effects, Prediction of Rain Attenuation.

**UNIT – IV****VSAT SYSTEMS:**

Introduction, overview of VSAT Systems, Network Architectures, One –way Implementation, Split – Two-Way (Split IP) Implementation, Two-Way Implementation, Access Control Protocols, Delay Considerations, Basic Techniques: Multiple Access Selection, Signal Formats, Modulation, Coding, and Interference Issues.

**VSAT Earth Station Engineering:** Antennas, Transmitters and Receivers, Calculation of Link Margins for a VSAT Star Network, System Design Procedure.

Introduction, GPS Position Location Principles, Position Location in GPS, GPS Time, GPS Receivers and Codes.

**TEXT BOOKS:**

- 1) T Pratt and W Bostian, Satellite Communications, 2nd Edition, John Wiley,
- 2) W Tomasi, Advanced Electronic Communication Systems, 4th Edition, Pearson Education, 2002.
- 3) Taub and Schilling, Principles of Communication Systems, TMH, 2003.
- 4) Simon Haykin, Communication Systems, 4th Edition, John Wiley & Sons, 2004.

**REFERENCE BOOKS:**

1. D C Agarwal, Satellite Communications, Khanna Publishers, 2003.
2. Robert M Gagliardi, Satellite Communications.

**EC – 416/A**

**APPLIED ELECTRONICS (OPEN ELECTIVE)**

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**4 0 0 100**

**UNIT -1**

Microphones, Headphones and Headsets, Loud Speakers, Disc Recording and Reproduction , Amplifying Systems Equalizers and Mixers, Electronic Music Synthesizers.

**UNIT – II**

Commercial Sound, Theatre Sound System, Audio Systems , Color TV standards and Systems, Remote Controls, Video Systems.

**UNIT – III**

Electronic Gadgets and Home Appliances:  
Telecommunication Systems, Switching Systems, Modulation Techniques, Carrier Systems, Fibre Optics

**UNIT –IV**

Data Services, Mobile Systems, Facsimile fax, Xerography

**Text Book:**

1. Consumer Electronics by S.P.Bali, Pearson Education, ISBN: 9788131717592.

**Reference Books:**

1. Consumer Electronics for Engineers by Philip Herbert Hoff, Cambridge University Press (July 28, 1998), **ISBN-10:** 0521582075
2. Digital Consumer Electronics Handbook by Ronadl K.Jurgen, (Editor) by McGraw Hill Professional Publishing, 1997. **ISBN-10:** 0070341435

**UNIT I****Digital communication and Broadband communications**

**Digital communication:** Digital fundamentals, fundamentals of data communications, data sets and sets and interconnection requirements, network and control consideration.

**Broadband communications:**

Multiplexing, short and medium-haul systems, long haul systems elements of long distance telephony.

**UNIT II****Microwave tubes and Circuits & Radar systems**

**Microwave tubes:** Microwave triodes, multicavity klystron, reflex klystron, magnetron, travelling-wave tube(TWT) types performance and applications, other microwave tubes like crossed-filed amplifier, backward-wave oscillator.

**Radar systems:** Basic principles, pulsed systems, other Radar systems

**UNIT III****Fiber optical technology and Antennas**

**Fiber optical technology** Introduction to light, the optical fiber and fiber cables, fiber optic components and systems, installation, testing and repairing.

**Antennas:** Basic considerations, wire radiators in space, terms and definitions, effects of ground on antennas.

**UNIT IV****Radio receivers and Transmission lines**

**Radio receivers:** Receiver types, AM receivers, Communications Receivers, FM Receivers, Single and independent-Sideband Receivers

**Transmission lines:** Basic principles, the smith chart and its applications, transmission-line components

**TEXT BOOKS:**

- 1) Electronic communication systems by KENNEDY 4th edition
- 2) Communication Systems by Simon Haykin 3rd edition

**REFERENCE BOOKS:**

- 1) Communication systems and techniques by Mischa Schwartz, Willam R.Bennett, Seymour Stein.
- 2) Communication systems by Marcelo S.Alencar, Valdemar C.da Rocha,

VHDL Modeling and Synthesis of the following Experiments

1. Logic Gates
2. Combinational Logic
3. JK, D, T, and SR flip-flops with preset and clear inputs
4. 4-bit shift register and bidirectional shift register with parallel load
5. 4-bit Ripple/Synchronous counters
6. 4-bit carry look ahead adder
7. Implementation Moore and Mealy state machines
8. Implementation of two 4-bit numbers multiplication using Booth's algorithm
9. Traffic light controller
10. Implementation of two floating-point numbers addition
11. Implementation of two floating-point numbers multiplication
12. Construct an 8-bit dedicated data path to generate and add the numbers from n down to 1, where 'n' is an 8-bit user input number
13. Construct an 8-bit dedicated control unit to generate and add the numbers from n down to 1, where 'n' is an 8-bit user input number
14. Construct an 8-bit general data path to generate and add the numbers from n down to 1, where 'n' is an 8-bit user input number
15. Construct an 8-bit general control unit to generate and add the numbers from n down to 1, where 'n' is an 8-bit user input number

**Experiments Based on Microwave Engineering**

- 1) To study microwave components.
- 2) To plot the V-I characteristics of Gunn Diode and determine the Threshold voltage.
- 3) To study the characteristics of reflex klystron oscillator.
- 4) Measurement of guided wavelength of the given Rectangular wave guide (Klystron or Gunn or both)
- 5) Calculate Low VSWR and High VSWR using VSWR Meter.
- 6) Attenuation and power measurement due to component under test and with the frequency.
- 7) Measure an unknown Impedance of a given load. (using smith chart also )
- 8) Measurement of scattering parameters of Magic Tee or Circulators.
- 9) Scattering coefficient measurement using the Vector Network Analyzer.
- 10) To demonstrate Spectrum Analysis measurement techniques of a signal source and measure frequency using spectrum analyzer.
- 11) Gain of Horn Antenna, radiation Pattern and beam width.
- 12) To measure the dielectric constant of given solid material.
- 13) To measure coupling coefficient, Insertion loss & Directivity of a Directional coupler.
- 14) To measure the Q – factor of the given wave guide.
- 15) To determine isolations, coupling coefficients and input VSWR's for E and H plane waveguide Tee and Magic Tee junctions

**UNIT I**

**CELLULAR MOBILE RADIO SYSTEMS:** Introduction to Cellular Mobile System, uniqueness of mobile radio environment, operation of cellular systems, consideration of the components of Cellular system, Hexagonal shaped cells, Analog and Digital Cellular systems.

**CELLULAR CONCEPTS:** Evolution of Cellular systems, Concept of frequency reuse, frequency reuse ratio, Number of channels in a cellular system, Cellular traffic: trunking and blocking, Grade of Service; Cellular structures: macro, micro, pico and femto cells; Cell splitting, Cell sectoring.

**INTERFERENCE:** Types of interferences, Introduction to Co-Channel Interference, real time Co-Channel interference, Co-Channel measurement, Co-channel Interference Reduction Factor, desired C/I from a normal case in a omni directional Antenna system, design of Antenna system, antenna parameters and their effects, diversity receiver, non-cochannel interference-different types.

**UNIT II**

**FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT:** Numbering and grouping, setup access and paging channels, channel assignments to cell sites and mobile units: fixed channel and non-fixed channel assignment, channel sharing and borrowing, overlaid cells.

**CELL COVERAGE FOR SIGNAL AND TRAFFIC:** Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long distance propagation, antenna height gain, form of a point to point model.

**UNIT III**

**CELL SITE AND MOBILE ANTENNAS :** Sum and difference patterns and their synthesis, omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, high gain antennas.

**HANDOFF STRATEGIES**

Concept of Handoff, types of handoff, handoff initiation, delaying handoff, forced handoff, mobile assigned handoff, intersystem handoff, vehicle locating methods, dropped call rates and their evaluation.

**UNIT IV**

**DIGITAL CELLULAR NETWORKS:** GSM architecture, GSM channels, multiple access schemes; TDMA, CDMA, OFDMA; architecture of 3G cellular systems.

**TEXTBOOKS:**

1. Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2nd Edn., 2006.
2. Principles of Mobile Communications – Gordon L. Stuber, Springer International 2nd Edition, 2007.

**REFERENCES:**

1. Wireless Communications – Theodore. S. Rapport, Pearson education, 2nd Edn., 2002.
2. Wireless and Mobile Communications – Lee McGraw Hills, 3rd Edition, 2006.
3. Mobile Cellular Communication – G Sasibhushana Rao Pearson
3. Wireless Communication and Networking – Jon W. Mark and Weihua Zhqung, PHI, 2005.
4. Wireless Communication Technology – R. Blake, Thompson Asia Pvt. Ltd., 2004.



**UNIT – I****INTRODUCTION:**

Historical development, Elements of an Optical Fiber transmission link, Advantages of Optical Fibers, Applications of Optical Fiber, Ray Theory Transmission, Total internal reflection, Acceptance angle, Critical angle, Numerical Aperture, Fiber types : Step Index, Graded Index : Modes of Propagation : single mode and multimode fibers, Fiber materials.

**UNIT – II****TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS:**

Attenuation, absorption, scattering and bending losses in fibers, Dispersion: Inter model and intra model.

**FIBER OPTIC COMPONENTS:**

Splicing, Connectors, Connection losses, Fiber Optic couplers, Fiber Optic Switches.

**UNIT – III****OPTICAL SOURCES:**

General characteristics, Principles of Light Emission. Light Emitting Diodes types-Planar, Dome, Surface emitting, Edge emitting Super luminescent LED's, Lens coupling to fiber, LED Characteristics – Optical output power & efficiency, output spectrum, modulation bandwidth, reliability.

LASER: Working of DH injection laser, DFB laser and Threshold condition for

lasing. DETECTORS: Principles of photo detection. PIN Photodiode, Avalanche Photodiode and their characteristics.

**UNIT – IV****OPTICAL FIBER SYSTEMS:**

Optical Transmitter Circuits - source limitations, LED drive circuits.

Optical Receiver operation-Digital system transmission, error sources, receiver configuration, Preamplifier types, Digital receiver performance probability of error, Quantum limit, System considerations – Link power budget, rise time budget, Direct intensity modulation, Advanced Multiplexing Strategies – OTDM, WDM.

**OPTICAL FIBER MEASUREMENTS:**

Numerical Aperture, attenuation, refractive index, dispersion losses, cutback and OTDR.

**TEXT BOOKS:**

1. John M Senior, Optical Fiber Communications: Principles and Practice, 2nd Edition, PHI, 2002.
2. Henry Zanger and Cynthia Zanger, Fiber Optics: Communication and other Applications, Maxwell Macmillan Edition.
3. JC Palais, Fiber Optic Communications, 2nd Edition, PHI, 2001.
4. W.Tomasi, Advanced Electronic Communication Systems, Pearson Education, 2002.

**UNIT I**

**TELECOMMUNICATION SWITCHING SYSTEMS:** Evolution of Telecommunications  
Simple Telephone Communication Basics of Switching System Electronic Space Division  
Switching Stored Program Control Centralized SPC Distributed SPC Software Architecture Two  
Stage Networks Three Stage Networks N Stage Networks Time Division Switching Basic Time  
Division Time Switching Combination Switching Three Stage Combination Switching N Stage  
Combination Switching

**UNIT II**

**TELEPHONE NETWORKS:** Subscriber Loop Systems Switching Hierarchy and Routing  
Transmission Plan Signaling Techniques In-channel Signaling Common Channel Signaling  
Network Traffic Load and Parameters Grade Of Service and Blocking Probability

**FUNDAMENTAL CONCEPTS OF DATA COMMUNICATIONS:** Data Communications  
Codes Bar Codes Character Synchronization Data Communications Hardware Data  
Communications Circuits Line Control Unit Serial Interfaces

**UNIT III****DATA-LINK PROTOCOLS AND DATA COMMUNICATIONS NETWORKS:**

Introduction Data Link Protocol Functions Character- and Bit- Oriented Data Link Protocols  
Asynchronous Data-Link Protocols Synchronous Data- Link Protocols Synchronous Data-Link  
Control High-Level Data-Link Control Public Switched Data Networks Asynchronous Transfer  
Mode

**DIGITAL T-CARRIERS AND MULTIPLEXING:** Time-Division Multiplexing T1 Digital  
Carrier North American Digital Hierarchy Digital Carrier Line Coding T Carrier Systems  
European Digital Carrier System Digital Carrier Frame Synchronization Bit Versus Word  
Interleaving Statistical Time Division Multiplexing Frequency Division Multiplexing FDM  
Hierarchy Composite Baseband Signal Formation of a Master Group

**UNIT IV**

**ISDN:** What Is ISDN? ISDN Components ISDN Channel Types Basic and Primary Rate  
Interfaces ISDN Protocols ISDN Features Services and Applications Other ISDN Initiatives

**DIALUP AND HOME NETWORKING:** What Is Dialup Networking? Analog Modem  
Concepts DSL Service Cable Modems Home Networking Concepts and Issues

**NETWORK CONVERGENCE:** What Is Network Convergence? Networking Issues and  
Convergence Effects of Network Convergence on Business Convergence At Home

**TEXT BOOKS:**

- 1) T Viswanathan, Telecommunication Switching Systems and Networks, PHI, 2004
- 2) Wayne Tomasi, Advanced Electronic Communications Systems, Pearson, 6th Edition, 2004
- 3) Machael A. Gallo and William M. Hancock, Computer Communications and Networking Technologies, Cengage Learning, 1st Edition, 2002

**REFERENCE BOOKS:**

- 1) J E Flood, Telecommunications Switching, Traffic and Networks, Person, 1999
- 2) Ray Horak, Communication Systems and Networks, 3rd Edition, Wiley, 2002

**UNIT – I****Introduction**

Wireless Technology in the Future- Orthogonal Frequency-Division Multiplexing- WLANs: MAC in WLAN Standards, QoS over WLANs, Security in IEEE 802.11-WPANs: Technical Challenges of a WPAN Technology, Enabling Technologies, Ongoing Research, Research Issues for Future WPAN Technology.

**UNIT – II**

**Channel Model for OFDM Systems :** Introduction, Characterization of the Mobile Radio Channel, FD Channel Modeling, FD Channel Simulation, Application to Millimeter-Wave Radio Channels.

**Basics of OFDM and Synchronization:** OFDM Introduction and System Model, Performance of an Uncoded OFDM System.

**UNIT – III****Peak Power Problem**

Introduction, Distribution of the PAPR, Clipping and Peak Windowing: Required Backoff with a Non ideal Power Amplifier, Coding and Scrambling. Peak Cancellation, PAPR Reduction Codes: Generating Complementary Codes, Minimum Distance of Complementary Codes, Maximum-Likelihood Decoding of Complementary Codes, Suboptimal Decoding of Complementary Codes, Large Code Lengths, Symbol Scrambling.

**UNIT – IV****A Novel Hybrid OFDM Concept**

Detailed Structure of Various Multiple-Access Schemes, Comparison to MCCDMA, Analytical Performance in Fading Channels and Simulation in AWGN Channels, Performance in Fading Channels with Perfect Estimation, Performance in Fading Channels with Realistic Estimation.

**TEXT BOOK:**

1. Ramjee Prasad, "OFDM for wireless Communication Systems", Artech House Publishers, 2004.

**REFERENCE BOOKS:**

1. Lajos Hanzo, M. Yunster, B.J. Cho! and T. Keller," OFDM and MC - COMA for Broadband Mult User Communications - WLANs and Broadcasting", John Wiley and sons, IEEE press, 2003.

**UNIT – I**

Direct Sequence Systems, definitions and concepts, Spreading sequences and waveforms, Systems with PSK Modulation, Quaternary Systems, Pulsed Interference, Rejection of Narrowband Interference.

**UNIT – II**

Frequency Hopping Systems, Concepts and Characteristics, Modulations, Codes for partial band interference, Frequency Synthesizers.

**UNIT – III**

Code Synchronization, Acquisition of Spreading sequences, Serial Search Acquisition, Acquisition correlator, code Tracking, Frequency Hopping Patterns.

**UNIT – IV**

Detection of Spread Spectrum Signals, Detection of Direct sequence signals, Detection of Frequency Hopping Signals.

**Text Book:**

1. Principles of Spread Spectrum Communication Systems by Don.J.Torrieri, Springer Publishers,2005.

**References:**

1. Introduction to spread-spectrum communications by Roger L. Peterson, Rodger E. Ziemer, David E. Borth, Prentice Hall, 1995.
2. Spread Spectrum in Communications, R.Skaug, J.F.Hjelmstad, Published by Institution of Electrical Engineers

**UNIT -I: Introduction to RF Electronics:** The Electromagnetic Spectrum, units and Physical Constants, Microwave bands – RF behavior of Passive components: Tuned resonant circuits, Vectors, Inductors and Capacitors – Voltage and Current in capacitor circuits – Tuned RF / IF Transformers.

**UNIT -II: Transmission Line Analysis:** Examples of transmission lines- Transmission line equations and Biasing- Micro Strip Transmission Lines- Special Termination Conditions- sourced and Loaded Transmission Lines. Single And Multiport Networks: The Smith Chart, Interconnectivity networks, Network properties and Applications, Scattering Parameters.

**Matching and Biasing Networks:** Impedance matching using discrete components – Micro strip line matching networks, Amplifier classes of Operation and Biasing networks.

**UNIT-III : RF Passive & Active Components:** Filter Basics – Lumped filter design – Distributed Filter Design – Diplexer Filters- Crystal and Saw filters- Active Filters – Tunable filters – Power Combiners / Dividers – Directional Couplers – Hybrid Couplers – Isolators. RF Diodes – BJTs- FETs- HEMTs and Models.

**RF Transistor Amplifier Design:** Characteristics of Amplifiers – Amplifier Circuit configurations, Amplifier Matching Basics, Distortion and noise products, Stability Considerations, Small Signal amplifier design, Power amplifier design, MMIC amplifiers, Broadband High Power multistage amplifiers, Low noise amplifiers, VGA Amplifiers.

**UNIT -IV: Oscillators:** Oscillator basics, Low phase noise oscillator design, High frequency Oscillator configuration, LC Oscillators, VCOs, Crystal Oscillators, PLL Synthesizer, and Direct Digital Synthesizer. RF Mixers:Basic characteristics of a mixer – Active mixers- Image Reject and Harmonic mixers, Frequency domain considerations.

### TEXT BOOKS

- 1) RF Circuit design: Theory and applications by Reinhold Ludwig, Pavel Bretchko. Pearson Education Asia Publication, New Delhi 2001.
- 2) Radio Frequency and Microwave Communication Circuits – Analysis and Design – Devendra K. Misra, Wiley Student Edition, John Wiley & Sons

### REFERENCE BOOKS

- 1) Radio frequency and Microwave Electronics – Mathew M. Radmangh, 2001, PE Asia Publ.
- 2) RF Circuit Design – Christopher Bowick, Cheryl Aljuni and John Biyler, Elsevier
- 3) Secrets of RF Design – Joseph Carr., 3rd Edition, Tab Electronics.
- 4) Complete Wireless Design – Cotter W. Sawyer, 2nd Edition, Mc-Graw Hill.
- 5) Practical RF Circuit Design for Modern Wireless Systems Vol.2 -Less Besser and Rowan

**UNIT – I****INTRODUCTION:**

Introduction to Embedded Systems, Processor Technology, Role of Processor Selection in Embedded Systems, Design Technology, Design of custom single purpose processor, optimization of custom single purpose processor, RT level - combination logic and sequential logic.

Design cycle in the development phase for an Embedded System, Using of target system or its Emulator and in-Circuit emulator, Use of software tools for development of an Embedded Systems.

**UNIT – II****RTOS AND OVERVIEW:**

Real Time Operating Systems: Architecture of Kernel, Task, Task States and Task Scheduler, Message Queues, Event Registers, Pipes, Signals, Semaphores, Memory Management, Interrupt Routines in an RTOS environment, Basic Design Using RTOS.

**UNIT – III****EMBEDDED SYSTEM DEVELOPMENT USING PIC MICROCONTROLLER:**

**Introduction to PIC:** Types of Memory Organizations, Various PIC Series, Present usage of PIC $\mu$ c, microC PRO to Program PIC, Merits and De Merits of PIC.

**PIC16C74A** Architecture, Memory Organization, Register Organization, Pin Description, Various Internal Peripherals (Timers, ADC, CCP, USART).

**Interfacing to PIC16C74A:** LEDs, Switch, LM35 & STEPER MOTOR.

**UNIT – IV****NETWORKS FOR EMBEDDED SYSTEMS:**

The I<sup>2</sup>C Bus, The CAN bus, SHARC link ports, Ethernet, Bluetooth: specification, Core protocol, IEEE 1149.1 (JTAG) Testability.

**TEXT BOOKS:**

1. Raj kamal "Embedded systems architecture, programming and design" Tata McGraw-Hill Publishing company Limited.
2. Embedded System Design: A Unified Hardware/Software Introduction  
Frank Vahid and Tony Givargis
3. Ajay V Deshmukh, "Microcontrollers: Theory and Applications" Tata McGraw-Hill Publishing company Limited.
4. K. D. K. K. PRASAD "Real time embedded systems".

**Reference Books:**

5. Peatman, J.B.,—Design with PIC Micro Controllers|Pearson Education, 3rd Edition, 2004.
6. Mazidi, M.A.,—PIC Microcontroller| Rollin Mckinlay, Danny causey Printice Hall of India, 2007.
7. Manish K Patel "The 8051 Microcontroller based embedded systems" Tata McGraw- Hill publishing company Ltd

**Unit - I**

Introduction: Nature of Radar. Maximum Unambiguous Range. Radar Waveforms, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Related Problems. Radar Equation: Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise and SNR, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets-sphere, cone-sphere). Transmitter power.

**Unit - II**

PRF and Range Ambiguities, System Losses (Qualitative treatment). Related Problems. CW and Frequency Modulated Radar: Doppler effect, CW Radar Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirement, Applications of CW radar. FMCW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Measurement Errors, Multiple Frequency CW Radar.

**Unit - III**

MTI and Pulse Doppler Radar: Introduction, Principle, MTIR Radar with- Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers Filter Characteristics, Blind Speeds, Double Cancellation staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance. Non-coherent MTI, MTI versus Pulse Doppler Radar. Tracking Radar : Tracking with Radar, Sequential Lobing, Conical Scan, Mono-pulse Tracking.

Radar Amplitude Comparison Mono-pulse (one and two coordinates), Phase Comparison Mono-pulse. Target Reflection Characteristics and Angular Accuracy. Tracking in Range Acquisition and Scanning Patterns. Comparison of Trackers. Radar Antennas Antenna Parameters, Reflector Antennas, Lens Antennas, Lens Antennas Coscant- Squared Antenna Pattern, Radomes.

**Unit IV**

Electronically Steered Phased Array Antennas, Phase Shifters, Frequency scan Arrays, Radiation for Phased Array, Architecture for Phased Arrays. Detection of Radar Signals in Noise: Introduction, Matched Filter Receiver Response Characteristics and Derivation, Correlation detection, Detection criteria, Detector Characteristics, Automatic Detection, Constant False Alarm Rate Receiver

Radar Receivers Noise Figure and Noise Temperature. Displays types. Duplexer Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas- Basic Concepts, Radiation Pattern. Beam Steering and Beam Width changes, Series versus Parallel Feeds. Applications, Advantages and Limitations.

**Text Books**

1. Introduction to Radar Systems Merrill I. Skolnik, SECOND EDITION, McGraw Hill, 1981.
2. Radar Engineering and fundamentals of Navigational Aids-G.S.N.Raju, I.K International, 2008.

**Reference Books**

1. Introduction to Radar Systems Merrill I. Skolnik, THIRD EDITION, Tata McGraw Hill, 2001.
2. Radar: Principles, Technologies, Applications- Byron Edde, Pearson Education.

**UNIT – I**

**Introduction :** Evaluation of Mobile Radio Communication, Mobile Radio Systems around the world, Examples of Wireless Communication Systems: Paging systems, Cordless Telephone Systems, Cellular Telephone Systems

**Modern Wireless Communication Systems :** Second generation cellular networks, third generation networks, Wireless Local Loop (WLL) LMDS, Wireless Local Area Networks (WLAN), Bluetooth & Personal Area Networks

**UNIT – II**

**The Cellular Concept – System Design Fundamentals :** Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems.

**Mobile Radio Propagation:** Large-Scale Path Loss: Introduction, Free Space Propagation Model, Relating Power to Electric Field, The Three Basic Propagation Mechanisms, Reflection, Ground Reflection, Diffraction Scattering, Practical Link Budget Design Using Path Loss Models, Outdoor Propagation Models-(Longley\_Rice Model & Durkin's Model\_ A Case Study), Indoor Propagation Model (Partition Losses (Same Model ) & Partition Losses between Floors), Signal Penetration into Buildings, Ray Tracing and Site Specific Modeling

**UNIT – III**

**Mobile Radio Propagation :** Small-Scale Fading and Multipath : Small-Scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small-Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types of Small Scale Fading, Rayleigh and Ricean Distributions, Statistical Models for Multipath Fading Channels, Theory of Multipath Shape Factors for Small-Scale Fading Wireless Channels, Examples of Fading Behavior, Second-Order Statistics Using Shape Factors, Applying Shape Factors to Wideband Channels, Revisiting Classical Channel Models with Shape Factors

**UNIT – IV**

Review of the Modulation Techniques for mobile radio, Review of the Multiple Access techniques for Wireless Communication, Wireless data networking, Wireless Data Services, AMPS, Global System for Mobile(GSM)

**Text Books:**

1. TS Rappaport, wireless communications: principles and practice, Pearson education 2nd edition.
2. J G Proakis, Digital Communication, McGraw Hill, 1995.
3. GE Stuber, Principles of Mobile Communications, Kluwer academic 1996



**UNIT – I**

**Source Coding :** Mathematical models of Information, A Logarithmic Measure of information, Average and Mutual Information and Entropy, coding for Discrete memoryless Sources, Properties of Codes, Huffman Code, Run Length Codes, Lempel-Ziv Codes, Shanon – Fano coding.

**UNIT – II**

**Channel Coding :** Introduction to Linear Block Codes, Generated Matrix, Systematic Linear Block Codes, Encoder Implementation of Linear Block Codes, Parity Check Matrix, Syndrome Testing, Error Detecting and Correcting Capability of Linear Block Codes, Hamming Codes, Probability of an Undetected Error for Linear Codes Over a BSC- Perfect Codes.

**UNIT – III**

**Cycle Codes :** Algebraic Structure of Cyclic Codes, Binary Cyclic Code Properties, Encoding in Systematic Form, Syndrome Computation and Error Detection, Decoding of Cyclic Codes, Cyclic Hamming Codes

**BCH Codes :** Description of the Codes, Minimum Distance and BCH Bounds, Decoding Procedure for BCH Codes, Implementation of Galors Field Arithmetic, Implementation of Error Correction.

**UNIT-IV**

**Convolutional Codes :** Encoding of Convolutional Codes, Structural Properties of Convolutional Codes, State Diagram, Tree Diagram, Trellis Diagram, Maximum, Likelihood Decoding of Convolutional Codes, Viterbi Algorithm, Sequential decoding algorithm.

**Text Books :**

1. Error Control Coding – Fundamentals and Applications by SHU LIN and Daniel J. Costello, JR., Prentice Hall Inc
2. Simon Haykin – Communication Systems, 4th edition
3. Digital Communications – Fundamentals and Applications by Bernard Sklar, Pearson Education Asis, 2003.
4. Digital Communications – John G. Proakis, Mc. Graw Hill Publications
5. J. Das, Sk. Mallik, PK Chattergee – Princiiples of Digital Communication, NAI (P) Ltd, 2000

**UNIT – I**

Introduction to verilog HDL and Level of Abstraction. Hierarchical Modeling Concepts- Design Methodologies Modules and instances.  
Simulation Demonstration. Basic concepts, Data types, System Tasks and Compiler Directives.

**UNIT – II**

Modules and Ports- List of ports, Port Declaration, Port Connections Rules, Inputs, outputs, inout, Gate-Level Modeling-Gate types, Gate Delays and Dataflow Modeling-Continuous Assignments, Delays, Expression, Operators, and Operands, Synthesis Demonstration.

**UNIT – III**

Behavioral Modeling- Structured Procedures, Procedure Assignment, Timing Controls and Conditional Statements, Tasks and Functions.

**UNIT – IV**

Logic Synthesis with verilog HDL-Synthesis Design flow, RTL and Test Bench Modeling Techniques and Timing and Path Delay Modeling, Timing Checks, Switch Level Modeling

**TEXT BOOK:**

1. Samir Palnitkar, Verilog HDL, Pearson Education India, 2001.

1. Study of Handling of Fibers
2. Characteristic of LASER and LED diodes
3. Characteristic of Photo Diode and Avalanche Photo Diode.
4. Measurement of Numerical Aperture
5. Measurement of Coupling and Bending Losses of a Fiber
6. Measurement of Fiber Dispersion
7. Analog Link Set up using a Fiber
8. Digital Link Set up using a Fiber
9. Characteristics of Time Division Multiplexing Link using Fiber Optics
10. Characteristics of Wave Length Division Multiplexing Link using Fiber Optics
11. Analog and voice communication through optical link
12. Study Of BER and Q- Factor

**EC 462**

**PROJECT WORK**