

## Syllabus for Ph. D. Admission

### 1<sup>st</sup> Semester

S. No.	Course Code	Subject	L	T	P	Credits
1	EC 511	Electronics System Design	4	0	0	4
2	EC 512	Microelectronics	4	0	0	4
3	MA 501	Advanced Mathematics	4	0	0	4
4	EC 513	Satellite Communication				
5	EC 515	Mobile Communication & Fading				

### 2<sup>nd</sup> Semester

S. No.	Course Code	Subject	L	T	P	Credits
1	EC 521	Telecommunication Systems	4	0	0	4
2	EC 522	Microcontroller & Embedded Systems	4	0	0	4
3	MA 505	Design of experiments and research methodology	4	0	0	4
4	EC 523	Advanced Digital Signal Processing				

**Course Name : ELECTRONIC SYSTEM DESIGN**

***DESIGN CONCEPTS:*** (04)  
Digital Hardware, Design Process, Design of Digital Hardware

***LOGIC CIRCUITS:*** (08)  
Variables & Functions Logic gates & Networks synthesis, SOP, POS forms, Introduction to VHDL.

***OPTIMIZED IMPLEMENTATION OF LOGIC FUNCTIONS:*** (10)  
Strategy for minimization, Incompletely specified functions, Multiple output circuits, Multilevel synthesis & Analysis

***COMBINATIONAL CIRCUITS:*** (05)  
Building Block, Multiplexers Decoders, Encoders Code Converters.

***SYNCHRONOUS SEQUENTIAL CIRCUITS:*** (08)  
Basic Design Steps, Mealy state Model, Design of FSM,.

***ASYNCHRONOUS SEQUENTIAL CIRCUITS:*** (08)  
Analysis, Synthesis, State Reduction, State Assignment, Hazards.

***DIGITAL SYSTEM DESIGN:*** (04)  
Building Block Circuits.

***TESTING OF LOGIC CIRCUITS:*** (08)  
Fault Model, Path sensitizing, Random testing, Circuits with Tree Structure.

**BOOKS:**

1. Introduction to Logic Design – MARCOVITZ

**REFERNCES:**

1. Engineering Digital Design – TINDER
2. An Engineering Approach to Digital Design – FLETCHER
3. Logic and Computer Design Fundamentals – MANO

**Course Name : MICROELECTRONICS**

***INTRODUCTION TO RF DESIGN AND WIRELESS TECHNOLOGY: (07)***

Design and applications, Complexity and Choice of Technology, Basic Concepts in RF Design; Non-linearly and time variance, Intersymbol Interference, Random Processes and Noise, Sensitivity and dynamic range, Conversion of gains and distortion.

***RF MODULATION: (08)***

Analog and Digital Modulation of RF Circuits, Comparison of Various techniques for power efficiency, Coherent and Non-coherent detection, Mobile RF communication and basics of Multiple Access techniques, Receiver and Transmitter Architectures, Direct Conversion and two step transmitters.

***RF TESTING: (08)***

RF testing for Heterodyne, Homodyne, Image Rejection, Direct IF and sub sampled receivers.

***BJT AND MOSFET BEHAVIOUR AT RF FREQUENCIES: (08)***

BJT and MOSFET behaviour at RF frequencies, Modelling of the transistor and SPICE Model, Noise performance and limitations of devices, integrated parasitic elements at high frequencies and their monolithic implementation

***RF CIRCUIT DESIGN (10)***

Overview of RF filter design, Active RF Components and Modelling, Matching and Biasing, Networks, Basic Blocks in RF System and their VLSI implementation, Low Noise Amplifier Design in various technologies, Design of Mixers at VHZ frequency range, various mixers working and implementation.

***OSCILLATORS: (11)***

Basic topologies CVO and definition of phase noise, Noise Power and Trade off, Resonator VCO designs, Quadrature and single sideband generators. Radio frequency synthesizers – PLLS, various RF synthesizer architectures and frequency dividers, Power Amplifier Design, Liberalization techniques, Design issues in integrated RF Filters.

**BOOKS :**

1. Thomas H. Lee “Design of CMOS RF Integrated Circuits” Cambridge University Press 1998.

**REFERENCE:**

1. B Razavi “RF Microelectronics” PHI 1998
2. R Jacob Baker, H W Li, D E Boyoe “CMOS Circuit Design, Layout and Simulation” PHI 1998

**Course Name :           ADVANCED MATHEMATICS**

Series solution of differential equations, Power series methods, Legendre's polynomial, generating functions, Recurrence relations **(6)**

Frobenius method, Series solution of Bessel's differential equation, Modified Bessel's functions, generating functions, Recurrence relations **(08)**

Equations reducible to Bessel's equation **(02)**

Sturm Liouville's problem, orthogonal functions, orthogonality of eigen functions, eigen function expansions **(08)**

Conformal mapping, Exponential function,, trigonometric function, logarithmic function, power function, bilinear and Schwarz-Christoffel transformation, Applications to engineering problems **(08)**

Matrices, Minimal polynomial of a matrix, Reduction of a matrix into Jordan canonical form **(03)**

Functions of square matrices, Sylvester's interpolation formula, Quadratic and Hermitian forms **(06)**

Linear vector matrix differential equations, Matrix Riccati equations **(04)**

**BOOKS:**

1.       Advanced Engineering Mathematics, Wylie and Barrett, Mc Graw Hill, 6<sup>th</sup> edition, 1995.

**REFERENCES:**

1.       Advanced Engineering Mathematics, Kreyszig, John Wiley and Sons, 8<sup>th</sup> edition, 2001.
2.       State space Analysis Of Control Systems, K Ogata, 1967, Prentice Hall Inc.

**Course Name : SATELLITE COMMUNICATION**

- INTRODUCTION AND BACKGROUND:** (03)  
Historical Background, basic concepts, communication satellites, communication networks and services, satellite description
- ORBITAL ASPECTS AND LAUNCHING:** (06)  
Orbital mechanics, orbital elements, geostationary orbit, other orbits for satellite communications, rocket propulsion, injection into final orbit, launch vehicle.
- SPACECRAFT SUBSYSTEMS:** (05)  
Spacecraft structure, primary power, various subsystems of a satellite
- FREQUENCY & PROPAGATION ASPECTS:** (03)  
Frequency spectrum, communication bands, frequency reuse, propagation aspects.
- LINK INTERFERENCE ANALYSIS:** (04)  
General considerations, rain induced attenuation, different types of interferences
- THE RF LINK DESIGN:** (07)  
The basic RF link, limits on link performance, satellite links-up and down, optimization of the link, temperature considerations, propagation factors, rain attenuation model
- MODULATION AND CARRIER RECOVERY:** (07)  
Source signals, digital modulation techniques-PSK,QPSK,M-array PSK& FSK.PLL, carrier recovery with narrowband filter and AFC loop
- MULTIPLE ACCESS** (04)  
System engineering considerations, FDMA, TDMA, CDMA, comparison of multiple access techniques
- CODING AND ERROR CORRECTION:** (03)  
Error correction techniques, coding
- EARTH STATION & VSATS:** (05)  
Transmitters, receivers, components of an earth station, VSAT-types, uses
- APPLICATIONS:** (03)  
GPS, Mobile, Internet, etc.

**BOOKS:**

1. Wilbur L.Pritchard, Henry G.Suyderhoud , Robert A.Nelson; *Satellite communication system engineering*, 2<sup>nd</sup> edition, Pearson

**REFERENCES:**

1. Tri T. Ha, *Digital Satellite Communication* McGraw-Hill
2. D. Roddy, *Satellite Communications*, McGraw-Hill Professional, 2001.
3. M. Richharia, *Satellite Communication Systems*, McGraw Hill, 1999.
4. G. Maral & M. Bousquet, *Satellite Communication Systems*, John Wiley and Sons, Inc., 1999.
5. B. Elbert, *Introduction to Satellite Communications*, Artech House, 1999.
6. Pratt, Bostian, and Allnutt, *Satellite Communication Systems*, 2<sup>nd</sup> Edition, John Wiley & Sons, 2003.

**Course Name : MOBILE COMMUNICATIONS AND FADING**

*Rationale: The student would be able to understand the basics of mobile communication and realise the problems encountered in day today life encouraging him to find solutions hencewith.*

***INTRODUCTION***

***(04)***

Introduction to Wireless Communications Systems and applications , Need of mobility , Development and differences between current standards, WLL, WLAN, Bluetooth and personal area networks (PANs) 802.11b (Wi-Fi Networks)

***WIRELESS TRANSMISSION***

***(04)***

Frequencies for radio transmission, cellular concept, signal propagation effects, Mobile communication channel models. Interference, improving capacity in cellular systems

***FADING, DIVERSITY AND EQUALISATION***

***(10)***

Small scale Multipath Propagation, Parameters of mobile multipath channels, Types of small scale fading ,Raleigh and Rician fading distribution, Training a generic adaptive equalizer, Linear , Nonlinear and algorithms for adaptive equalization, Diversity techniques, RAKE Receiver. Interleaving, Block, Convolutional and turbo codes

***MULTIPLE ACCESS TECHNIQUES***

***(05)***

FDMA, TDMA, SSMA, Spectral efficiency of multiple access systems

***WIRELESS NETWORKING***

***(07)***

Mobile IP, Mobility and internet module, Assumptions and requirements, entities and terminology, IP packet delivery, registration, Tunneling, Optimisation, IPv6 protocol, Indirect TCP, Snooping TCP, Mobile TCP, Transmission, Transaction oriented TCP

***TELECOMMUNICATION SYSTEMS***

***(07)***

GSM, Mobile Services, Architecture, frame structure, Signal Processing in GSM

***EMERGING TECHNOLOGY***

***(03)***

Ultra wideband (UWB), Multiband OFDM, Broadband wireless access (BWA), UMTS

**BOOKS**

1. Wireless Communications-Principles and Practice Theodore S. Rappaport

**REFERENCE**

1. Mobile Communications Jochen Sciller
2. Wireless Digital Communications Dr. Kamilo Feher
3. Wireless Communications and Networks William Stallings:

**Course Name : TELECOMMUNICATIONS SYSTEMS**

***INTRODUCTION TO TELECOMMUNICATIONS:*** (08)

Telecommunication Technology  
How it can meet various business needs

***TELECOMMUNICATIONS BASICS:*** (10)

Concepts of Telecommunications technology, Encoding, Transmitting, Receiving Storing, Retrieving, Decoding,  
Basic Transmission Technology

***VOICE TELECOMMUNICATIONS:*** (10)

Telephone services, Stationary Telephone Systems, Mobile Communication Systems

***DATA TELECOMMUNICATIONS:*** (04)

Digital Transmission Basics, Transmission Methods, Transmission Mode.

***LOCAL & WIDE AREA NETWORKS:*** (03)

Local Area Networks, Network Management System, Designing a Local Area Network, Interconnecting LANs &  
WANs.

***VIDEO TELECOMMUNICATIONS*** (04)

The Video Signal, Video Signal Compression Video Text, Teletext, Teleconferencing

***MICROWAVE, SATELLITE, COPPER & FIBER OPTICS FOR VIDEO TRANSMISSION:*** (06)

Microwave Systems, Satellite Systems, Other Transmitting Systems, Cable systems, Fiber Optics.

***VOICE, DATA & VIDEO INTEGRATION:*** (05)

Integrated services Digital Network

**BOOKS:**

1. Introduction to Telecommunications: Voice, Data & the Internet - Cole

**REFERENCES:** Introduction to Data Communications & Networking by BEHROUZ FOROUZAN, Tata McGraw  
Hill Edition (Latest Edition)

**Course Name: MICRO CONTROLLER AND EMBEDDED SYSTEMS**

**8 BIT MICROCONTROLLER-** (06)  
8051 Architecture memory organization, SFR's addressing modes, Instruction set, assembly language programming

**PIC MICROCONTROLLER** (12)  
Introduction to 68HC11 family of microcontroller, CPU, Architecture & pipelining memory organization, CPU family registers, addressing modes Instruction set, Assembly language programming, using timers, subroutines, Interrupts I/O ports special feature

**INTERFACING:** (05)  
Interfacing ADC, DAC, LED, Switches, LCD with examples, RS – 232 / 422 link

**FUNDAMENTALS OF EMBEDDED SYSTEMS** (02)  
Real time systems, Multitasking system, operating system structures, building an embedded application

**CONCURRENT SOFTWARE** (04)  
Foreground / background systems, multithreaded programming, shared resources & critical sections.

**SCHEDULING:** (04)  
Thread states, pending threads, context switching, round robin scheduling, priority based scheduling , assigning priorities, deadlock.

**BOOKS:-**

1. Muhammed Ali Mazidi & J G Mazidi, "The 8051 Microcontroller & Embedded Systems", Pearson Education.

**REFERENCES:**

1. Kenneth J Ayala "The 8051 Microcontroller Architecture Programming & Application", PHI.
2. Microcomputer Engineering by Gene H. Miller, Pearson Education
3. Fundamentals of Embedded software by Danial W. Lewis, PHI
4. Embedded Microcontroller by Todd D. Mortan, Pearson Education

**Course Name : DESIGN OF EXPERIMENT AND RESEARCH METHODOLOGY**

Basic principles, Error analysis in experiments. (10)

Classification of experimental designs, Design and analysis of one factor experiments -Completely randomized and randomized complete block designs, Analysis of variance. (08)

Estimation of parameters, Residual analysis and model checking, Sample size problem. (05)

Design with two blocking variables, Latin squares, Analysis of data from a Latin square. (02)

Experiment with two factors- Introduction, Main effects and interactions, Two-factor analysis of variance, Graphic analysis, Choice of sample size. (06)

Design of Experiments with the help of orthogonal arrays, Taguchi's Robust parameter design, Analysis, Noise factors, Tolerance on control factors. (05)

Research Methodology – Nature and objective of research, Research topic, Literature review, Formulation of problem, Research design, Sampling techniques, Data collection, Statistical and sensitive analysis of data, Interpretation of result and report writing. (10)

**BOOKS:**

1. Probability and Statistics for Engineers and scientists, Walpole, Myers, Myers and Ye, 7<sup>th</sup> ed, 2002, Pearson Education.

**REFERENCES:**

1. Statistics in Research, Bernand Ostle and Richard N.Mensing 3<sup>rd</sup> ed, 1975, Oxford & IBH Pub Co.
2. Probability and Statistics in Engineering, Hines, Montgomery, Goldsman and Borror, 4<sup>th</sup> ed, 2003, John Wiley & Sons.
3. Experimental design, Theory & application, Federer, 1955, Oxford & IBH pub Co.

**Course Name : ADVANCED DIGITAL SIGNAL PROCESSING**

**INTRODUCTION:** (06)  
Review of discrete Convolution, discrete time Fourier transform and Z- transforms, DFT, FFT. Relationship between continuous and discrete time systems; Difference equation for digital filters: definition and properties. MATLAB problems.

**DIGITAL FILTERS:** (06)  
FIR filters, IIR filters. Digital filter design techniques: Impulse invariance. Bilinear transformation, finite difference, window design methods, frequency sampling optimization algorithms. MATLAB problems.

**WAVELET TRANSFORM:** (03)  
Continuous & discrete wavelet transforms, Filter Banks. MATLAB problems.

**TMS320C5X SERIES PROCESSORS:** (10)  
Architecture, Memory, Interrupts, Addressing modes, Assembly language programming.

**EFFECTS OF FINITE WORD LENGTH IN DSP SYSTEMS:** (02)  
Rounding and truncation errors, quantization effects in A/D converter, FIR and IIR filters

**MULTI-RATE SIGNAL PROCESSING:** (03)  
Integer sampling rate conversion. Interpolation and decimation filters. Design of practical sampling rate converters. Sampling rate conversion by an arbitrary factor. Applications of multi-rate signal processing in telecommunications.

**ADAPTIVE FILTERING:** (03)  
Concepts, Adaptive filters as noise cancellers, adaptive line enhancer, in-system modeling. Basic Wiener filter.

**APPLICATIONS OF DSP:** (02)  
Radar, sonar, biomedical, communications, speech and image processing.

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**BASIC CONCEPTS OF SPEECH SIGNAL PROCESSING** (02)

**BOOKS:**

1. Digital Signal Processing-E C Ifeachor & B W Jervis; PHI

**REFERENCES:**

1. Digital Signal Processing-A.V. Oppenheim & B.W. Jervis; PHI.
2. Digital Signal Processing-J.G. Prokis & D.G. Manolakis; PHI.
3. Digital Signal Processing—M.H. Hayes; Schaum's Outlines.
4. Digital Signal Processing-S Salivahanan, A Vallavraj & C Gyanapriya; TMH.

1. num Press 1992.