## EC 601 DIGITAL COMMUNICATION

### Module 1

**Introduction to Digital Communication:** Random variables & random process-Detection & Estimation: G-S Procedure, Geometric Interpretation of signals, Response of bank of correlators to noisy input, Detection of known signals in noise, Probability of error, correlation & matched filter receiver, detection of signals with unknown phase in noise.
**Estimation concepts & criteria:** MLE, Estimator quality measures, Cramer Rao Bound, Wiener filter for waveform estimation, Linear prediction.

### Module 2

**Sampling Process:** Sampling theorem, Interpolation Formula, signal space interpretation, statement of sampling theorem, Quadrature sampling of band pass signals, Reconstruction of a message process from its samples, signal distortion in sampling, practical aspects. PAM, PPM, PWM (Generation & Reconstruction), Multiplexing- TDM, FDM.
**Waveform Coding Techniques:** PCM, Channel noise & error probability, Quantization Noise & Signal to noise ratio, robust quantization, DPCM, Delta Modulation.

### Module 3

**Digital Modulation techniques:** Digital modulation formats, Coherent binary modulation techniques- PSK, FSK, QPSK, MSK. Non-coherent binary modulation techniques-DPSK. Comparison of binary & quaternary modulation techniques. M-ary Mod techniques- PSK, QAM, FSK( Block level treatment only)
**Base band data transmission:** Discrete PAM signals, Power spectra of discrete PAM signals, Intersymbol interference, Nyquist's criterion for distortion less base band binary transmission, Eye pattern, Adaptive equalization.

### Module 4

**Information theory & Coding:** Discrete messages, amount of information, Entropy, Information rate, Coding, Shannon's theorem, Channel capacity, Capacity of a Gaussian channel, Bandwidth-S/N Trade off, Use of orthogonal signals to attain Shannon's limit, Efficiency of orthogonal signal transmission.
**Coding:** Parity check bit coding for error detection, Coding for error detection and correction- Block codes- Coding & Decoding; Systematic and Non Systematic codes; Cyclic codes -Generator polynomial, Generator & parity check matrices, Encoding & decoding of cyclic codes, Syndrome computation & error detection; Convolutional coding - Code generation, Decoding- code tree, sequential decoding, State & Trellis diagrams, Viterbi algorithm; Burst error Correction: Block & Convolutional interleaving; ARQ- Types of ARQ, Performance of ARQ; Comparison of error rates in coded & uncoded system.

### Text Books:

1. Simon Haykin, *Digital Communication*, John Wiley& Sons, 2005
2. Simon Haykin, *Communication Systems*, John Wiley& Sons , 2004
3. Taub & Schilling, *Principles of Communication Systems*, Tata Mc Graw Hill, 1991

### Reference:

1. B.P.Lathi, *Modern Digital and analog Communication Systems*, Oxford University Press, 3rd Ed., 2005
2. Bernard Sklar,*Digital Communications Fundamentals and applications* ,Pearson edu., 2006
3. Hwei Hsu, Schaum's Outline, *Analog and Digital Communications*, McGraw Hill, 2003.

***Type of questions for University Examination***
***Question 1 - 8 short answer questions of 5 marks each. 2 questions from each module***
*Question 2-5 – There will be two choices from each module .Answer one question from each module of 15 marks*

## EC 602 MICROWAVE TECHNIQUES AND DEVICES

**Module I**

**Introduction to microwaves** - frequency range, significance, applications. Guided waves: TE,TM,TEM waves, Velocity of propagation.
**Rectangular Waveguide:-**TE waves, TM waves, Field configurations, Dominant mode, Degenerate mode, Impossibility of TEM.
**Rectangular Cavity resonators:-** Q factor-Unloaded, loaded and external Q - Coupling two cavities.

**Module II**

Scattering matrix -Concept of N port scattering matrix representation- Properties of S matrix- S matrix formulation of two-port junction. Microwave Passive devices - Tee junctions, Magic Tee, Rat race, Corners, bends and twists - Two hole directional coupler. Ferrite Isolator-Circulator- Phase shifter-Attenuator. S matrix of microwave components (E plane Tee, H plane Tee, Magic Tee, Directional coupler, Circulator only).

**Module III**

**Solid state microwave devices:-** Tunnel diodes –construction and working based on energy band diagrams-Applications. Principle of operation and applications of Varactor diode, Point contact diode, PIN diode Transferred Electron Devices -Gunn diode- Two valley theory , modes. Avalanche Transit time devices-IMPATT and TRAPATT devices. Comparison of GUNN, IMPATT and TRAPPAT . Basic principle of operation of parametric amplifiers, Manley Rowe power relations, Negative resistance amplifiers.

**Module IV**

**Microwave tubes:-** High frequency limitations - Principle of operation of two cavity Klystron, Reflex Klystron, Traveling Wave Tube Amplifier, Magnetron Oscillator (detailed mathematical analysis not needed), Microwave BJT structure and performance.
**Microwave measurements:** Measurement of wavelength, frequency, SWR, impedance, power, attenuation. Basic concepts of Network Analyzer and Anechoic chamber.

**Text Books:**

1. Annapurna Das and Sisir K Das, *Microwave Engineering*, Tata Mc Graw Hill ,5th reprint,2003.
2. B.Somanathan Nair, *Microwave Engineering- Theory, Analyses and Application* ,Sanguine Technical Publishers, 2005.

**References:-**

1. Samuel Y Liao , *Microwave Devices & Circuits*, Pearson Education, 3rd edition.
2. George Kennedy, *Electronic Communication systems*, Tata Mc Graw Hill, 4th edition.
3. Jordan and Balmain, *Electromagnetic waves and Radiating systems*, Pearson education, 2nd edition
4. John A Seeger , *Microwave theory, components and devices*, Prentice Hall.
5. C.A Balanis, *Antenna Theory- analysis and design*, John Wiley student edition ,2nd edition.
6. Pozar, *Microwave Engineering*, Wiley.

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## EC/EI 603 VLSI DESIGN

**Module I.**

**VLSI process integration**: - fundamental considerations in IC processing - NMOS IC technology - CMOS IC technology - BiCMOS IC technology. - GaAs technology. Ion implantation in IC fabrication.

The MOS device : (n - channel & p- channel) - capacitance of MOS structure - accumulation, depletion and inversion, threshold voltage, current equations - characteristics, channel pinch-off.

Second order MOS device effects : short-channel effect, narrow width effect, sub-threshold current,device saturation characteristics.

**Module II.**

Switch logic- pass transistors and transmission gates, Gate logic-The basic inverter using NMOS-circuit - current equations - pull up to pull down ratio- transfer characteristics- Alternate forms of pull up. Basic NAND, NOR circuits. The CMOS inverter, characteristics – NAND, NOR and compound circuits using CMOS. Other forms of CMOS logic : pseudo CMOS, CMOS domino logic, n-p logic. Layout design of static MOS circuits – Layout rules - general principles & steps of lay-out design - use of stick diagrams - design rules - Layout examples of NAND and NOR.

**Module III.**

Basic circuit concepts: sheet resistance, area capacitance, delay unit, inverter delays – driving large capacitive loads, cascaded inverters, super buffers, BiCMOS drivers . Combinational circuits - clocked sequential circuit - drivers for bus lines. Scaling of MOS circuits: scaling models and scaling factors for device parameters.

**Module IV.**

**Timing issues in VLSI system design**: timing classification- synchronous timing basics – skew and jitter- latch based clocking- self timed circuit design - self timed logic, completion signal generation, self timed signaling– synchronizers and arbiters.

**Text Books :**

1. Douglas A Pucknell, Kamran Eshraghian , *Basic VLSI Design*, Prentice Hall India, 2nd edition.
2. Jan M. Rabaey, A. Chandrakasan, B. Nikolic, *Digital Integrated Circuits- A Design perspective*, Pearson education, 2nd edition

**References:**

1. Thomas E. Dillinger , *VLSI Engineering* , Prentice Hall International editions.
2. S M Sze, *VLSI Technology*, Mc Graw Hill, 2nd edition
3. Weste and Eshraghian, *Principles of CMOS VLSI Design ,A Systems Perspective* ,Pearson Education 2nd edition.
4. Mead & Conway , *Introduction to VLSI System Design* , Addison-Wesley Publishing Co., 1980
5. Fabricius, *Introduction to VLSI Design,* McGraw-Hill, 1990
6. Charles H Roth Jr ,*Fundamentals of Logic Design* , Jaico Publishers,4th edition
7. Wolf, Modern VLSI Design, Pearson Education, 3rd edition

***Type of questions for University Examination***

***Question 1 - 8 short answer questions of 5 marks each. 2 questions from each module***

***Question 2-5 – There will be two choices from each module .Answer one question from each module of 15 marks***

## EC604 ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

**Module I.**

**General measurement system:** Static characteristics -, accuracy, precision, linearity, hysteresis, threshold, dynamic range, calibration standards. Errors – measurement of errors, error reduction.
**Dynamic characteristics:-**Transfer function-first and second order instruments-first and second order response – dynamic errors and dynamic compensation .Loading effect.

**Module II.**

**Transducers and sensors:** Transducers- sensors- active and passive, Temperature measurements:- RTD, Thermocouples analog and digital transducers .Review of transducers for pressure, velocity, vibration, torque, temperature. LVDT, piezo electric transducers. Impedance measurement:- dc bridges for low, medium and high resistance-ac bridges for capacitance and inductance . Sources of error in bridge circuits- precautions. Vector impedance meter, digital impedance meter. Multimeters :- Principles of analog multimeter- digital multimeter (dual slope integrations)

**Module III.**

**Signal generators: -** AF and RF generators- Function generator- sweep frequency generator- Frequency synthesizers.
**Signal analyzers:-** Wave analyzer –spectrum analyzer. Frequency and time measurement. CRO, Digital storage oscilloscope, sampling oscilloscope. Recording instruments:- self balancing system, strip chart recorders, x-y-recorders.

**Module IV.**

**Industrial Instrumentation:** Temperature measurements:- RTD, Thermocouples-different types. Radiation thermometer, Optical pyrometer. Pressure measurements: Elastic type pressure gauges. Measurement of low pressure-McLeod gauge, Ionization gauge, solid state pressure transducers. Flow measurements:- Head type flow meters, mass flow meters. Electromagnetic flow meter, laser-Doppler anemometer, and Ultra sound flow meters. Data Acquisition System:- signal conditioning , multiplexing and demultiplexing, telemetry-block diagram, characteristics and different types. Sophisticated and virtual instrumentation systems.

**References: -**

1. W.D. Cooper , *Modern Electronic Instrumentation and Measurement Techniques*, Prentice-Hall India
2. Bulentley, *Principles of Measurement Systems*, Pearson education,3rd edition
3. Joseph J. Carr , *Elements of Electronic Instrumentaion and Measurement* , Pearson education ,3rd edition
4. D. Patranabis ,*Principles of Industrial Instrumentation* , Tata McGraw Hill
5. C.S. Rangan, G.R. Sharma , *Instrumentation Devices and Systems* , Tata McGraw Hill
6. Beckwith, Marangoni , *Mechanical Measurements* , Pearson education ,5th edition
7. D.V.S. Murty ,*Transducers and Instrumentation* ,Prentice-Hall India
8. AL Sutllo & Jerry D, Faulk, *Industrial Instrumentation*, Thomson Learning, I edition

***Type of questions for University Examination***
***Question 1 - 8 short answer questions of 5 marks each. 2 questions from each module***
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## CS/EB/EC/EI 605 CONTROL SYSTEM ENGINEERING

**Module I.**

**Basic idea of control systems and their classification** - differential equations of systems - linear approximation - Laplace transform and transfer function of linear system - Model of physical system (Electrical, mechanical and electromechanical)- block diagram - signal flow graph - Mason's gain formula.

**Module II.**

**Time domain analysis** - Representation of deterministic signals - First order system response - S-plane root location and transient response - impulse and step response of second order systems - performance - characteristics in the time domain - effects of derivative and integral control - steady state response - error constant - generalised definition of error coefficients - concepts of stability - Routh - Hurwitz criterion.

**Module III.**

**Frequency domain analysis** - frequency response - Bode plot, Polar plot, Nicol's chart - closed loop frequency response and frequency domain performance characteristics. Stability in frequency domain. Nyquist criterion.

**Module IV.**

**Root locus method** - basic theory and properties of root loci - procedure for the construction of root loci - complete root locus diagram. Design and compensation of feed back control system :- approaches to compensation - cascade compensation networks and their design in the frequency domain - simple design in S-plane.

**Text Book:**

1. Ogata K, *Modern Control Engineering*, Prentice Hall/Pearson

**References:**

1. Dorf , *Modern Communication Systems* ,Pearson Education
2. Franklin, *Feed back Control Systems*, Pearson Education
3. Kuo B. C, *Automatic Control System*, Prentice Hall
4. Nagoor Kani, *Control Systems*, R B P
5. Ogata, *Discrete Time Control Systems*, Pearson Education
6. Nagarath & Gopal, *Control System Engineering*, Wiley Eastern
7. Ramkayan, *Control Engineering*, Vikas Pub
8. M N Bandyopadhyaya, *Control Theory* , Prentice Hall
9. Glad , *Control Theory* , Thomson Pub

***Type of questions for University Examination***
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## EC/EI 606 EMBEDDED SYSTEMS

**Module I**

**Overview of Embedded System**:- Embedded System, Categories of Embedded System, Requirements of Embedded Systems, Challenges and Issues in Embedded Software Development, Applications of Embedded Systems in Consumer Electronics, Control System, Biomedical Systems, Handheld computers, Communication devices.

**Module II**

**Embedded Hardware & Software Development Environment:** - Hardware Architecture, Microcontroller Architecture, Communication Interface Standards, Embedded System Development Process, Compilers and assemblers, Embedded Operating systems, Types of Embedded Operating systems.

**Module III**

**Embedded system Design:** Microchip PIC16 family, PIC16F873 processor architecture- features, memory organization, on chip peripherals, Watchdog timer, ADC, Data EEPROM, Asynchronous serial port, SPI mode, I2C mode.
Development systems and compilers for PIC micro controllers. Interfacing with LCD, ADC, sensors, stepper motor, key board, DAC. Examples for data acquisition and control

**Module IV**

**Real Time & Database Applications:** - Real-Time Embedded Software Development, Sending a Message over a Serial Link, Simulation of a Process Control System, Controlling an Appliance from the RTLinux System, Embedded Database Applications with examples like Salary Survey, Energy Meter Readings.

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**Text Books :**

1. *Programming for Embedded Systems*- Dreamtech Software Team, Wiley Dreamtech
2. Rajkamal, *Microcontrollers Architecture,programming,Interfacing and system Design*, Pearson Education ,2005
3. Nebojsamatic, *The PIC Microcontroller*, Mikro Elekronica

**References:**

1. Daniel W Lewis, *Fundamentals of Embedded Software where C and Assembly Meet*, Prentice Hall
2. *DS101374: National Semiconductor reference manual*.
3. *Embedded / RealTime systems: Concepts, Design and programming*, Dreamtech Software Team, Wiley Dreamtech
4. Barnett Cox & O'Cull , *Embedded C Programming and the Microchip PIC* , Thomson Learning, I edition
5. *1187D: Atmel semiconductor reference manual*.
6. *www.atmel.com*
7. *DS30292B: Microchip reference manual*. from *www.microchip.com*
8. Rajkamal, *Embedded Systems - Architecture, Programming and Design* , Tata McGraw Hill, 2005

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## EC 607 COMMUNICATION LABARATORY I

### PART A (compulsory)

1. Active Filters - Band Pass, Band reject (II order Butterworth)-Magnitude and phase characteristics, Q-factor.
2. Amplitude modulation - Collector and Emitter modulation schemes - measurement of modulation Indices.
3. Balanced modulator for DSB-SC signal.
4. Mixer using JFET/BJT
5. Frequency modulation using FET and VCO - Frequency deviation
6. FM generation (reactance modulator)
7. Implementation of intermediate frequency amplifier- Frequency response
8. PLL characteristics and demodulation using PLL
9. AM generation and demodulation using OP-AMPs and IC multipliers
10. SSB generation and demodulation using integrated circuits
11. AM Demodulator and Simple, Delayed and Amplified AGC
12. Time division multiplexing implementation.
13. High frequency oscillators (Any 2 from Hartely, Colpitts and Crystal oscillators)

### PART B (*)

1. PAM.modulator and demodulator
2. PWM modulator and Demodulator
3. PPM modulator and Demodulator.
4. TV receiver/video system demonstration and study using demonstration kits.
5. Implementation of a communication system including a radio receiver, FM transmitter etc.

* At least two topics from part B has to be covered

**Note: 50% Marks is earmarked for continuous evaluation and 50% marks for end semester examination to be assessed by two examiners. A candidate shall secure a minimum of 50% marks separately for the two components to be eligible for a pass in that subject.**

## EC608 MINI PROJECT

Each batch comprising of 3 to5 students shall design, develop and realize an electronic product. Basic elements of product design must be considered. Fully software/simulation projects are not allowed. Each student shall submit a project report at the end of the semester. The project report should contain the design and engineering documentation including the Bill Of Materials and test results. Product has to be demonstrated for its full design specifications. Innovative design concepts, reliability considerations and aesthetics/ergonomic aspects taken care of in the project shall be given due weightage.

*Guidelines for evaluation*:

| | |
|---|---|
| i) Attendance and Regularity | 10 |
| ii) Work knowledge and Involvement | 30 |
| iii) End-Semester presentation & Oral examination | 20 |
| iv) Level of completion and demonstration of functionality/specifications | 25 |
| v) Project Report | 15 |
| *Total* | 100 marks |

***Note**: External projects and R&D projects need not be encouraged at this level. Points (i)&(ii) to be evaluated by the project guide & co-ordinator and the rest by the final evaluation team comprising of 3 teachers including the project guide.*