R.T.M. Nagpur University
Scheme of Examination for
DEPARTMENT OF ELECTRONICS AND COMMUNICATION

M. Tech. in Electronics Engineering (Communication)

Scheme of Teaching & Examination

Semester-I

Subjects Code	Name of the Subjects	Hours/Week			Evaluation(Marks)				Total
		Lecture	Tutorial	Practical	Theory		Practical		
					Internal	External	Internal	External	
PG-EEC1-01	Optical Communication	3	0	0	30	70	0	0	100
PG-EEC1-02	Computer Communication Network	3	0	0	30	70	0	0	100
PG-EEC1-03	Advanced DSP	3	0	0	30	70	0	0	100
PG-EEC1-04	VLSI Signal Processing	3	0	0	30	70	0	0	100
PG-EEC1-05	Error Control Coding	3	0	0	30	70	0	0	100
PG-EEC1-06	Advanced DSP Lab	0	0	2	0	0	25	25	50
PG-EEC1-07	Optical Communication Lab	0	0	2	0	0	25	25	50
								Total	600

Semester-II

Subjects Code	Name of the Subjects	Hours/Week			Evaluation(Marks)				Total
		Lecture	Tutorial	Practical	Theory		Practical		
					Internal	External	Internal	External	
PG-EEC2-01	Advanced Digital Satellite Communication	3	0	0	30	70	0	0	100
PG-EEC2-02	Digital Image Processing	3	0	0	30	70	0	0	100
PG-EEC2-03	Digital System Design	3	0	0	30	70	0	0	100
PG-EEC2-04	Advanced Communication System	3	0	0	30	70	0	0	100
PG-EEC2-05	Elective-I	3	0	0	30	70	0	0	100
PG-EEC2-06	Advanced Communication System Lab	0	0	2	0	0	25	25	50
PG-EEC2-07	DSD Lab	0	0	2	0	0	25	25	50
								Total	**600**

Elective –I :

1) **Fuzzy & Neural Network.**
2) **Multimedia Communication System.**
3) **DSP Processor and Architecture.**

Semester-III

Subjects Code	Name of the Subjects	Hours/Week			Evaluation(Marks)				Total
		Lecture	Tutorial	Practical	Theory		Practical		
					Internal	External	Internal	External	
PG-EEC3-01	Signal Processing & Smart Antenna for Wireless Communication	4	0	0	30	70	-	-	100
PG-EEC3-02	Elective-II	4	0	0	30	70	-	-	100
PG-EEC3-03	Project Seminar	0	0	3	0	0	200	-	200
								Total	**400**

Elective-II :

1) **Embedded System**
2) **Micro Strip Integrated Systems.**
3) **Modern Radar System.**

Semester-IV

Subjects Code	Name of the Subjects	Hours/Week			Evaluation(Marks)				Total
		Lecture	Tutorial	Practical	Theory		Practical		
					Internal	External	Internal	External	
PG-EEC4-01	Thesis and Defense	0	0	6	0	0	0	400	400
								Total	**400**

OPTICAL COMMUNICATION

Syllabus

PG-EEC1-01

Fundamentals of coherent systems: Basic concepts. Modulation and Demodulation schemes. System performance

Semiconductor optical amplifiers. EDFA and Raman amplifier- modelling and analysis. Analysis and digital transmission with high power fiber amplifier.

Multichannel systems: WDM light wave systems. TDM and code division multiplexing.

Advances in wavelength division multiplexing technologies.

SONET/SDH, ATM, IP, storage area networks. Wavelength routed network. Next generation optical Internets.

Soliton systems: Nonlinear effects. Solution-based communication. High speed and WDM solution systems.

References:

1. G. P. Agrawal, Fiber Optic Communication Systems (3/e), Wiley, 2002

2. B.P. Pal, Guided Wave Optical Components and Devices, Elsevier, 2006

3. K-P. Ho Phase-modulated Optical Communication Systems, 2005

4. C. S. Murthy & M. Gurusamy, WDM Optical Networks, PHI, 2002

COMPUTER COMMUNICATION NETWORKS

Syllabus

PG- EEC1 – 02

Introduction: Network components, switching technologies network topologies transmission, protocol, routing and flow, WAN, MAN, LAN, ARPANET.
Queuing Theory: Importance Queuing models, Poisson statistics, little theorem, M/M/I and models, applications to computer networks

Data Communication Concepts: Asynchronous and synchronous transmission, error correction and detection, CRC loner arid and block codes, transmission protocols: STOP START, BSC, SDLC and HDLC. Retransmission technique: Base band interface standards modems. Forward error detection, Automatic repeat request, Acknowledgement mechanism.

LOCAL AREA NETWORK: Component – topologies access technique, polling ALLOHA, CSMA CD token spring token passing and IEEE 802 standards. Transmission media, performance. Comparison, applications, implementation procedure MAN and its IEEE standards switched and fast Ethernet. FDDI and SONET.

Network protocols:
Concept, functions, goals of layered Architecture, OSI reference model, X-25, Frame relaying. TCP/IP architecture and operations the IP layers and function naming addressing and routing in an internet, major application layers user services: E-mail, WWW, FTP, TEONET.
Backbone network/ internetworking:- Need for concepts devices: Hubs, switches, bridges, routers, grouters, gateways & repeaters, choice for implementation.
Broadband networks: Telecommunication networks, evolution ISDN: structures limitation – ISDN(B) services transfer models asynchronous transfer mode (ATM) characteristics, protocols reference model, ATM cell format, ATM services and quality of services, classes of traffic and management concept, introduction to VAST networks.

References:

1. Block U., "Computer networks, protocols standards and interfaces", PHI 2nd Edition, 1997. Keiser. G.E. "Local area networks". McGraw hill. 1989.
2. Croaches P. "Communication and network-a handbook for the first time user", 2nd edition, East-West press. 1995.
3. Taneum baum S.A. "Computer networks", Third edition PHI,. 1996.
4. Comar. D.E., "Internetworking with TCP IP-Vol-1: principle and architecture", PHI, 1996.
5. Stalling W. "High-speed Networks TCP IP and ATM design principals", Prentice Hall-inc, 1998.
6. Stalling W. "ISDN and broadband ISDN with farm relay and ATM, 3rd edition", 1998.

ADVANCED DIGITAL SIGNAL PROCESSING

Syllabus

PG – EEC1 – 03

Multirate Signal Processing : Introduction sampling and signal Reconstruction sampling rate conversion, Decimation by an integer factor, interpolation by an integer factor, Sampling rate conversion by rational factor, Sampling rate converter as a time variant system, Practical structures for decimators and interpolators, Direct from and polyphase FIR structures, with time varying coefficients.
Multirate FIR Filter design, Design of FIR Filter for sampling rate conversion, Multistage implementation of sampling rate conversion. Application of Interpolation and decimation in signal processing operations low pass and band pass filters, filter bank implementation, sub band processing, Decimated Filter banks. Two Channel filter banks, QMF filter banks, perfect reconstruction filter banks tree structure filter banks octave, band filters banks, uniform DFT filter banks.

Power Spectral Estimation: Estimation of spectra from finite duration observation of a signal, the periodogram, use of DFT in power spectral estimation, Non periodic method for power spectral estimation. Wetch & Backman, Tuckey methods, comparison of performance of non periodic power spectral estimation methods.
Parametric methods of Power Spectral Estimation : Parametric methods of Power Spectral Estimation , Relationship between auto correlation and models parameters, Auto regressive process and linear prediction, Yule – Walker. Burg & unconstrained least square methods, Sequential estimation, Moving average and ARMA models, minimum variance method, Pizarenko's harmonic Decomposition method, MUSIC method.

Multiresolution Signal analysis, decomposition, transform, Subbands & Wavelets, Orthogonal transforms, Cosine, Sine, Henmite, Walse fourier, Wavelets.
International standards for speech, Image & Video compression for personal communication.

References:

1. Operation and Schaffer, " Descrete time signal processing", Prentice Hall
2. J.G. Proakis, D.G. manolakis, "Digital Signal Processing", Prentice Hall
3. Rabinar and Gold, " Theory and Application of Digital Signal Processing".Prentice Hall
4. Rabinar and Schaffer, "Digital processing of Speech Signals", Prentice Hall
5. Orfanadis S. "Introduction to Digital Signal Processing", Prentice Hall, 1989.
6. Orfanadis S. “Optimum Signal Processing”, Printice Hall,1990.

VLSI SIGNAL PROCESSING

Syllabus

PG – EEC1 – 04

Pipelining and parallel processing: Introduction, pipelining of FIR Digital filters parallel processing, Pipelining and parallel processing for low power.
Retiming: Introduction, Definition and properties, solving system of inequalities, retiming techniques.
Unfolding introduction, An algorithms for unfolding, properties of unfolding, critical path, unfolding and retiming application of unfolding.
Folding: Introduction folding Transformation, Register Minimization Techniques, register minimization in folded architectures.

Systolic Architecture design: Introduction, systolic array design Methodology, FIR systolic Arrays, Selection of scheduling vector, Matrix Multiplication and 2D systolic array design, systolic design for space representation containing Delays.
Fast Convolution: Introduction, Cook, Toom algorithm, winogard algorithm, iterated convolution, Cyclic Convolution, Design of Fast Convolution Algorithm by Inspection.

References:

1. Keshab K. Parhi. " VLSI Digital Signal Processing System" Wiley-Inter Scinces.1999
2. Mohammed Ismail, Terri, fiez, "anolog VLSI signal and information processing 1994. Mc Graw Hill.
3. Keshab. Parthi, VLSI Digital signal processing system design and implementation Wiley-Inter science, 1999.
4. Kung. S.Y., H.J. While house T. Kailath "VLSI and Modern Signal Processing, Prentice Hall. 1985.
5. Jose E. France, Yannis Tsividls" Design of Analog Digital VLSI circuits for telecommunication and Signal Processing" Prentice Hall, 1994

ERROR CONTROL CODING

Syllabus

PG-EEC1-05

Introduction to Algebra: Groups Fields Binary Field Arithmetic, Construction of Galois Field GF (2m) and its basic properties. Computation using Galois Field GF (2m) Arithmetic Vector spaces and Matrices

Linear Block Codes: Generator and Parity check Matrices, Encoding circuits, Syndrome and Error Detection, Minimum Distance Considerations, Error detecting and Error correcting capabilities, Standard array and Syndrome decoding, Decoding circuits, Hamming Codes. Reed- Muller codes, The (24, 12) Golay code,, Product codes and Interleaved codes.

Cyclic Codes: Introduction Generator and Parity check Polynomials, Encoding using Multiplication circuit. Systematic Cyclic codes – Encoding using Feed back shift register circuits. Generator matrix for Cyclic codes. Syndrome computation and Error detection, Meggit decoder. Error trapping decoding. Cyclic Hamming codes, Golay code, Shortened cyclic codes.

BCH Codes: Binary primitive BCH codes, Decoding procedures, Implementation of Gaiois field Arithmetic, Implementation of Error correction . Non- binary BCH codes: q-aray Linear Block Codes. Primitive BCH codes over GF (q) Reed- Solomon Codes, Decoding of Non-Binary BCH and RS codes: The Berlekamp- Massey Algorithm.

Majority Logic Decodable Codes: One – Step Majority logic decoding, one –step Majority logic decodable Codes. Two- step Majority logic decoding, Multiple – step Majority logic decoding.

Convolution Codes: Encoding of Convolutional codes Structural properties, Distance properties. Viterbi Decoding Algorithm for decoding, Soft – output Viterbi Algorithm,
Stack and Fano sequential decoding Algorithms, Majority logic decoding

Concatenated Codes & Turbo Codes: Single level Concatenated codes, Multilevel Concatenated codes, Soft decision Multistage decoding, Concatenated coding schemes with Convolution inner codes, Introduction to turbo coding and their distance properties, Design of Turbo codes.

Burst- Error – Correcting Codes: Burst and Random error correcting codes, Concept of Inter – leaving, cyclic codes for Burst Error correction – Fire codes Convolutional codes for Burst Error correction.

References:

1. Shu Lin & Daniel J. Costello, Jr '' Error Control Coding'' Pearson/ Prentice Hall Second Edition, 2004. (Major Reference)
2. Blahut, R. E. ''Theory and Practice of Error Control Codes'' Addison Wesley, 1984
3. F. J. Mac Williams and N.J.A. Slone, ''The theory of error correcting codes'' North Holland, 1977
4. Peterson, W.W. & Weldon, E.J. ''Error-Correcting Codes'' MIT Press, Cambridge. Massachusetts, 1972
5. Das, J, Mullick, S.K & Chaterjee. P. K, "Principles of Digital Communications'' Wiley Eastern Ltd. New Delhi, 1986.
6. Satyanarayana P.S., ''Concepts of Information Theory & coding'', Dynaram Publications, Bangalore, 2005.

ADVANCED DIGITAL SATELLITE COMMUNICATION

Syllabus

PG – EEC2- 01

Nonlinear satellite channel; TDMA, Frequency reuse, satellite switched TDMA

Time slot assignment; Frame and burst synchronization; Scanning spot beam ; Multiple scanning beam systems; Efficient use of orbit and spectrum.

Satellite switching and onboard processing; Digital speech interpolation; Echo and delay cancellation

Satellite tracking and data acquisition network; Maritime and broadcast satellite communication system; Examples of INTELESAT-VI and other advanced communication satellites

Space mission communications; Manned and unmanned; Inter satellite links; Integrated satellite systems.

References:

1.Communication Satellite by Bruce I. Elbert
2.The Satellite Communication Applications Handbook, Second Edition by Bruce I. Elbert
3.Satellite Communications Fundamentals; Jules E. Kadish and Thomas W.R. East
4.Mobile Satellite Communications ; Shingo Ohmori, Hiromitsu Wakan, Swiichiro kawase
5.Satellite Technology an Introduction 2ND Edition by Andrew F Inglis

DIGITAL IMAGE PROCESSING

Syllabus

PG – EEC2-02

Digital Image Fundamentals: Elements of Digital Image System, Structure of the human eyes Image formation in the eye and contrast sensitivity, sampling and Quantization of an Image-basic relationship between pixels, imaging geometry photographic film.

Image Transform: Need for image transform Walsh transform hotel ling transform.

Image Enhancement: Spatial domain method frequency domain method, histogram modification technique neighbourhood averaging median filtering low pass filtering averaging of multiple image Restoration: Degradation model for continuous functions-discrete formulation digitalization of circulating and block, circulate matrices, effect of diogonalization, unconstrained restoration, inverses filtering, wiener filter constrained-least square restoration

Image compression: Coding and inter pixel redundancies, fidelity criteria, image compression modes, elements of information theory, transform coding.
Image Segmentation and representation, detection of discontinuous point, line and edge detections, gradient operators, combined detection, thresholding.
Representation Scheme: Chain codes polygon approximation,
Boundary descriptors: simple descriptors, shape numbers, Fourier descriptors, introduction to recognition, interpretation.

References:

1. Rafel C. Gonzalez and Richard E. Woods "Digital Image Processing." Addition wisely
2. Anil K. Jain "Fundamental of Digital Image Processing" Prentice Hall 1995.
3. Rosenfeld A.C.Kak, Digital Picture Processing- Academic Press inc 1976.
4. Hall E. L. Computer image processing and recognition academic press inc 1979.
5. Huang T.S. "Picture Processing and Digital Filtering" Springer, Berlin

DIGITAL SYSTEM DESIGN

Syllabus

PG – EEC2 – 03

Programming Technologies: ROMs & EPROMS PLA. PAL gate Arrays Programmable gate arrays and application, Antifuse FPGA, synthesis methods for FPGA. HARDWARE Description Language, design entities, architecture Bodies, Block Statements, processes, data types, Operators, Classes of Objects, Attributors, Functions and procedures, Packages Control Statements.
Behaviour modelling- Process Statement, Assertion statement, Sequential wait statement, formatted ASCII I/O Operators Structural Modelling; Parts Library wiring of Primitives. Wiring of Iterative networks. Modelling a test bench.

Chip Level Modelling : Chip level modelling structure modelling delay, process model graphs, Functionally petitioned models, Timing Assertion, setup & Hold time for clocked devices, Design rule checks

System Modelling: Modelling System interconnection, general model for signal interconnection, Multiplexing of signals, Multiple valued logic, Processor model, RAM model, UART model, Parallel I/O Ports, Interrupt controller ,simulation with the physical model, simulation, writing test bench, converting real and integer to time. Dumping results into text file, reading vectors from text file, test bench example.

References:

1. Navabi Z, "VHDL Analysis and Modeling of digital Systems." Prentice Hall, 1993
2. J. Bhaskar " VHDL Primer", Pearson Education, 2000.
3. Armstrong & Grey, "VHDL Design. Representation and Synthesis". PHPTR, 2000
4. James R. Armstrong, "Chip Level Modelling with VHDL", Prentice Hall, 1989.

ADVANCED COMMUNICATION SYSTEMS

Syllabus

PG-EEC2-04

Network Goals. Topology and network structure. Voice and data communication, digital revolution.

The electrical interface and signal types. the medium characteristics.

Baseband and modems with public carrier circuit. Broadband modems. Description of modems.

Link layer protocols. Flow control. Transparency. Numbering of Frame. The HDLC Protocol.

Theory of transmission System. SDH and PDH.

Integrated services of Digital networks – ISDN. ISDN protocols, accesses and interface standard.

ISDN – DSS1 and CCS7 signalling protocols. XDSL technology

PPPoE and PPPoA protocols for DSL

Asynchronous transfer mode – ATM. ATM structure and transfer protocols.

Wireless and mobile networks. Analog system NMT and digital system GSM.

Digital wireless systems Blue Tooth and WiFi, Routing in mobile networks. Radio trunk systems. Cyx and DECT systems.

References:

1.Schiller, J.: Mobile Communications (2nd edtion), Addison-Wesley 2003, ISBN 0-321-12381-6
2.Hansmann, U., Merk, L., Nicklous, M., Strober, T.: Pervasive Computing (2nd edition), Springer 200:3-540-00218-9
3.Geier, J.: Wireless LANs (2nd edition), SAMS 2001, ISBN 0-672-32058-4
4.Puzmanova, R.: Moderni Komunikacni site od A do Z, Computer Press 1998, ISBN 80-7226-098-7
5.Halsall, F.: Date Communications, Computer Networks and Systems. Addison-Wesley. Fourth 1997, ISBN 0-201-42293-X
6.Walrand, J., Varaiya, P.: High- Performance Communication Networks, Morgan Kaufmann 1996.

FUZZY LOGIC & NUERAL NETWORKS

Syllabus

PG – EEC2- 05

(Elective – I)

Fuzzy Logic:
Crisp sets and fuzzy sets: Introduction concept, fuzzy operations general aggregation of operation, fuzzy relation, binary relation, equivalence and similarity relation, fuzzy relation equation.
Application: natural engineering management and decision making and computer science.

Neural Network:
Introduction , neural net classifiers, self organizing nets, associative memory, cellular neural nets, adaptation algorithms, pattern capacity, global / local minima, convergence, application of neural networks.

References:

1. George klir, "Fuzzy sets uncertainty and information", Prentice hall
2. B kosko. '" Neural Network and Fuzzy System" Prentice hall 1992

MULTIMEDIA COMMUNICATION SYSTEM

Syllabus

PG – EEC2-05
(Elective –I)

Multimedia Communication: Multimedia information representation. Multimedia Networks, Multimedia applications, Network QoS and application QoS.

Information Representation: text, image, audio and video, text and image compression, compression principles, text compression, image compression. Audio and Video compression. Audio compression. Video compression. Video compression Principles, video compression standards: H.261. H.263.PI.323, MPEG 1, MPEG 2, Other coding formats for text, speech, image and video.

Detailed study of MPEG 4: coding of audiovisual objects, MPEG 4 systems. MPEG 4 audio and video, profile and levels. MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework, Significant features of JPEG 2000, MPEG 4 transport across the internet
Synchronization: notion of synchronization, presentation requirements, reference model for synchronization

Introduction to SMIL: Multimedia operating System, Resource management and process management techniques.

Multimedia communication across networks: Layered video coding, error relevant video coding techniques, multimedia transport across IP networks and relevant products such as RSVP, RTP, RTCP, DVMRP, multimedia in mobile networks, multimedia broadcast networks, and content based retrieval in digital libraries.

References:

1. Ze-Nian Li & Mark S. Drew, "Fundamentals of Multimedia", Pearson Education
2. J.R. Ohm. "Multimedia Communication Technology", Springer International Edition, 2005.
3. K.Sayood. "Introduction to Data Compressiojn", 2nd Ed, Morgan Kauffman. Indian Edition, 2000.
4. V.Bhaskaran and K. Konstantinedes. "Image and Video Compression Standards. Algorithms and Architecture." 2nd ed, Kluwer publication, 1997.
5. Fred Halsall, "Multimedia communication", Pearson Education, 2001.
6. K.R. Rao, Zoram S. Bojkovic, Dragorad A. Milovanovic, "Multimedia Communication System", Pearson Education, 2004.
7. Raif steinmetz, klara Nahrstedt. "Multimedia Computing, Communication and Application". Pearson Education, 2002.
8. Tay Vaughan. "Multimedia: Making it work". 6th edition, Tata McGraw Hill. 2004.
9. John Billamil, louis Molina." Multimedia: An Introduction". PHI, 2002.
10. Pallapa Venkataram, Multimedia information System, Pearson Education, 2005.

DSP PROCESSORS AND ARCHITECTURE

Syllabus

PG – EEC2 – 05
(Elective-I)

INTRODUCTION TO DIGITAL SIGNAL PROCESSING
The sampling process, Discrete time sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) , Linear time- invariant system, Digital Filters, Decimation and interpolation, Analysis and Design tool for DSP System MATLAB, DSP using MATLAB.
COMPUTATIONAL ACCURACY IN DSP IMPLEMENTATION
Number formats for signals and coefficients in DSP system, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion error, DSP Computational errors, D/A Conversion Errors, Compensating filter.
ARCHITECTURE FOR PROGRAMABLE 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.
EXECUTION CONTROL AND PIPELINING
Hardware looping, interrupts, stacks, relative branch support, pipelining and Performance, Pipeline depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programmable models.
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, Programme control, TMS320C54XX instructions and programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX processors.
IMPLEMENTATION OF BASIC DSP ALGORITHMS
The Q- notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing.
MPLEMENTATION OF FFT ALGORITHMS, An FFT Algorithms for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit Revised index generation, An 8- Point FFT implementation on the TMS320C54XX , Computation of the signal spectrum.
INTERFACING MEMORY AND I/O PERIPHERALS TO PROGRAMABLE DSP DEVICES, memory space organization, external bus interfacing signals, Memory interface, Parallel I/O interface, Parallel I/O interface, programmed I/O , Interrupts and I/O, Direct memory access (DMA) . A Multichannel buffered serial port (McBSP)
Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

References:

1. Digital Signal Processing – Avtar Singh and S. Srinivasam, Thomson Publication, 2004
2. DSP Processor Fundamentals, Architecture & Feature – lapsley S. Chand & Co., 2000.

SIGNAL PROCESSING AND SMART ANTENNAS FOR WIRELESS COMMUNICATION

Syllabus

PG-EEC3-01

Overview if wireless and mobile, Cellular system concepts, standards and Evolution of mobile & wireless communication technologies.

Wireless channel characterization, Attenuation, Shadowing, Fading, Doppler Shift, Delya Spread, Co- channel, Adjacent Channel and other forms of interferences.
Modulation technique: - QAM, Multitone, MSK, GMSK, CPM, TFM and OFDM.

Receiver architecture and algorithms, Digital IF receivers, Sub-sampling digital receivers, Digital receivers, I & Q channel sampling, No coherent and Coherent technique, Rake receiver.
Equalization and Synchronization: - MLSE, Adaptive Equalization: LMS, RLS & Blind adjustment, Timing recovery and carrier recovery.

Smart Antennas systems generalized array signal processing, Beam forming concepts: DOB, TRB & SSBF, Switched beam antennas, spatial diversity, and fully adaptive antennas for enhanced coverage, range extension & improvement in frequency refuse, interference Nulling for LOS & Multipath systems.

SDMA concepts and Smart antennas implementation issues.

RF Ics LNA, IQ Modulator, Mixers, DSP s & Micro-controllers in wireless communication, ASICs and FPGAs.

References:

1. T.S.Rappaport, Wireless Communication: Principles & Practices, 2/e.2002, Prentice Hall

2. Liberti & T.S.Rappaport, Smart Antennas for Wireless Communication: IS-95and Third Generation CDMS applications, 1999, Prentice Hall.

3. B.Pattan, Robust Modulation Methods and Smart Antenna in Wireless Communication, 2000, Prentice Hall.

EMBEDDED SYSTEM

Syllabus

PG – EEC3 – 02
(Elective – II)

Introduction to Embedded System

Embedded System Hardware: Processors-digital signal processors, Microcontrollers, Special purpose processors,

I/O devices: interfacing and control, analog I/O, Digital I/O, Bus I/O, Serial and Network I/O.

Processor and Memory Organization.

Custom Logic Devices, System hardware case Studies.

Embedded system High performance processors

CISC and RISC Processor architecture and an Exemplary Instruction set.

Hardware / software co- design in an embedded system

Introduction to Real time operating System

Application case studies from areas such as Communication, Instrumentation and Signal processing Systems.

References:-

1. Embedded System: Raj Kamal

2. Embedded System Design: Frank Vahid, Tony Givargis

3. Real Time Systems: Jan W. S.Liu

4. Embedded microcomputer System: Jonathan W. valvano

5. Intels processor Manual

MICROSTRIP INTEGRATED SYSTEMS

Syllabus

PG – EEC3 – 02
(Elective-II)

MICROSTRIP LINES DESIGN AND ANALYSIS

Introduction, Types of MICs and their technology, propagating models, Analysis of MIC by conformal transformation, Numerical method, Hybrid mode analysis, Losses in micro strip, Introduction to slot line and coplanar waveguide.

COPLED MICROSTRIP, DIRECTIONAL COUPLERS AND LUMPED ELEMENTS FOR MICs

Introduction to coupled micros rip, Even and odd mode analysis, Branch line couplers, Design and fabrication of lumped elements for MICs, Comparison with distributed circuits.

NON- RECIPROCAL COMPONENTS AND ACTIVE DEVICES FOR MICs

Ferromagnetic substrates and inserts, Micro strip circulators, Phase shifters, Microwave transistors, Parametric diodes and amplifiers, PIN diodes, Transferred electron devices, Avalanche diodes, IMPATT, BARITT devices.

DESIGN OF MICROSTRIP CIRCUITS AND APPLICATIONS

Introduction, Impedance transformers, Filters, High power circuits, Low power circuits, MICs in Radar and satellite.

MMIC TECHNOLOGY

Fabrication process of MMIC, Hybrid MICs, Dielectric substances, Thick film and thin film technology and materials, Testing method, Encapsulation and mounting of devices.

References:

1. Gupta K.C. and Amarjit Singh, "Microwave Integrated Circuits", Jon Wiley,
New York, 1975.

2. Hoffman R.K. "Hand book of Microwave Integrated Circuits", Artech House, Boston, 1987.

MODERN RADAR SYSTEMS

Syllabus

PG-EEC3-02
(Elective-II)

Introduction:
Historical background, radar terminology, radar band designations
The radar equation: point targets, radar cross section, distributed targets, propagation, coverage diagrams.
Noise, clutter and detection: theory of detection, sea and land clutter models, CFAR processing.
Display: A-scope, B-scope, PPI, modern displays
Doppler radar and MTI: Doppler Effect, delay-line cancellers, blind speeds, staggered PRFs, adaptive Doppler filtering, and Space –Time Adaptive Processing (STAP)
Pulse Doppler processing: airborne radar, high low and medium PRF operation
Pulse compression: principles, the ambiguity function, the matched filter, chirp waveforms, SAW technology
Waveforms design: nonlinear FM, phase codes, waveform generation and compression
FM radar: principles, radar equation, effect of phase and amplitude errors
Synthetic Aperture Radar: principles, SAR processing, autofocus, spotlight mode, airborne and space borne systems and applications, interferometer, ISAR
Tracking radar: conical scan, monopulse, alpha-beta tracker, track-while-scan, Kalman filters
Avionics and radio navigation: Air Traffic Control, Primary and secondary radar, GPS
Phased array radar: phased array principles, array signal processing, multifunction radar, scheduling
Electronic Warfare: ESM, ECM, ECCM; super resolution, IFM, types of jammers, calculation of performance, adaptive arrays, LPI radar
Stealth and counter stealth: stealth techniques for aircraft and other target types , low-frequency and UWB radar
Bistatic radar: bistatic radar equation, synchronization, illuminators of opportunity
Sonar: similarities and differences to radar, underwater propagation, ASW and MCM systems.
System design examples: Airborne Early Warning (AEW) radar, vehicle collision avoidance radar, maritime navigation radar, weapon locating radar.

References:

1. Introduction to RADAR systems by Merrill Skolnik, TMH

2. RADAR Systems and Navigation By Bhattacharya TMH