CHRIST
UNIVERSITY
BANGALORE, INDIA

Declared as Deemed to be University under Section 3 of UGC Act 1956

FACULTY OF ENGINEERING

Kengeri Campus, Kanminike, Kumbalgodu, Bangalore – 560060

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MASTER OF TECHNOLOGY
COMMUNICATION SYSTEMS
JANUARY 2013
2013 BATCH

TABLE OF CONTENTS

1. INTRODUCTION

Christ University was formerly Christ College (Autonomous) affiliated to Bangalore University. Established in July 1969, Christ College became the most preferred educational institution in the city of Bangalore within the first three decades. From 1990 onwards it scaled from heights to heights. By the introduction of innovative and modern curriculum, insistence on academic discipline, imparting of Holistic Education and with the help of the creative and dedicated staff, Christ College has been continually rated among the top 10 educational institutions of the country. It has the rare distinction to be the first institution in Karnataka to be accredited by National Assessment and Accreditation Council (NAAC) UGC for quality education. On 7 October 2004, UGC has conferred Autonomy to Christ College (No.F.13-1/2004). On May 20, 2005, it became the first College in South India to be reaccredited with A+ by NAAC. UGC has identified it as an Institution with Potential for Excellence in June 2006.

July 22, 2008 is the most glorious day in the history of the institution. Under Section 3 of the UGC Act, 1956, Ministry of Human Resources Development of the Union Government of India, vide Notification No. F. 9-34/2007-U.3 (A), has declared it a Deemed to be University, in the name and style of Christ University

VISION

"EXCELLENCE AND SERVICE"

- Christ University, a premier educational institution, is an academic fraternity of individuals dedicated to the motto of excellence and service. We strive to reach out to the star of perfection through an earnest academic pursuit for excellence and our efforts blossom into 'service' through our creative and empathetic involvement in the society to transform it.
- Education prepares one to face the challenges of life by bringing out the best in him/her. If this is well accepted, education should be relevant to the needs of the time and address the problems of the day. Being inspired by Blessed Kuriakose Elias Chavara, the founder of Carmelites of Mary Immaculate and the pioneer in innovative education, Christ University was proactive to define and redefine its mission and strategies reading the signs of the time.

MISSION STATEMENT

"Christ University is a nurturing ground for an individuals holistic development to make effective contribution to the society in a dynamic environment."

CORE VALUES

The values which guide us at Christ University are:

Faith in God

Moral Uprightness

Love of Fellow Beings

Social Responsibility

Pursuit of Excellence

2. COURSE OFFERED

- **Undergraduate Programmes (B. Tech) (4 Years Program)**
  Electronics and Communication Engineering (ECE)
- **Int. BTech with MBA (5 Years Program)**
  Int. BTech(ECE) with MBA (Finance/HR/Marketing/Lean Operations & Systems)
- **Int. BTech with M. Tech (5 Years Program)**
  Int. BTech(ECE) with MTech (Communication Systems)
- **Postgraduate Programmes (M. Tech) (2 Years Program)**
  Master of Technology in Communication Systems
- **Doctoral Programmes (Ph.D.) (Doctor of Philosophy)**
  Doctor of Philosophy (Ph.D.) in Electronics and Communication Engineering

3. ELIGIBLITY CRITERIA

❖ **For Postgraduate Programmes:**

- For Master of Technology in Communication Systems
  - A Pass Class in B.Tech/B.E or **M.Sc in Electronics** and VLSI or equivalent

4. SELECTION PROCESS

1) Candidates can process the admission based on the Undergraduate Entrance Test and Ranking by COMEDK.

   OR

2) Christ University Selection Process as given below:

Process	Particulars	Date	Venue/Centre
Entrance Test	Christ University Entrance test for each candidate	As per the E-Admit Card	As per the E- Admit Card
Personal Interview	Personal interview for 15 minutes for each candidate by an expert panel	As per the E-Admit Card	As per the E- Admit Card
Academic Performance	Assessment of past performance in Class 10, Class 11/12 during the Personal Interview	As per the E-Admit Card	As per the E- Admit Card

5. ADMISSION PROCESS

Candidates will be intimated about the Selection status (Selected/Wait Listed/Not Selected) through the University Notice Board/on the "Application Status" link on University website. The Selection results will be declared within 24 hours of Personal Interview session.

The selected candidates must process admission at **Office of Admissions, Central Block, Christ University within 3 working days of declaration of Selection Process results/as per the stipulated date and time mentioned by Office of Admissions.**

Selected candidates should collect the Fee Challan from the Office of Admissions and remit the Annual fee at the South Indian Bank, Christ University Branch. The **Offer of Admission** will stand cancelled, if failing to remit the fee within the stipulated date and time.

Admission will not be processed without the presence of the candidate and the mandatory original documents mentioned below;

1. The Offer of Admission Card (E-Admission Card/Mail)
2. Class 10 Marks Statement
3. Class 11 Marks Statement, if Candidate is pursuing class 12 and appearing for final examination during March-April 2012
4. Class 12 Marks Statement, if candidate has appeared and passed the Class 12 examination

The University ID card is a smart card, which is both an ID card as well as a South Indian Bank ATM card with a chip containing the student personal details. All transactions within the University campus after commencement of classes, including fees payment will be processed only through this card. It is also an access card for Library and other restricted places. Candidates are advised to collect the South Indian Bank account opening form along with fees challan and process it at the Bank branch within the University premises.

Candidates who fall under International student category (ISC), If selected, should register with the Foreigner Regional Registration Officer (FRRO/FRO) of the Local

Police in Bangalore, India within 14 working days from the date of admission or arriving in Bangalore.

All International student category (ISC) candidates if studied in India should obtain an NOC from the previous qualifying institution.

6. GENERAL RULES

- There is a grading scheme for each paper and for all the courses.
- All marks will indicate the marks, percentage obtained, grade and grade point average.
- The grade point average will be calculated as follows: for each subject, multiply the grade point with the number of credits; divide the sum of product by the total number of credits.
- The CGPA [Cumulative GPA] is calculated by adding the total number of earned points [GP x Cr] for all semesters and dividing by the total number of credit hours for all semesters.

$$\textbf{CGPA}=\frac{\sum[\textbf{GPA x Cr}]}{\sum \textbf{Cr}}$$

7. Grading scheme for Each Paper: Postgraduate Courses

Percentage	Grade	Grade Point	Interpretation	Class
80 and above	A+	4.0	Excellent	First Class with Distinction
70-79	A	3.5	Very Good	
65-69	B+	3.0	Good	First Class
60-64	B	2.5	Above Average	
55-59	C+	2.0	Average	Second Class
50-54	C	1.5	Satisfactory	
40-49	C-	1.0	Exempted if aggregate is more than 50%	Pass Class
39 and below	F	0	Fails	Fail

8. COURSE OVERVIEW

The department is well established with state of art technology to impart knowledge for future industrial and educational needs. It is furnished with sound Laboratoryoratories outfitted with hi-tech instruments, internet and computer systems. It has acoustic poof class rooms with audio-visual teaching aids. The total campus is networked by wire and Wi-Fi system. It has well experienced faculties from reputed industries and institutions. The department has been made as paperless office. It has personalized sylLaboratoryus suited for global industrial and academic needs. It is well integrated by standalone seminar hall and supporting auditorium to conduct seminars, workshops and training.

9. COURSE OBJECTIVE

The goal of the Department is to create professionals who are well versed with the study and application of electricity, electronics and electromagnetism so that mundane jobs are taken away from men or women to machines. The entertainment & leisure industries exist since Electronics & Communication engineers exist.

10. TEACHING PEDAGOGY

1. Team/Class room teaching.
2. PowerPoint presentations and handouts.
3. Simulated situations and role-plays.
4. Video films on actual situations.
5. Assignments.
6. Case Studies.
7. Exercises are solved hands on.
8. Seminars
9. Industry / Field visits.
10. Information and Communication Technology.
11. Project work.
12. Learning Management System- Moodle

11. ASSESSMENT RULES

Assessment is based on the performance of the student throughout the semester.

Assessment of each paper

- Continuous Internal Assessment (CIA) for Theory papers: 50% (50 marks out of 100 marks)
- End Semester Examination(ESE) : 50% (50 marks out of 100 marks)

Components of the CIA

CIA I : Mid Semester Examination (Theory)	: 25 marks
CIA II : Assignments	: 10 marks
CIA III: Quizzes/Seminar/Case Studies/Project Work	: 10 marks
Attendance	: 05 marks
Total	**: 50 marks**

For subjects having practical as part of the subject

End semester practical examination	: 25 marks
Records	: 05 marks
Mid semester examination	: 10 marks
Class work	: 10 marks
Total	**: 50 marks**

Mid semester practical examination will be conducted during regular practical hour with prior intimation to all candidates. End semester practical examination will have two examiners an internal and external examiner.

❖ **Assessment of Project Work(Phase I)**

- Continuous Internal Assessment:100 Marks
  - ♦ Presentation assessed by Panel Members
  - ♦ Assessment by Guide

❖ **Assessment of Project Work(Phase II) and Dissertation**

- Continuous Internal Assessment:100 Marks
  - ♦ Presentation assessed by Panel Members
  - ♦ Assessment by Guide

- End Semester Examination:100 Marks
  - ♦ Viva Voce
  - ♦ Demonstration
  - ♦ Project Report
- Dissertation (Exclusive assessment of Project Report): 100 Marks
  - ♦ Internal Review : 50 Marks
  - ♦ External review : 50 Marks

❖ **Assessment of Seminar**

- Continuous Internal Assessment:50 Marks
  - ♦ Presentation assessed by Panel Members

12. QUESTION PAPER PATTERN:

End Semester Examination (ESE) :

Theory Papers:

The ESE is conducted for 100 marks of 3 hours duration.

The syllabus for the theory papers is divided into FIVE units and each unit carries equal weightage in terms of marks distribution.

Question paper pattern is as follows.

Two full questions with either or choice, will be drawn from each unit. Each question carries 20 marks. There could be a maximum of three sub divisions in a question. The emphasis on the questions is broadly based on the following criteria:

50 % - To test the objectiveness of the concept

30 % - To test the analytical skill of the concept

20 % - To test the application skill of the concept

Laboratory / Practical Papers:

The ESE is conducted for 50 marks of 3 hours duration. Writing, Execution and Viva – voce will carry weightage of 20, 20 and 10 respectively.

Mid Semester Examination (MSE) :

Theory Papers:

The MSE is conducted for 50 marks of 2 hours duration.

Question paper pattern; Five out of Six questions have to be answered. Each question carries 10 marks.

Laboratory / Practical Papers:

The MSE is conducted for 50 marks of 2 hours duration. Writing, Execution and Viva – voce will carry weightage of 20, 20 and 10 respectively.

Holistic Education:

End Semester Examination	25 Marks
Participation	25 Marks
Total	**50 Marks**

13. Course Structure

SEMESTER – I

S.No	Course No	Course Name	L	T	P	M	C
THEORY							
1	MTEC131	Satellite Communication	3	1	0	100	3
2	MTEC132	Advanced Radiation Systems	3	1	0	100	3
3	MTEC133	Modern Digital Communication Techniques	3	1	0	100	3
4	MTEC134	Digital Signal Processing and its Application	3	1	0	100	3
5	MTEC135	Optical Communication Networks	3	1	0	100	3
6	HE171	Holistic Education	1				1
PRACTICAL							
7	MTEC151	Modern Digital Communication Laboratory	0	0	3	50	2
8	MTEC152	Digital Signal Processing and its Application Laboratory	0	0	3	50	2
		TOTAL				600	20

SEMESTER – II

S.No	Course No	Course Name	L	T	P	M	C
THEORY							
1	MTEC231	Mobile Communication Networks	3	1	0	100	3
2	MTEC232	Multimedia Compression Techniques	3	1	0	100	3
3	MTEC233	Wireless Sensor Networks	3	1	0	100	3
4	MTEC234	Applied Mathematics for Electronics Engineers	3	1	0	100	3
5	MTEC235	Elective I	3	1	0	100	3
6	HE271	Holistic Education	1				1
PRACTICAL							
7	MTEC251	Communication System Laboratory	0	0	3	50	2
8	MTEC252	Microwave Laboratory	0	0	3	50	2
9	MTEC271	Professional Practice – I	0	0	2	50	2
		TOTAL				650	22

SEMESTER – III

S.No	Course No	Course Name	L	T	P	M	C
THEORY							
1	MTEC331	Elective II	3	1	0	100	3
2	MTEC332	Elective III	3	1	0	100	3
3	MTEC333	Elective IV	3	1	0	100	3
PRACTICAL							
4	MTEC371	Project Work (Phase I)	0	0	12	100	3
5	MTEC372	Professional Practice-II	0	0	2	50	2
		TOTAL				450	14

SEMESTER – IV

S.No	Course No	Course Name	Marks	Credit
1	MTEC471	Project Work (Phase II) and Dissertation	300	9
2	MTEC472	Seminar	50	2
		TOTAL	350	11

LIST OF ELECTIVES

S.NO	Course Title	M	C
1	RF System Design	100	3
2	Advanced Digital Signal Processing	100	3
3	Advanced Microwave Systems	100	3
4	Communication protocol Engineering	100	3
5	DSP Processor Architecture and programming	100	3
6	Wavelets and Multi-resolution Processing	100	3
7	Speech and Audio Signal Processing.	100	3
8	Network Routing Algorithms	100	3
9	Simulation of Communication Systems and Networks	100	3
10	Global Positioning Systems	100	3
11	Communication Network Security	100	3
12	Soft Computing	100	3
13	Digital Communication Receivers	100	3
14	Advanced Microprocessors and Microcontrollers	100	3
15	Digital Image Processing	100	3
16	Internetworking multimedia	100	3
17	Electromagnetic Interference and Compatibility in System Design	100	3
18	High Performance Communication Networks	100	3
19	Embedded systems	100	3
20	High Speed Switching Architecture	100	3
21	Real Time Operating Systems	100	3
22	Special Elective	100	3

14. Detailed Syllabus

MTEC131 SATELLITE COMMUNICATION

UNIT I **9**

ORBITAL MECHANICS

Kepler's laws of motion, Orbits, Orbit Equations, Orbit Description, Locating the Satellite in the Orbit and with Respect to Earth, Orbital Elements-Look Angle Determination and Visibility - Orbital Perturbations, Orbit Determination, Launch Vehicles, Orbital Effects in Communication System - Performance Attitude control; Satellite launch vehicles. spectrum allocations for satellite systems.

UNIT II **9**

SPACECRAFT SUB SYSTEMS AND EARTH STATION

Spacecraft Subsystems, Altitude and Orbit Control, Telemetry and Tracking, Power Systems, Communication Subsystems, Transponders, Antennas, Equipment Reliability, Earth Stations, Example of payloads of operating and planned systems.

UNIT III **9**

SPACE LINKS

The Space Link, Satellite Link Design - Satellite uplink -down link power Budget, Basic Transmission Theory, System Noise Temp, G/T Ratio, Noise Figure, Downlink Design, Design of Satellite Links for Specified C/N - Microwave Propagation on Satellite-Earth Paths. Interference between satellite circuits, Energy Dispersal, propagation characteristics of fixed and mobile satellite links.

UNIT IV **9**

MULTIPLE ACCESS TECHNIQUES AND NETWORK ASPECTS

Single access vs. multiple access (MA). Classical MA techniques: FDMA, TDMA. Single channel per carrier (SCPC) access - Code division multiple access (CDMA).

Demand assignment techniques. Examples of MA techniques for existing and planned systems (e.g. the satellite component of UMTS).Mobile satellite network design, ATM via satellite. TCP/IP via satellite - Call control, handover and call set up procedures. Hybrid satellite-terrestrial networks.

UNIT V **9**

SERVICES AND APPLICATIONS

Fixed and mobile services - Multimedia satellite services - Advanced applications based on satellite platforms - INTELSAT series - INSAT, VSAT, Remote Sensing - Mobile satellite service: GSM. GPS, INMARSAT, Navigation System, Direct to Home service (DTH), Special services, E-mail, Video conferencing and Internet connectivity

L = 45 T = 0 Total = 45

REFERENCES

[1] Dennis Roddy, “Satellite Communications”, Third Edition, Mc Graw Hill International Editions, 2001

[2] Bruce R.Elbert, "The Satellite Communication Applications Hand Book, Artech House Boston,1997.

[3] Wilbur L.Pritchard, Hendri G.Suyderhood, Robert A.Nelson,"Satellite Communication Systems Engineering", II Edition, Prentice Hall, New Jersey, 1993

[4] Tri T.Ha, "Digital satellite communication", 2nd Edition, McGraw Hill, New york.1990

MTEC132 ADVANCED RADIATION SYSTEMS

UNIT I

CONCEPTS OF RADIATION 9

Retarded vector potentials – Heuristic approach and Maxwell's equation approach. The Lorentz gauge condition. Vector potential in Phasor form. Fields radiated by an alternating current element. Total power radiated and radiation resistance. Radiation from Half wave dipole from assumed current distribution. Power radiated in the farfield. Electric vector potential F for a magnetic current source M. Far zone fields due to magnetic source M.

UNIT II

9

ANTENNA ARRAYS

N element linear arrays – uniform amplitude and spacing. Phased arrays. Directivity of Broadside and End fire arrays. Three dimensional characteristics. Binomial arrays and Dolph-Tchebycheff arrays. Circular array. Antenna Synthesis- Line source and discretization of continuous sources. Schelkunoff polynomial method. Fourier transform method.

UNIT III

9

APERTURE ANTENNAS

Magnetic current – Duality. Electric and Magnetic current sheets as sources. Huyghens source. Radiation through an aperture in an absorbing screen. Fraunhoffer and Fresnel diffraction. Cornu Spiral. Complimentary screens and slot antennas. Slot and dipoles as dual antennas. Babinets principle. Fourier transform in aperture antenna theory.

UNIT IV

9

HORN , MICROSTRIP , REFLECTOR ANTENNAS.

E and H plane sectoral Horns. Pyramidal horns. Conical and corrugated Horns. Multimode horns. Phase center.

Microstrip antennas – feeding methods. Rectangular patch- Transmission line model.

Parabolic Reflector antennas – Prime focus and cassegrain reflectors. Equivalent focal length of Cassegrain antennas. Spillover and taper efficiencies. Optimum illumination.

UNIT V **9**

ANTENNA POLARIZATION.

Simple relationship involving spherical triangles. Linear, Elliptical and circular polarization. Development of the Poincare sphere. Representation of the state of polarization in the Poincare sphere. Random polarization – Stokes parameters.

L = 45 T = 0 Total = 45

REFERENCES

[1] Balanis, C.A., "Antenna Theory" Wiley, 2003
[2] Jordan, E.C., " Electromagnetic waves and Radiating systems". PHI 2003
[3] Krauss, J.D., "Radio Astronomy" McGraw-Hill 1966, for the last unit (reprints avaiLaboratoryle)
[4] Krauss, J.D.,, Fleisch,D.A., "Electromagnetics" McGraw-Hill,1999

MTEC133 MODERN DIGITAL COMMUNICATION TECHNIQUES

UNIT I

9

POWER SPECTRUM AND COMMUNICATION OVER MEMORYLESS CHANNEL:

PSD of a synchronous data pulse stream; M-ary Markov source; Convolutionaly coded modulation; Continuous phase modulation – Scalar and vector communication over memoryless channel – Detection criteria.

UNIT II

9

COHERENT AND NON-COHERENT COMMUNICATION:

Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Noncoherent receivers in random phase channels; M-FSK receivers – Rayleigh and Rician channels – Partially coherent receives – DPSK; M-PSK; M-DPSK,-BER Performance Analysis.

UNIT III

9

BANDLIMITED CHANNELS AND DIGITAL MODULATIONS:

Eye pattern; demodulation in the presence of ISI and AWGN; Equalization techniques – IQ modulations; QPSK; QAM; QBOM; -BER Performance Analysis. – Continuous phase modulation; CPFM; CPFSK; MSK,OFDM.

UNIT IV

9

BLOCK CODED DIGITAL COMMUNICATION:

Architecture and performance – Binary block codes; Orthogonal; Biorthogonal; Transorthogonal – Shannon's channel coding theorem; Channel capacity; Matched filter; Concepts of Spread spectrum communication – Coded BPSK and DPSK demodulators – Linear block codes; Hammning; Golay; Cyclic; BCH ; Reed – Solomon codes..

UNIT V

9

CONVOLUTIONAL CODED DIGITAL COMMUNICATION:

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Threshold methods – Error probability performance for BPSK and Viterbi algorithm, Turbo Coding.

L = 45 T = 0 Total = 45

REFERENCES:

[1] M.K.Simon, S.M.Hinedi and W.C.Lindsey, Digital communication techniques; Signaling and detection, Prentice Hall India, New Delhi. 1995.

[2] Simon Haykin, Digital communications, John Wiley and sons, 1998

[3] Wayne Tomasi, Advanced electronic communication systems, 4th Edition Pearson Education Asia, 1998

[4] B.P.Lathi Modern digital and analog communication systems, 3rd Edition, Oxford University press 1998.

MTEC134 DIGITAL SIGNAL PROCESSING AND ITS APPLICATION

AIM

To study the signal processing methods and processors.

OBJECTIVES

• To study of DFT and its computation

• To study the design techniques for digital filters

• To study the finite word length effects in signal processing

• To study special techniques like power spectrum estimation, time frequency representation.

UNIT I SIGNALS AND SYSTEMS 9+3

Classification of signals- Continuous time and discrete time signals, Signal Energy and Power, Periodic signals, Even and Odd signals, Classification of systems-Continuous time and Discrete time systems, Basic system properties, Linear time invariant systems, Convolution Sum, Properties of LTI systems

UNIT II FOURIER SERIES AND FOURIER TRANSFORM 9 + 3

Fourier series representation of periodic signals, properties, Discrete Time Fourier Transform and its properties, DFT – Efficient computation of DFT, Properties of DFT ,FFT algorithms , Radix-2 FFT algorithms , Decimation in Time and Decimation in Frequency algorithms, Inverse DFT.

UNIT III DIGITAL FILTER DESIGN 9 + 3

Amplitude and phase responses of FIR filters, Linear phase filters, Windowing techniques for design of Linear phase FIR filters, Parks-McClellan Method, frequency sampling techniques, IIR Filters –Magnitude response, Phase response, Analog filter design-Butterworth and Chebyshev approximations, Digital design using Bilinear and impulse invariant transformation ,Warping, Prewarping, Frequency transformation

UNIT IV DIGITAL FILTER STRUCTURES 9 + 3

Block diagram representation, Basic IIR digital filter structures, Basic FIR digital filter structures, IIR Tapped Cascaded Lattice Structures, FIR Cascaded Lattice Structures, Parallel Allpass Realization of IIR Transfer functions.

UNIT V MULTIRATE SIGNAL PROCESSING 9 + 3

Multirate Building Blocks, Decimation, Interpolation, Digital filter Banks, DFT Filter Banks, Polyphase Decomposition, Quadrature Mirror Filter Banks, Introduction to wavelets, Optimization Algorithms- LMS and RLS, Harvard architecture and programming in DSP.

TEXT BOOK:

1. "Digital Signal Processing" S.K Mitra, TMH, Second Edition.
2."Digital Signal Processing : A Practical Approach", Emmanuel C Ifeachor& Barrie W. Jervis, Pearson Education Asia, Second Ed., 2003.
3. "Digital Signal Processing", Oppenhiem& Schafer, Pearson Education Asia, 2003.
4. "*Multirate systems and Filter banks",* P P Vaidyanathan

REFERENCE BOOKS:

1. "Digital Signal Processing :Pronciples, Algorithms and Application", John G Proakis& D G Manolakis, PHI, 1998.
2. "Introduction to Digital Signal Processing",Johny R. Johnson, PHI
3. "Digital Signal Processors: Architecture, Programming and Applications", B. Venkataramani& M Bhaskar, TMH, 2002.
4. "Digital Signal Processing: Implementations using DSP Microprocessors with examples from TMS320C54x", Avatar Singh & S. Srinivasan, Thomson,Brooks/cole, 2004.
5. TI DSP Processor User Manuals.
6. "Digital Signal Processing; Analysis and Design", Paulo S.R.,Diniz& Sergio L. Netto, Cambridge University Press.

MTEC135 OPTICAL COMMUNICATION NETWORKS

UNIT I **9**

OPTICAL NETWORKING COMPONENTS:

First- and second-generation optical networks, Components: couplers, isolators, circulators, multiplexers, filters, amplifiers, switches, and wavelength converters.

UNIT II **9**

SONET AND SDH NETWORKS:

Integration of TDM signals, Layers, Framing, Transport overhead, Alarms, Multiplexing, Network elements, Topologies, Protection architectures, Ring architectures, Network Management.

UNIT III **9**

BROADCAST – AND- SELECT NETWORKS:

Topologies, Single-hop, Multihop, and Shufflenet multihop networks, Media-Access control protocols, Test beds.

UNIT IV **9**

WAVELENGTH-ROUTING NETWORKS:

Node designs, Issues in Network design and operation, Optical layer cost Tradeoffs, Routing and Wavelength assignment, Wavelength routing test beds.

UNIT V **9**

HIGH CAPACITY NETWORKS:

SDM, TDM, and WDM approaches, Application areas, Optical TDM Networks: Multiplexing and demultiplexing, Synchronization, Broadcast networks, Switch-based networks, OTDM test beds.

L = 45 T = 0 Total = 45

REFERENCES:

[1] Rajiv Ramaswami and Kumar Sivarajan, Optical Networks: A practical perspective, Morgan Kaufmann, 2nd edition, 2001.
[2] Vivek Alwayn, Optical Network Design and Implementation, Pearson Education, 2004.
[3] Hussein T.Mouftab and Pin-Han Ho, Optical Networks: Architecture and Survivability, Kluwer Academic Publishers, 2002.
[4] Biswanath Mukherjee, Optical Communication Networks, McGraw Hill, 1997

MTEC151 Modern Digital Communication Laboratory

1. Antenna Radiation Pattern measurement.
2. Performance evaluation of Digital Data Transmission through Fiber Optic Link.
3. Implementation of Video Link using Optical Fiber.
4. Generation of discrete time iid random processes with different distributions (Bernoulli, Binomial, Geometric, Poisson, Uniform, Gaussian, Exponential, Laplacian, Rayleigh, Rician)
5. Communication system Design for Band limited Channels - Signal Design for Zero ISI and Controlled ISI - Partial Response Signaling.
6. Carrier Phase Modulation and Quadrature Amplitude Modulation - BER Performance in AWGN channel.
7. Channel Coding: Linear Block code and Convolutional codes -Viterbi Decoding

P = 45 Total = 45

MTEC152 DSP and its Application Laboratory

Class Objectives:

To produce graduates who understand how to analyze and manipulate digital signals and have the fundamental programming knowledge to do so.

Course Outcomes:

- Describe the Sampling Theorem and how this relates to Aliasing and Folding.
- Determine if a system is a Linear Time-Invariant (LTI) System.
- Be able to take the Z-transform of a LTI system
- Determine the frequency response of FIR and IIR filters.
- Understand the relationship between poles, zeros, and stability.
- Determine the spectrum of a signal using the DFT, FFT, and spectrogram.
- Be able to design, analyze, and implement digital filters in MatLab.
- Be able to implement filters on a digital signal processor.

1) Introduction to MatLab
2) Introduction to Complex Exponentials
3) Synthesis of Sinusoidal Signals
4) AM and FM Sinusoidal Signals
5) FIR Filtering of Sinusoidal Waveforms
6) Filtering Sampled Waveforms
7) Everyday Sinusoidal Signals
8) Filtering and Edge Detection of Images
9) Sampling and Zooming of Images

EXPERIEMNTS ON TMS320C6X ,TMS320C5X and OMAP

1. Introduction to DSK 2. Sessions using MATLABORATORY, Simulink and DSK kit
2. LED DIP switches
3. To verify linear convolution
4. To verify circular convolution
5. To design FIR filter of given specifications
6. To design IIR filter of given specifications
7. MATLABORATORY Programming
8. Mini-projects

P = 45 Total = 45

MTEC231 MOBILE COMMUNICATION NETWORKS

UNIT I

9

OPERATION OF MOBILE COMMUNICATION NETWORKS

Operation of first, second, and third generation wireless networks: cellular systems, medium access techniques, Mobile networks Elementary Principles of cellular Telephony Channel Division Techniques (TDMA, FDMA, CDMA) Cellular Coverage Methods Network Planning and Resource Allocation, Network Dimensioning ,Mobility Management Procedures

UNIT II

9

PROPAGATION MODELS AND AIR PROTOCOLS

Radio propagation models, error control techniques, handoff, power control, Soft handover, Forward link ,Reverse link , common air protocols (AMPS, IS-95, IS-136, GSM, GPRS, EDGE, WCDMA, cdma2000, etc)

UNIT III

9

MOBILE NETWORK ARCHITECTURE

General Architecture definition, Mobile Terminals (MT, SIM) Radio Section (BTS, BSC) Core Network (MSC, G-MSC, VLR, HLR, AuC) User and Control Plane Protocol Stack, MAP & SS#7, the Key Role of Signaling Interfaces and Network Entities Relation The Physical Channel, The Logical Channels Terminal, Call and Network Management Procedures, Network Planning.

UNIT IV

9

WIRELESS LOCAL AREA NETWORKS

Wireless Local Area Networks, General Characteristics of the Hyper LAN System, 802.11 Standard, Basic DCF access scheme DCF Access Scheme with Handshaking, PCF Access Scheme, The 802.11a Standard, Mobile Ad Hoc Networks, Wireless Sensor Networks, Routing Energy Efficiency, Localization, Clustering.

UNIT V

9

SECURITY ISSUES IN WIRELESS NETWORKS

Security in Wireless Networks, Secure routing, Key Pre-distribution and Management, Encryption and Authentication, Security in Group Communication, Trust Establishment and Management, Denial of Service Attacks, Energy-aware security mechanisms, Location verification, Security on Data fusion.

L = 45 T = 0 Total = 45

REFERENCES

[1] W. Stallings, "Wireless Communications and Networks", Prentice Hall, 2002.

[2] V.K. Garg, "IS-95 CDMA and CDMA 2000", Prentice Hall PTR, 2000.

[3] T.S. Rappaport, "Wireless Communications: Principles & Practice", Second Edition, Prentice Hall, 2002.

[4] Leon-Garcia and I. Widjaja, "Communication Networks, Fundamental Concepts and Key Architectures", McGraw-Hill, 2000.

[5] J.Schiller,"Mobile Communications", Addison Wesley, 2000.

[6] Fred Halsall, "Multimedia Communications, Applications, Networks, Protocols and Standards", Addison Wesley, 2001.

[7] Uyless Black ,"Mobile and Wireless Networks" , Prentice Hall PTR, 1996.

MTEC231 MULTIMEDIA COMPRESSION TECHNIQUES

UNIT I **9**

INTRODUCTION

Special features of Multimedia – Graphics and Image Data Representations – Fundamental Concepts in Video and Digital Audio – Storage requirements for multimedia applications -Need for Compression - Taxonomy of compression techniques – Overview of source coding, source models, scalar and vector quantization theory – Evaluation techniques – Error analysis and methodologies

UNIT II **9**

TEXT COMPRESSION

Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmatic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

UNIT III **9**

AUDIO COMPRESSION

Audio compression techniques - μ- Law and A- Law companding. Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 – Application to audio coding – MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders

UNIT IV **9**

IMAGE COMPRESSION

Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization – Contour based compression – Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards - JBIG, JBIG2 standards.

UNIT V **9**

VIDEO COMPRESSION

Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

L = 45 T = 0 Total = 45

REFERENCES:

[1] Khalid Sayood : Introduction to Data Compression, Morgan Kauffman Harcourt India, 2nd Edition, 2000.

[2] David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001.

[3] Yun Q.Shi, Huifang Sun : Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards, CRC press, 2003.

[4] Peter Symes : Digital Video Compression, McGraw Hill Pub., 2004.

[5] Mark Nelson : Data compression, BPB Publishers, New Delhi,1998.

[6] Mark S.Drew, Ze-Nian Li : Fundamentals of Multimedia, PHI, 1st Edition, 2003.

[7] Watkinson,J : Compression in Video and Audio, Focal press,London.1995.

[8] Jan Vozer : Video Compression for Multimedia, AP Profes, NewYork, 1995

MTEC133 WIRELESS SENSOR NETWORKS

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS 8

Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks.

UNIT II ARCHITECTURES 9

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT III NETWORKING SENSORS 10

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

UNIT IV INFRASTRUCTURE ESTABLISHMENT 9

Topology Control , Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS 9

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

TOTAL= 45 PERIODS

TEXT BOOKS:

1. Holger Karl & Andreas Willig, " Protocols And Architectures for Wireless Sensor Networks" , John Wiley, 2005.

2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

REFERENCES:

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, And Applications", John Wiley, 2007.

2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

MTEC234 APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS

UNIT – I:

Linear Algebraic equation and Eigen Value Problem 12 Hours

System of Equations – Solution by Gauss Elimination, Gauss – Jordan and LU decomposition method – Jacobi, Gauss – Seidal iteration method – Eigen Values of a matrix by Jacobi and Power methods.

UNIT – II:
Differential Geometry 12 Hours

Vector fields, integral curves of vector fields, tangent spaces. Surfaces in Euclidean spaces, vector fields on surfaces, Gauss map. Geodesics, parallel transport, Weingarten map. Curvature of plane curves, arc length and line integrals. Curvature of surfaces. Parameterized surfaces. Gauss-Bonnet Theorem, Poincare - Hopf Index Theorem.

UNIT – III:

Special Functions 12 Hours

Bessel's equation – Bessel Functions – Legendre's Equation – Legendre Polynomials – Rodrigue's formula – Recurrence relations – generating function and orthogonal property of Bessel functions and Legendre polynomials.

UNIT - IV:

Random Variables 12 Hours

One dimensional Random Variables – Moments and MGF – Binomial, Poisson, Geometrical, Uniform, Exponential, Normal and Welbull distributions – Two dimensional Random Variables – Marginal and Conditional distribution – Covariance and correlation coefficient – Functions of one dimensional and Two dimensional Random Variables.

UNIT – V:

Queuing Theory **12 Hours**

Single and Multiple server Markovian queuing models – Steady state system size probabilities – Little's formula – customers impatience – priority queues – M/G/1 queuing system – P.K formula.

REFERENCES:

1. Sanjay K Bose, "An Introduction to Queuing Systems", Kluwer Academic / Plenum Publishers, 2002.
2. Michael T Health, "Scientific Computing, An Introductory Survey", Second Edition, McGraw – Hill Higher Education, New York, 2002.
3. Martin M. Lipschutz, "Theory and Problems of Differential Geometry", Tata McGraw – Hill Publishing Company Limited, 2005.
4. Jain M.K., Iyengar. S.R.K. & Jain. R.K, "Numerical Methods for Scientific and Engineering Computation", New Age International (P) Ltd., Publishers, 2003.
5. Sankara Rao K, "Introduction to Partial Differential", Prentice Hall of India, 1997.
6. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, 2005.
7. Kapur J.N & Saxena. H.C, "Mathematics Statistics", S. Chand & Company Limited, New Delhi, 2003.
8. Taha H.A, "Operations Research - An Introduction", Prentice Hall of India, 2001.
9. Gross D & Harris C.M, "Fundamentals of Queuing Theory", John Wiley & Sons, 1985.
10. M. doCarmo, Differential Geometry of Curves and Surfaces, Prentice Hall, 1976.
11. B. O'Neill, Elementary Differential Geometry, Academic Press, New York, 1966.
12. J.J. Stoker, Differential Geometry, Wiley - Interscience, 1969.
13. J.A. Thorpe, Elementary Topics in Differential Geometry, Springer (India), 2004.

MTEC251 COMMUNICATION SYSTEM LABORATORY

1. Simulation of Audio and speech compression algorithms
2. Simulation of EZW / SPIHT Image coding algorithm.
3. Study of Global Positioning System.
4. Study of GPRS
5. Modeling and Simulation of Radio Channels - Multipath Fading Channels- Frequency non-selective and frequency selective fading channels realization.
6. Spread Spectrum Communication Systems: Direct Sequence and Frequency Hopped Systems- CDMA systems
7. MIMO OFDM systems(OSTBC over fading channel, HiPerLAN).
8. MIMO OFDM systems(IEEE 802.11, IEEE 802.16).

P = 45 Total = 45

MTEC232 MICROWAVE LABORATORY

1. Study of wave guide components.
2. To study the characteristics of reflex Klystron and determine its timing range.
3. To measure frequency of microwave source and demonstrate relationship among guide dimensions, free space wave length and guide wavelength.
4. To measure VSWR of unknown load and determine its impedance using a smith chart.
5. To match impedance for maximum power transfer using slide screw tuner.
6. To measure VSWR, insertion losses and attenuation of a fixed and variable attenuator
7. To measure coupling and directivity of direction couplers.
8. To measure insertion loss, isolation of a three port circulator.
9. To measure the Q of a resonant cavity.
10. Simulation of Microstrip Antennas
11. S-parameter estimation of Microwave devices.

P = 45 Total = 45

DETAILED SYLLABORATORYUS OF ELECTIVES

RF SYSTEM DESIGN

UNIT I **9**

RF ISSUES

Importance of RF design, Electromagnetic Spectrum, RF behaviour of passive components, Chip components and Circuit Board considerations, Scattering Parameters, Smith Chart and applications.

UNIT II **9**

RF FILTER DESIGN

Overview , Basic resonator and filter configuration, Special filter realizations, Filter implementations, Coupled filter.

UNIT III **9**

ACTIVE RF COMPONENTS & APPLICATIONS

RF diodes, BJT, RF FETs, High electron mobility transistors; Matching and Biasing Networks – Impedance matching using discrete components, Microstripline matching networks, Amplifier classes of operation and biasing networks.

UNIT IV **9**

RF AMPLIFIER DESIGNS

Characteristics, Amplifier power relations, Stability considerations, Constant gain circles, Constant VSWR circles, Low Noise circuits, Broadband , high power and multistage amplifiers.

UNIT V **9**

OSCILLATORS, MIXERS & APPLICATIONS

Basic Oscillator model, High frequency oscillator configuration, Basic characteristics of Mixers; Phase Locked Loops ; RF directional couplers and hybrid couplers ; Detector and demodulator circuits.

L = 45 T = 0 Total = 45

REFERENCES:

[1] Reinhold Ludwig and Powel Bretchko, RF Circuit Design – Theory and Applications, Pearson Education Asia, First Edition, 2001.

[2] Joseph . J. Carr, Secrets of RF Circuit Design , McGraw Hill Publishers, Third Edition, 2000.

[3] Mathew M. Radmanesh, Radio Frequency & Microwave Electronics, Pearson Education Asia, Second Edition, 2002.

[4] Ulrich L. Rohde and David P. NewKirk, RF / Microwave Circuit Design, John Wiley & Sons USA 2000.

[5] Roland E. Best, Phase - Locked Loops : Design, simulation and applications, McGraw Hill Publishers 5^{TH} edition 2003.

ADVANCED DIGITAL SIGNAL PROCESSING

[Review of discrete-time signals and systems- DFT and FFT, Z-Transform, Digital Filters is recommended]

UNIT I

9

DISCRETE RANDOM SIGNAL PROCESSING

Discrete Random Processes- Ensemble averages, stationary processes, Autocorrelation and Auto covariance matrices. Parseval's Theorem, Wiener-Khintchine Relation- Power Spectral Density-Periodogram Spectral Factorization , Filtering random processes. Low Pass Filtering of White Noise. Parameter estimation: Bias and consistency.

UNIT II

9

SPECTRUM ESTIMATION

Estimation of spectra from finite duration signals, Non-Parametric Methods-Correlation Method , Periodogram Estimator, Performance Analysis of Estimators -Unbiased, Consistent Estimators- Modified periodogram, Bartlett and Welch methods, Blackman –Tukey method. Parametric Methods - AR, MA, ARMA model based spectral estimation. Parameter Estimation -Yule-Walker equations, solutions using Durbin's algorithm

UNIT III

9

LINEAR ESTIMATION AND PREDICTION

Linear prediction- Forward and backward predictions, Solutions of the Normal equations- Levinson-Durbin algorithms. Least mean squared error criterion -Wiener filter for filtering and prediction , FIR Wiener filter and Wiener IIR filters ,Discrete Kalman filter

UNIT IV **9**

ADAPTIVE FILTERS

FIR adaptive filters -adaptive filter based on steepest descent method-Widrow-Hoff LMS adaptive algorithm, Normalized LMS. Adaptive channel equalization-Adaptive echo cancellation-Adaptive noise cancellation- Adaptive recursive filters (IIR). RLS adaptive filters-Exponentially weighted RLS-sliding window RLS.

UNIT V **9**

MULTIRATE DIGITAL SIGNAL PROCESSING

Mathematical description of change of sampling rate - Interpolation and Decimation , Decimation by an integer factor - Interpolation by an integer factor, Sampling rate conversion by a rational factor, Filter implementation for sampling rate conversion-direct form FIR structures, Polyphase filter structures, time-variant structures. Multistage implementation of multirate system. Application to sub band coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.

L = 45 T = 0 Total = 45

REFERENCES:

[1] Monson H.Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons, Inc.,Singapore, 2002.

[2] John G. Proakis, Dimitris G.Manolakis, Digital Signal Processing Pearson Education, 2002.

[3] John G. Proakis et.al.,'Algorithms for Statistical Signal Processing', Pearson Education, 2002.

[4] Dimitris G.Manolakis et.al.,'Statistical and adaptive signal Processing', McGraw Hill, Newyork,2000.

[5] Rafael C. Gonzalez, Richard E.Woods, 'Digital Image Processing', Pearson Education, Inc., Second Edition, 2004.(For Wavelet Transform Topic)

ADVANCED MICROWAVE SYSTEMS 3 0 0 100

UNIT I **9**

FIELD ANALYSIS OF PLANAR TRANSMISSION LINES

Microstrip Transmission Lines – Attenuation – High frequency properties of Microstrip lines. Coupled Microstrip lines – even and odd modes. Strip transmission lines – Coupled strip lines – Fin lines.

UNIT II **9**

CIRCUIT THEORY FOR WAVE GUIDE SYSTEMS

Equivalent voltages and currents – Impedance description of waveguide elements and circuits – one port circuit. Foster's reactance theorem. N-port circuits. Two port junctions. Excitation of waveguides. Probe coupling in rectangular waveguide. Radiation from linear current elements and current loops. Waveguide coupling by apertures.

UNIT III **9**

PERIODIC STRUCTURES AND FILTERS

Wave analysis of periodic structures. Periodic structures composed of Unsymmetrical two port networks. Terminated Periodic structures. Matching of Periodic structures. Floquet's theorem and spatial Harmonics. Microwave Filters – Image parameter method. Filter design by insertion loss method. Low pass filter design. Microstrip parallel coupled filter.

UNIT IV **9**

MICROWAVE SOLID STATE AMPLIFIERS

S-parameters - Unilateral design of amplifiers – simultaneous conjugate match. Bilateral design of amplifiers. Amplifier stability. Conditional and unconditional stability criteria. Amplifier power gain. Constant gain circles. Noise temperature concept. Noise factor and noise figure. Noise temperature for cascaded stages. Constant noise figure circles. Design of single stage microwave amplifiers.

UNIT V

9

MICROWAVES AND OPTICS

Geometrical optics as a limiting case of wave optics. Ray matrices for paraxial ray optics. Gaussian beams. Generation of Gaussian beams at microwave frequencies. The beam waist. Propagation of Gaussian beams in Homogeneous medium. Transformation of Gaussian beams with lenses.

L = 45 T = 0 Total = 45

REFERENCES

[1] R.E.Collin, " Foundations for Microwave Engineering", McGraw-Hill, 1992.

[2] Ramo, Whinnery and Van Duzer : "Fields and Waves in communication electronics". 3rd Edition., Wiley, 1997.

COMMUNICATION PROTOCOL ENGINEERING 3 0 0 100

UNIT I **9**

NETWORK REFERENCE MODEL

Communication model-software, subsystems, protocol, protocol development methods, Protocol engineering process, Layered architecture, Network services and Interfaces, Protocol functions, OSI model ,TCP/IP protocol suite

UNIT II **9**

PROTOCOL SPECIFICATIONS

Components of protocol, Specifications of Communication service, Protocol entity, Interface, Interactions, Multimedia protocol, Internet protocol, SDL, SDL based protocol-other protocol specification languages

UNIT III **9**

PROTOCOL VERIFICATION/VALIDATION

Protocol verification, Verification of a protocol using finite state machines, Protocol validation, protocol design errors, Protocol validation approaches, SDL based protocol verification and validation

UNIT IV **9**

PROTOCOL CONFORMANCE/PERFORMANCE TESTING

Conformance testing methodology and frame work, Conformance test architectures, Test sequence generation methods, Distributed architecture by local methods, Conformance testing with TTCN, systems with semi controlLaboratoryle interfaces - RIP,SDL based tools for conformance testing, SDL based conformance testing of MPLS Performance testing, SDL based performance testing of TCP and OSPF, Interoperability testing, SDL based interoperability testing of CSMA/CD and CSMA/CA protocol using Bridge, ScaLaboratoryility testing

UNIT V

9

PROTOCOL SYNTHESIS AND IMPLEMENTATION

Protocol synthesis, Interactive synthesis algorithm, Automatic synthesis algorithm, Automatic synthesis of SDL from MSC, Protocol Re-synthesis; Requirements of protocol implementation, Object based approach to protocol implementation, Protocol compilers, Tool for protocol engineering

L = 45 T = 0 Total = 45

REFERENCES

[1] Pallapa Venkataram and Sunilkumar S.Manvi, "Communication protocol Engineering", Eastern Economy edition, 2004

[2] Richard Lai and Jirachiefpattana, "Communication Protocol Specification and Verification", Kluwer Publishers, Boston, 1998.

[3] Tarnay, K., "Protocol Specification and Testing", Plenum, New York, 1991.

[4] Mohamed G. Gouda, "Elements of Network Protocol Design", John Wiley & Sons, Inc. New York, USA, 1998

[5] V.Ahuja, "Design and Analysis of Computer Communication networks", McGraw-Hill, London, 1982.

[6] G.J.Holtzmann, "Design and validation of Computer protocols", Prentice Hall, New York, 1991.

DSP PROCESSOR ARCHITECTURE AND PROGRAMMING 3 0 0 100

UNIT I **9**

FUNDAMENTALS OF PROGRAMMABLE DSPs

Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access in P-DSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals.

UNIT II **9**

TMS320C5X PROCESSOR

Architecture – Assembly language syntax - Addressing modes – Assembly language Instructions - Pipeline structure, Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals.

UNIT III **9**

TMS320C3X PROCESSOR

Architecture – Data formats - Addressing modes – Groups of addressing modes- Instruction sets - Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals – Generating and finding the sum of series, Convolution of two sequences, Filter design

UNIT IV **9**

ADSP PROCESSORS

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

UNIT V **9**

ADVANCED PROCESSORS

Architecture of TMS320C54X: Pipe line operation, Code Composer studio - Architecture

of TMS320C6X - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

L = 45 T = 0 Total = 45

REFERENCES

[1] B.Venkataramani and M.Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications" – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.

[2] User guides Texas Instrumentation, Analog Devices, Motorola.

WAVELETS AND MUTIRESOLUTION PROCESSING 3 0 0 100

UNIT I **9**

INTRODUCTION

Vector Spaces - properties - dot product - basis - dimension, orthogonality and orthonormality - relationship between vectors and signals - Signal spaces - concept of Convergence - Hilbert spaces for energy signals - Generalised Fourier Expansion.

UNIT II **9**

MULTI RESOLUTION ANALYSIS

Definition of Multi Resolution Analysis (MRA) – Haar basis - Construction of general orthonormal MRA-Wavelet basis for MRA – Continuous time MRA interpretation for the DTWT – Discrete time MRA- Basis functions for the DTWT – PRQMF filter banks

UNIT III **9**

CONTINUOUS WAVELET TRANSFORM

Wavelet Transform - definition and properties - concept of scale and its relation with frequency - Continuous Wavelet Transform (CWT) - Scaling function and wavelet functions (Daubechies, Coiflet, Mexican Hat, Sinc, Gaussian, Bi-Orthogonal) - Tiling of time -scale plane for CWT.

UNIT IV **9**

DISCRETE WAVELET TRANSFORM

Filter Bank and sub band coding principles - Wavelet Filters - Inverse DWT computation by Filter banks -Basic Properties of Filter coefficients - Choice of wavelet function coefficients - Derivations of Daubechies Wavelets -Mallat's algorithm for DWT – Multi-band Wavelet transforms.

Lifting Scheme: Wavelet Transform using Polyphase matrix Factorization - Geometrical foundations of lifting scheme - Lifting scheme in Z -domain

UNIT V

9

APPLICATIONS

Signal Compression – Image Compression techniques: EZW-SPHIT Coding - Image denoising techniques: Noise estimation - Shrinkage rules -. Shrinkage Functions - Edge detection and object Isolation, Image Fusion, and Object Detection. Curve and Surface Editing- Variational modeling and finite element method using wavelets.

L = 45 T = 0 Total = 45

REFERENCES

[1] Rao .R.M and A.S.Bopardikar, "Wavelet Transforms: Introduction to theory and Applications", Pearson Education Asia Pte. Ltd., 2000.

[2] K.P.Soman and K.I.Ramachandran," Insight into Wavelets – From Theory to practice", Prentice- Hall, 2004.

[3] Strang G, Nguyen T, "Wavelets and Filter Banks," Wellesley Cambridge Press, 1996

[4] Vetterli M, Kovacevic J., "Wavelets and Sub-band Coding," Prentice Hall, 1995

[5] Mallat S., "Wavelet Signal Processing", Academic Press, 1996

SPEECH AND AUDIO SIGNAL PROCESSING 3 0 0 100

UNIT I

MECHANICS OF SPEECH 9

Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speech production – Representation of Speech signals – Classification of Speech sounds – Phones – Phonemes – Phonetic and Phonemic alphabets – Articulatory features.

Music production – Auditory perception – Anatomical pathways from the ear to the perception of sound – Peripheral auditory system – Psycho acoustics

UNIT II

TIME DOMAIN METHODS FOR SPEECH PROCESSING 9

Time domain parameters of Speech signal – Methods for extracting the parameters Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy – Short Time Auto Correlation Function – Pitch period estimation using Auto Correlation Function

UNIT III

FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING 9

Short Time Fourier analysis – Filter bank analysis – Formant extraction – Pitch Extraction – Analysis by Synthesis- Analysis synthesis systems- Phase vocoder—Channel Vocoder. Homomorphic speech analysis: Cepstral analysis of Speech – Formant and Pitch Estimation – Homomorphic Vocoders.

UNIT IV

LINEAR PREDICTIVE ANALYSIS OF SPEECH 9

Formulation of Linear Prediction problem in Time Domain – Basic Principle – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's Recursive algorithm – lattice formation and solutions – Comparison of different methods – Application of LPC parameters – Pitch detection using LPC parameters – Formant analysis – VELP – CELP.

UNIT V

APPLICATION OF SPEECH & AUDIO SIGNAL PROCESSING 9

Algorithms: Spectral Estimation, dynamic time warping, hidden Markov model – Music analysis – Pitch Detection – Feature analysis for recognition – Music synthesis – Automatic Speech Recognition – Feature Extraction for ASR – Deterministic sequence recognition – Statistical Sequence recognition – ASR systems – Speaker identification and verification – Voice response system – Speech Synthesis: Text to speech, voice over IP.

L = 45 T = 0 Total = 45

REFERENCES

[1] Ben Gold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons Inc. , Singapore, 2004

[2] L.R.Rabiner and R.W.Schaffer – Digital Processing of Speech signals – Prentice Hall -1978

[3] Quatieri – Discrete-time Speech Signal Processing – Prentice Hall – 2001.

[4] J.L.Flanagan – Speech analysis: Synthesis and Perception – 2nd edition – Berlin – 1972

[5] I.H.Witten – Principles of Computer Speech – Academic Press – 1982

NETWORK ROUTING ALGORITHMS 3 0 0 100

UNIT I **9**

CIRCUIT SWITCHING NETWORKS

AT & T's Dynamic Routing Network, Routing in Telephone Network-Dynamic Non Hierarchical Routing-Trunk Status Map Routing-Real Time Network Routing, Dynamic Alternative Routing-Distributed Adaptive Dynamic Routing-Optimized Dynamic Routing

UNIT II **9**

PACKET SWITCHING NETWORKS

Distance vector Routing, Link State Routing, Inter domain Routing-Classless Interdomain routing (CIDR), Interior Gateway routing protocols (IGRP) - Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Exterior Gateway Routing Protocol (EGRP) - Border Gateway Protocol (BGP), Apple Talk Routing and SNA Routing

UNIT III **9**

HIGH SPEED NETWORKS

Routing in optical networks-The optical layer, Node Designs, Network design and operation, Optical layer cost tradeoffs, Routing and wavelength assignment, Architectural variations, Routing in ATM networks-ATM address structure, ATM Routing, PNNI protocol, PNNI signaling protocol, Routing in the PLANET network and Deflection Routing.

UNIT IV **9**

MOBILE NETWORKS

Routing in Cellular Mobile Radio Communication networks-Mobile Network Architecture, Mobility management in cellular systems, Connectionless Data service for cellular systems, Mobility and Routing in Cellular Digital Packet Data (CDPD) network, Packet Radio Routing-DARPA packet radio network, Routing algorithms for small,

medium and large sized packet radio networks.

UNIT V **9**

MOBILE AD-HOC NETWORKS (MANET)

Internet based mobile ad-hoc networking, communication strategies, routing algorithms – Table-driven routing - Destination Sequenced Distance Vector (DSDV), Source initiated on-demand routing- Dynamic Source Routing (DSR), Ad-hoc On- demand Distance Vector (AODV), Hierarchical based routing- Cluster head Gateway Switch Routing (CGSR) and Temporally-Ordered Routing Algorithm (TORA), Quality of Service.

L = 45 T = 0 Total = 45

REFERENCES

[1] M. Steen strub, "Routing in Communication networks", Prentice Hall International, NewYork, 1995.

[2] "Internetworking Technologies Handbook", Fourth Edition, Inc. Cisco Systems, ILSG Cisco Systems, 2003.

[3] William Stallings, "ISDN and Broadband ISDN with Frame Relay and ATM", PHI, New Delhi, 2004.

[4] Behrouz A Forouzan, "Data Communications and Networking (3/e), TMH, 2004

[5] William Stallings, "High Speed Networks TCP/IP and ATM Design Principles", Prentice Hall International, New York, 1998.

[6] Mohammad Ilyas, "The Handbook of Ad hoc Wireless Networks" CRC Press, 2002.

[7] Vijay K.Garg, "Wireless Network Evolution: 2G to 3G", Pearson Education, New Delhi, India, 2003.

[8] Rajiv Ramaswami and Kumar N.Sivarajan, "Optical Networks",Morgan Kaufmann Publishers,1998.

[9] Sumit Kasera and Pankaj sethi, "ATM Networks", Tata McGraw-Hill Publishing Company limited, New Delhi,2001.

[10] IEEE Journal on Selected Areas in Communications, Special issue on Wireless Ad-hoc Networks, Vol. 17, No.8, 1999.

[11] Scott. M. Corson, Joseph P. Macker, Gregory H. Cirincione, IEEE Internet Computing Vol.3, No. 4, 1999.

[12] Alder M.Scheideler.Ch. Annual ACM Symposium on Parallel Algorithms and Architectures, ACM, NewYork 1998.

[13] http://www.cisco.com/univercd/cc/td/doc/cisintwk/ito_doc/

[14] www.moment.cs.ucsb.edu

SIMULATION OF COMMUNICATION SYSTEMS & NETWORKS

3 1 0 100

UNIT I **9 + 3**

MODELLING OF COMMUNICATION SYSTEM

Model of speech and picture signals, Pseudo noise sequences, Non-linear sequences, Analog channel model, Noise and fading, Digital channel model-Gilbert model of bursty channels, HF, Troposcatter and satellite channels, Switched telephone channels, Analog and Digital communication system models, Light wave system models.

UNIT II **9 + 3**

SIMULATION OF RANDOM VARIABLES AND RANDOM PROCESS

Univariate and multivariate models, Transformation of random variables, Bounds and approximation, Random process models-Markov and ARMA Sequences, Sampling rate for simulation, Computer generation and testing of random numbers

UNIT III **9 + 3**

ESTIMATION OF PERFORMANCE MEASURES

Quality of an estimator, estimator for SNR, Probability density functions of analog communication system, BER of digital communication systems, Monte Carlo method and Importance of sampling method, estimation of power spectral density

UNIT IV **9 + 3**

COMMUNICATION NETWORKS

Queuing models, M/M/I and M/M/I/N queues, Little formula, Burke's theorem ,M/G/I queue, Embedded Markov chain analysis of TDM systems, Polling, Random access systems

UNIT V **9 + 3**

NETWORK OF QUEUES

Queues in tandem, store and forward communication networks, capacity allocation, Congestion and flow chart, Routing model, Network layout and Reliability

L = 45 T = 15 Total = 60

REFERENCES

[1] M.C.Jeruchim,Philip BaLaboratoryan and K.Sam Shanmugam, "Simulation of communication systems", Plenum Press, New York,1992

[2] A.M.Law and W.David Kelton, "Simulation Modelling and analysis", Mc Graw Hill Inc., New York ,1991

[3] J.F.Hayes, "Modelling and Analysis of Computer Communication networks", Plenum Press, New York,1984

[4] Jerry Banks and John S.Carson, "Discrete-event System Simulation", Prentice Hall Inc., New Jersey,1984

GLOBAL POSITIONING SYSTEMS 3 0 0 100

UNIT I 9

History of GPS – BC-4 System – HIRAN – NNSS – NAVSTAR GLONASS and GNSS Systems – GPS Constellation – Space Segment – Control Segment – User Segment – Single and Dual Frequency – Point – Relative – Differential GPS – Static and Kinematic Positioning – 2D and 3D – reporting Anti Spoofing (AS); Selective AvaiLaboratoryility (SA) – DOP Factors.

UNIT II 9

Coordinate Systems – Geo Centric Coordinate System – Conventional Terrestrial Reference System – Orbit Description – Keplerian Orbit – Kepler Elements – Satellite Visibility – Topocentric Motion – Disturbed Satellite Motion – Perturbed Motion – Disturbing Accelerations - Perturbed Orbit – Time Systems – Astronomical Time System – Atomic Time – GPS Time – Need for Coordination – Link to Earth Rotation – Time and Earth Motion Services.

UNIT III 9

C/A code; P-code; Y-code; L1, L2 Carrier frequencies – Code Pseudo Ranges – Carries Phases – Pseudo Ranges – Satellite Signal Signature – Navigation Messages and Formats – Undifferenced and Differenced Range Models – Delta Ranges – Signal Processing and Processing Techniques – Tracking Networks – Ephemerides – Data Combination: Narrow Lane; Wide Lane – OTF Ambiguity.

UNIT IV 9

Propagation Media – Multipath – Antenna Phase Centre – Atmosphere in brief – Elements of Wave Propagation – Ionospheric Effects on GPS Observations – Code Delay – Phase Advances – Integer Bias – Clock Error – Cycle Slip – Noise-Bias – Blunders – Tropospheric Effects on GPS Oberservables – Multipath Effect – Antenna Phase Centre Problems and Correction.

UNIT V **9**

Inter Disciplinary Applications – Crystal Dynamics – Gravity Field Mapping – Atmospheric Occulation – Surveying – Geophysics – Air borne GPS – Ground Transportation – Space borne GPS – Metrological and Climate Research using GPS.

L = 45 T = 0 Total = 45

REFERENCES

[1] B.Hoffman - Wellenhof, H.Lichtenegger and J.Collins, "GPS: Theory and Practice", 4th revised edition, Springer, Wein, New york,1997

[2] A.Leick, "GPS Satellites Surveying", 2nd edition, John Wiley & Sons,NewYork,1995

[3] B.Parkinson, J.Spilker, Jr.(Eds), "GPS: Theory and Applications", Vol.I & Vol.II, AIAA, 370 L'Enfant Promenade SW, Washington, DC 20024, 1996

[4] A.Kleusberg and P.Teunisen(Eds), “GPS for Geodesy”, Springer-Verlag, Berlin,1996

[5] L.Adams, "The GPS - A Shared National Asset”, Chair, National Academy Press, Washington, DC, 1995

Websites:

[6] http://www.auslig.gov.au

[7] http://igscb.jpl.nasa.gov

[8] http://gibs.leipzig.ifag.de

[9] http://www.navcen.uscg.mil

COMMUNICATION NETWORK SECURITY 3 0 0 100

UNIT I 9

SYMMETRIC CIPHERS (Techniques and Standards) –I

Introduction – Services, Mechanisms and Attacks, OSI security Architecture, Model for network Security; Classical Encryption Techniques- Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Stegnography; Block Ciphers and Data Encryption Standard- Simplified DES, Block Cipher Principles, Data Encryption Standard, Strength of DES, Differential and Linear Crypt Analysis, Block Cipher Design Principles, Block Cipher Modes of Operation.

UNIT II 9

SYMMETRIC CIPHERS (Techniques and Standards) – II

Advanced Encryption Standard- Evaluation Criteria for AES, AES Cipher; Contemporary Symmetric Ciphers- Triple DES, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers, RC4 Stream Cipher; Confidentiality using Symmetric Encryption- Placement of Encryption Function, Traffic Confidentiality, Key Distribution, and Random Number Generation.

UNIT III 9

PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS

Public Key Cryptography and RSA- Principles of Public Key Cryptosystems, RSA Algorithm; Key Management and other public key cryptosystems- Key Management, Diffie-Hellman Key Exchange, Elliptic Curve arithmetic, Elliptic Curve Cryptography; Message Authentication and Hash Functions- Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions and MACs; Hash Algorithms- MD5 Message Digest Algorithm; Secure Hash Algorithm, RIPEMD 160, HMAC; Digital Signatures and Authentication Protocols- Digital Signatures, Authentication Protocols, Digital Signature Standards.

UNIT IV **9**

NETWORK SECURITY PRACTICE

Authentication Applications- Kerberos, X.509 Authentication Service; Electronic Mail Security- Pretty Good Privacy, S/MIME; IP Security- IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations; Web Security- Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.

UNIT V **9**

SYSTEM SECURITY

Intruders- Intruder Detection, Password Management; Malicious Software- Virus and Related Threats, Virus Counter Measures; Firewalls- Firewall Design Principles, Trusted Systems.

L = 45 T = 0 Total = 45

REFERENCES

[1] William Stallings, "Cryptography and Network Security", 3ed. Prentice Hall of India, New Delhi ,2004
[2] William Stallings, "Network Security Essentials", 2 ed. Prentice Hall of India, New Delhi, 2004
[3] Charlie Kaufman , "Network Security: Private Communication in Public World", 2 edition. Prentice Hall of India, New Delhi , 2004

SOFT COMPUTING **3 0 0 100**

UNIT I **9**

ARTIFICIAL NEURAL NETWORKS

Basic concepts-single layer perceptron-Multi layer perceptron-Adaline-Madaline-Learning rules-Supervised learning-Back propagation networks-Training algorithm, Practical difficulties, Advanced algorithms-Adaptive network- Radial basis network-modular network-Applications

UNIT II **9**

UNSUPERVISED NETWORKS

Introduction- unsupervised learning -Competitive learning networks-Kohonen self organising networks-Learning vector quantisation - Hebbian learning - Hopfield network-Content addressable nature, Binary Hopfield network, Continuous Hopfield network Travelling Salesperson problem - Adaptive resonance theory –Bidirectional Associative Memory-Principle component Analysis

UNIT III **9**

FUZZY SYSTEMS

Fuzzy sets-Fuzzy rules: Extension principle, Fuzzy relation- fuzzy reasoning – fuzzy inference systems: Mamdani model, Sugeno model. Tsukamoto model -Fuzzy decision making- Multiobjective Decision Making,-Fuzzy classification-Fuzzy control methods - Application

UNIT IV **9**

NEURO-FUZZY MODELLING

Adaptive Neuro Fuzzy based inference systems – classification and regression trees: decision tress, Cart algorithm – Data clustering algorithms: K means clustering, Fuzzy C means clustering, Mountain clustering, Subtractive clustering – rule base structure identification – Neuro fuzzy control: Feedback Control Systems, Expert Control, Inverse Learning, Specialized Learning, Back propagation through Real –Time Recurrent

Learning.

UNIT V **9**

GENETIC ALGORITHM

Fundamentals of genetic algorithm-Mathematical foundations-Genetic modeling-Survival of the fittest-crossover-Inversion and Deletion-mutation-reproduction-Generational cycle-rank method-rank space method- Other derivative free optimization-simulated annealing, Random search, Downhill simplex search-Application

L = 45 T = 0 Total = 45

REFERENCES

[1] Jang J.S.R.,Sun C.T and Mizutani E – "Neuro Fuzzy and Soft computing", Pearson education (Singapore) 2004
[2] David E.Goldberg : "Genetic Algorithms in Search, Optimization, and Machine Learning", Pearson Education, Asia,1996
[3] Laurene Fauseett:"Fundamentals of Neural Networks", Prentice Hall India, New Delhi,1994.
[4] Timothy J.Ross:"Fuzzy Logic Engineering Applications", McGrawHill, NewYork,1997.
[5] S.Rajasekaran and G.A.Vijayalakshmi Pai "Neural networks,Fuzzy logics,and Genetic algorithms", Prentice Hall of India,2003
[6] George J.Klir and Bo Yuan,"Fuzzy Sets and Fuzzy Logic",Prentice Hall Inc., New Jersey,1995

DIGITAL COMMUNICATION RECEIVERS 3 0 0 100

UNIT I 9

REVIEW OF DIGITAL COMMUNICATION TECHNIQUES

Base band and band pass communication, signal space representation, linear and non-linear modulation techniques, and spectral characteristics of digital modulation.

UNIT II 9

OPTIMUM RECEIVERS FOR AWGN CHANNEL

Correlation demodulator, matched filter, maximum likelihood sequence detector, Optimum receiver for CPM signals, M-ary orthogonal signals, envelope detectors for M-ary and correlated binary signals.

UNIT III 9

RECEIVERS FOR FADING CHANNELS

Characterization of fading multiple channels, statistical models, slow fading, frequency selective fading, diversity technique, RAKE demodulator, coded waveform for fading channel

UNIT IV 9

SYNCHRONIZATION TECHNIQUES

Carrier and symbol synchronization, carrier phase estimation – PLL, Decision directed loops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation.

UNIT V 9

ADAPTIVE EQUALIZATION

Zero forcing algorithm, LMS algorithm, Adaptive decision – feedback equalizer, and equalization of Trellis-coded signals, Kalman algorithm, blind equalizers, and stochastic gradient algorithm, Echo cancellation **L = 45 T = 0 Total = 45**

REFERENCES

[1] Heinrich Meyer, Mare Moeneclacy and Stefan.A. Fechtel, "Digital Communication Receivers", Vol I & II, John Wiley, New York, 1997

[2] John. G. Proakis, "Digital Communication", 4th ed., McGraw Hill, New York, 2001

[3] E.A. Lee and D.G. Messerschmitt, "Digital Communication", 2nd edition, Allied Publishers, New Delhi, 1994

[4] Simon Marvin, "Digital Communication Over Fading channel; An unified approach to performance Analysis", John Wiley, New York, 2000

[5] Bernard Sklar, "Digital Communication Fundamentals and Applications, Prentice Hall, 1998

ADVANCED MICROPROCESSORS AND MICRO CONTROLLERS

3 0 0 100

UNIT I **9**

MICROPROCESSOR ARCHITECTURE

Instruction set – Data formats – Instruction formats – Addressing modes – Memory hierarchy – register file – Cache – Virtual memory and paging – Segmentation – Pipelining – The instruction pipeline – pipeline hazards – Instruction level parallelism – reduced instruction set – Computer principles – RISC versus CISC – RISC properties – RISC evaluation – On-chip register files versus cache evaluation

UNIT II **9**

HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM

The software model – functional description – CPU pin descriptions – RISC concepts – bus operations – Super scalar architecture – pipe lining – Branch prediction – The instruction and caches – Floating point unit –protected mode operation – Segmentation – paging – Protection – multitasking – Exception and interrupts – Input /Output – Virtual 8086 model – Interrupt processing -Instruction types – Addressing modes – Processor flags – Instruction set -programming the Pentium processor.

UNIT III **9**

HIGH PERFORMANCE RISC ARCHITECTURE: ARM

The ARM architecture – ARM assembly language program – ARM organization and implementation – The ARM instruction set - The thumb instruction set – ARM CPU cores.

UNIT IV **9**

MOTOROLA 68HC11 MICROCONTROLLERS

Instructions and addressing modes – operating modes – Hardware reset – Interrupt system – Parallel I/O ports – Flags – Real time clock – Programmable timer – pulse

accumulator – serial communication interface – A/D converter – hardware expansion – Assembly language Programming

UNIT V **9**

PIC MICRO CONTROLLER

CPU architecture – Instruction set - Interrupts – Timers – I/O port expansion –I^2C bus for peripheral chip access – A/D converter – UART

L = 45 T = 0 Total = 45

REFERENCES :

[1] Daniel Tabak , ‘’ Advanced Microprocessors” McGraw Hill.Inc., 1995

[2] James L. Antonakos, “The Pentium Microprocessor ‘’ Pearson Education, 1997.

[3] Steve Furber, ‘’ ARM System –On –Chip architecture “Addison Wesley, 2000.

[4] Gene .H.Miller.” Micro Computer Engineering,” Pearson Education, 2003.

[5] John .B.Peatman, “Design with PIC Microcontroller, Prentice hall, 1997.

[6] James L.Antonakos,” An Introduction to the Intel family of Microprocessors ‘’ Pearson Education 1999.

[7] Barry.B.Breg,” The Intel Microprocessors Architecture , Programming and Interfacing “, PHI, 2002.

[8] Valvano "Embedded Microcomputer Systems" Thomson Asia PVT LTD first reprint 2001

[9] www.ocw.nit.edu

[10] www.arm.com

DIGITAL IMAGE PROCESSING 3 0 0 100

UNIT I 9

DIGITAL IMAGE FUNDAMENTALS:

Elements of digital image processing systems, Elements of visual perception, psycho visual model, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals -RGB,HSI models, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries.

UNIT II 9

IMAGE TRANSFORMS:

1D DFT, 2D transforms – DFT, DCT, Discrete Sine, Walsh, Hadamard, Slant, Haar, KLT, SVD, Wavelet Transform.

UNIT III 9

IMAGE ENHANCEMENT AND RESTORATION:

Histogram modification and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contraharmonic and Yp mean filters, Homomorphic filtering, Color image enhancement. Image Restoration – degradation model, Unconstrained and Constrained restoration, Inverse filtering – removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations – spatial transformations, Gray-Level interpolation.

UNIT IV 9

IMAGE SEGMENTATION AND RECOGNITION:

Edge detection. Image segmentation by region growing, region splitting and merging, edge linking.. Image Recognition – Patterns and pattern classes, Matching by minimum distance classifier, Matching by correlation, Back Propagation Neural Network, Neural Network applications in Image Processing.

UNIT V **9**

IMAGE COMPRESSION:

Need for data compression, Huffman,. Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Block Truncation Coding. Transform Coding – DCT and Wavelet. JPEG, MPEG. Standards, Concepts of Context based Compression.

L = 45 T = 0 Total = 45

REFERENCES:

[1] Rafael C. Gonzalez, Richard E.Woods, 'Digital Image Processing', Pearson Education, Inc., Second Edition, 2004.

[2] Anil K. Jain, 'Fundamentals of Digital Image Processing', Prentice Hall of India, 2002.

[3] David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001

[4] Rafael C. Gonzalez, Richard E.Woods, Steven Eddins, ' Digital Image Processing using MATLABORATORY', Pearson Education, Inc., 2004.

[5] William K.Pratt, ' Digital Image Processing', John Wiley, NewYork, 2002.

[6] Milman Sonka, Vaclav Hlavac, Roger Boyle, 'Image Processing, Analysis, and Machine Vision', Brooks/Cole, Vikas Publishing House, II ed., 1999.

[7] Sid Ahmed, M.A., 'Image Processing Theory, Algorithms and Architectures', McGrawHill, 1995.

INTERNETWORKING MULTIMEDIA 3 0 0 100

UNIT I 9

MULTIMEDIA NETWORKING

Digital sound, video and graphics, basic multimedia networking, multimedia characteristics, evolution of Internet services model, network requirements for audio/ video transform, multimedia coding and compression for text, image, audio and video.

UNIT II 9

BROADBAND NETWORK TECHNOLOGY

Broadband services, ATM and IP, IPV6, High speed switching, resource reservation, Buffer management, traffic shaping, caching, scheduling, and policing, throughput, delay and jitter performance. Storage and media services, voice and video over IP, MPEG-2 over ATM/IP, indexing synchronization of requests, recording and remote control.

UNIT III 9

RELIABLE TRANSPORT PROTOCOL AND APPLICATIONS

Multicast over shared media network, multicast routing and addressing, scaling multicast and NBMA networks, Reliable transport protocols, TCP adaptation algorithm, RTP, RTCP. MIME, Peer- to-Peer computing, shared application, video conferencing, centralized and distributed conference control, distributed virtual reality, light weight session philosophy.

UNIT IV 9

MULTIMEDIA COMMUNICATION STANDARDS

Objective of MPEG- 7 standard, Functionalities and systems of MPEG-7, MPEG-21 Multimedia Framework Architecture, - Content representation, Content Management and usage, Intellectual property management, Audio visual system- H322: Guaranteed QOS LAN systems; MPEG_4 video Transport across internet.

UNIT V **9**

MULTIMEDIA COMMUNICATION ACROSS NETWORKS

Packet Audio/video in the network environment, video transport across Generic networks- Layered video coding, error Resilient video coding techniques, ScaLaboratoryle Rate control, Streaming video across Internet, Multimedia transport across ATM networks and IP network, Multimedia across wireless networks.

L = 45 T = 0 Total = 45

REFERENCES

[1] Jon Crowcroft, Mark Handley, Ian Wakeman, Internetworking Multimedia, Harcourt Asia Pvt. Ltd. Singapore, 1998.

[2] B.O. Szuprowicz, Multimedia Networking, McGraw Hill, Newyork. 1995

[3] Tay Vaughan, Multimedia - Making it to work, 4ed, Tata McGraw Hill , NewDelhi, 2000.

[4] K.R.Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic, Multimedia Communication systems, PHI , 2003

ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN 3 0 0 100

UNIT I 9

EMI ENVIRONMENT

EMI/EMC concepts and definitions, Sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency domain EMI, Units of measurement parameters, Emission and immunity concepts, ESD.

UNIT II 9

EMI COUPLING PRINCIPLES

Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply coupling.

UNIT III 9

EMI/EMC STANDARDS AND MEASUREMENTS

Civilian standards - FCC,CISPR,IEC,EN,Military standards - MIL STD 461D/462, EMI Test Instruments /Systems, EMI Shielded Chamber, Open Area Test Site, TEM Cell, Sensors/Injectors/Couplers, Test beds for ESD and EFT, Military Test Method and Procedures (462).

UNIT IV 9

EMI CONTROL TECHNIQUES

Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting.

UNIT V 9

EMC DESIGN OF PCBs

PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models.

L = 45 T = 0 Total = 45

REFERENCES

[1] Henry W.Ott, "Noise Reduction Techniques in Electronic Systems", John Wiley and Sons, NewYork. 1988.

[2] C.R.Paul, "Introduction to Electromagnetic Compatibility" , John Wiley and Sons, Inc, 1992

[3] V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, 1996.

[4] Bernhard Keiser, "Principles of Electromagnetic Compatibility", Artech house, 3rd Ed, 1986.

HIGH PERFORMANCE COMMUNICATION NETWORKS

3 1 0 100

UNIT I **9 + 3**

PACKET SWITCHED NETWORKS

OSI and IP models, Ethernet (IEEE 802.3), Token ring (IEEE 802.5), Wireless LAN (IEEE 802.11) FDDI, DQDB, SMDS: Internetworking with SMDS

UNIT II **9 + 3**

ISDN AND BROADBAND ISDN

ISDN - overview, interfaces and functions, Layers and services - Signaling System 7 (SS7)- Broadband ISDN architecture and Protocols.

UNIT III **9 + 3**

ATM AND FRAME RELAY

ATM: Main features-addressing, signaling and routing, ATM header structure-adaptation layer, management and control, ATM switching and transmission.

Frame Relay: Protocols and services, Congestion control, Internetworking with ATM, Internet and ATM, Frame relay via ATM.

UNIT IV **9 + 3**

ADVANCED NETWORK ARCHITECTURE

IP forwarding architectures overlay model, Multi Protocol Laboratoryel Switching (MPLS), integrated services in the Internet, Resource Reservation Protocol (RSVP), Differentiated services

UNIT V **9 + 3**

BLUE TOOTH TECHNOLOGY

The Blue tooth module-Protocol stack Part I: Antennas, Radio interface, Base band, The Link controller, Audio, The Link Manager, The Host controller interface; The Blue tooth module-Protocol stack Part I: Logical link control and adaptation protocol, RFCOMM,

Service discovery protocol, Wireless access protocol, Telephony control protocol.

L = 45 T = 15 Total = 60

REFERENCES

[1] William Stallings,"ISDN and Broadband ISDN with Frame Relay and ATM", 4th edition, Pearson education Asia, 2002.

[2] Leon Gracia, Widjaja, "Communication networks ", Tata McGraw-Hill, New Delhi, 2000.

[3] Jennifer Bray and Charles F.Sturman,"Blue Tooth" Pearson education Asia, 2001.

[4] Sumit Kasera, Pankaj Sethi, "ATM Networks ", Tata McGraw-Hill, New Delhi, 2000.

[5] Rainer Handel, Manfred N.Huber and Stefan Schroder ,"ATM Networks",3rd edition, Pearson education asia,2002.

[6] Jean Walrand and Pravin varaiya ,"High Performance Communication networks",2nd edition, Harcourt and Morgan Kauffman,London,2000.

[7] William Stallings,"High-speed Networks and Internets", 2nd edition, Pearson education Asia, 2003.

EMBEDDED SYSTEMS **3 0 0 100**

UNIT I **9**

EMBEDDED ARCHITECTURE

Embedded Computers, Characteristics of Embedded Computing Applications, Challenges in Embedded Computing system design, Embedded system design process- Requirements, Specification, Architectural Design, Designing Hardware and Software Components, System Integration, Formalism for System Design- Structural Description, Behavioral Description, Design Example: Model Train Controller

UNIT II **9**

EMBEDDED PROCESSOR AND COMPUTING PLATFORM

ARM processor- processor and memory organization, Data operations, Flow of Control, SHARC processor- Memory organization, Data operations, Flow of Control, parallelism with instructions, CPU Bus configuration, ARM Bus, SHARC Bus, Memory devices, Input/output devices, Component interfacing, designing with microprocessor development and debugging, Design Example : Alarm Clock.

UNIT III **9**

NETWORKS

Distributed Embedded Architecture- Hardware and Software Architectures, Networks for embedded systems- I2C, CAN Bus, SHARC link pports, ethernet, Myrinet, Internet, Network-Based design- Communication Analysis, system performance Analysis, Hardware platform design, Allocation and scheduling, Design Example: Elevator Controller.

UNIT IV **9**

REAL-TIME CHARACTERISTICS

Clock driven Approach, weighted round robin Approach, Priority driven Approach, Dynamic Versus Static systems, effective release times and deadlines, Optimality of the Earliest deadline first (EDF) algorithm, challenges in validating timing constraints in

priority driven systems, Off-line Versus On-line scheduling.

UNIT V **9**

SYSTEM DESIGN TECHNIQUES

Design Methodologies, Requirement Analysis, Specification, System Analysis and Architecture Design, Quality Assurance, Design Example: Telephone PBX- System Architecture, Ink jet printer- Hardware Design and Software Design, Personal Digital Assistants, Set-top Boxes.

L = 45 T = 0 Total = 45

REFERENCES

[1] Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers, 2001.

[2] Jane.W.S. Liu Real-Time systems, Pearson Education Asia, 2000

[3] C. M. Krishna and K. G. Shin , Real-Time Systems, ,McGraw-Hill, 1997

[4] Frank Vahid and Tony Givargi, Embedded System Design: A Unified Hardware/Software Introduction, s, John Wiley & Sons, 2000.

HIGH SPEED SWITCHING ARCHITECTURE 3 0 0 100

UNIT I 9

HIGH SPEED NETWORK:

Introduction- LAN, WAN, Network evolution through ISDN to B-ISDN, Transfer mode and control of B-ISDN, SDH multiplexing structure, ATM standard, ATM adaptation layers.

UNIT II 9

LAN SWITCHING TECHNOLOGY:

Switching Concepts, switch forwarding techniques, switch path control, LAN Switching, cut through forwarding, store and forward, virtual LANs

UNIT III 9

ATM SWITCHING ARCHITECTURE

Switch model, Blocking networks - basic - and- enhanced banyan networks, sorting networks - merge sorting, re-arrangable networks - full-and- partial connection networks, non blocking networks - Recursive network construction, comparison of non-blocking network, Switching with deflection routing - shuffle switch, tandem banyan

UNIT IV 9

QUEUES IN ATM SWITCHES

Internal Queueing -Input, output and shared queueing, multiple queueing networks – combined Input, output and shared queueing - performance analysis of Queued switches.

UNIT V 9

IP SWITCHING

Addressing model, IP Switching types - flow driven and topology driven solutions, IP Over ATM address and next hop resolution, multicasting, Ipv6 over ATM.

L = 45 T = 0 Total = 45

REFERENCES

[1] Achille Pattavina, Swtching Theory: Architectures and performance in Broadband ATM networks "John Wiley & Sons Ltd, New York. 1998

[2] Christopher Y Metz, Switching protocols & Architectures, McGraw - Hill Professional Publishing, NewYork.1998.

[3] Rainer Handel, Manfred N Huber, Stefan Schroder, ATM Networks - Concepts Protocols, Applications III Edition, Addison Wesley, New York. 1999.

[4] John A.Chiong: Internetworking ATM for the internet and enterprise networks. McGraw Hill, New York, 1998.

Real Time Operating Systems 3 1 0 100

UNIT 1 Introduction to Real-Time Embedded Systems and System Resources

Brief history of Real Time Systems, A brief history of Embedded Systems. Resource Analysis, Real-Time Service Utility,Scheduling Classes, The Cyclic Esecutive, Scheduler Concepts, PreemptiveFixed Priority Scheduling Policies, Real-Time OS, Thread Safe Reentrant

Functions

UNIT 2 Processing and Memory

Processing: Preemptive Fixed-Priority Policy, Feasibility, Rate Montonic least upper bound, Necessary and Sufficient feasibility, Deadline – Monotonic Policy, Dynamic priority policies Worst-case Execution time, Intermediate I/O, Execution efficiency, I/O Architecture.

Memory:

Physical hierarchy, Capacity and allocation, Shared Memory, ECC Memory, Flash filesystems.

UNIT 3 Multi source and Soft Real Time Services

Multiresource Services:

Blocking, Deadlock and livestock, Critical sections to protect shared resources, priority inversion.

Soft Real-Time Services:

Missed Deadlines, QoS, Alternatives to rate monotonic policy, Mixed hard and soft real-time services.

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UNIT 4 Embedded System Components, Debugging Components

Embedded System Components:

Firmware components, RTOS system software mechanisms, Software application components.

Debugging Components:

Execptions assert, Checking return codes, Single-step debugging, kernel scheduler traces, Test access ports, Trace ports, Power-On self test and diagnostics, External test equipment, Application-level debugging.

Performance Tuning:

Basic concepts of drill-down tuning, hardware – supported profiling and tracing, Building performance monitoring into software, Path length, Efficiency, and Call frequency, Fundamental optimizations.

UNIT 5 Design

High avaiLaboratoryility and Reliability Design:

Reliability and AvaiLaboratoryility, Similarities and differences, Reliability, Reliable software, AvaiLaboratoryle software, Design trade offs, Hierarchical applications for Fail-safe design.

Design of RTOS – PIC microcontroller. **(Chap 13 of book Myke Predko)**

References:

1. "**Real-Time Embedded Systems and Components" ,** Sam Siewert, Cengage Learning India Edition, 2007.

2. " **Programming and Customizing the PIC microcontroller" ,** Myke Predko, 3rd Ed, TMH, 2008