M.Sc. Electronics & Instrumentation

Course Curriculum

[Effective from the admitted batch 2013-14]

Semester # 2 – FIRST YEAR

THEORY	EI 201	Microcontrollers and Interfacing
	EI 202	Analog and Digital Communications
	EI 203	Power Electronics
	EI 204	Control Systems
	EI 205	Antennas and Microwave Devices
	*	NON-Core Paper
LABORATORIES	EI 206	Microcontrollers Laboratory
	EI 207	Digital Signal Processing Laboratory

CREDIT SYSTEM – SCHEME OF INSTRUCTION AND EXAMINATION

M.Sc. Electronics & Instrumentation

[Effective from the admitted batch 2013-14]

Semester # 2 – FIRST YEAR

Code	Title of the paper	Per / Week			Examination Marks				Credits
		L	T	P	Sem Exam	Mid	Total	Pass Min	
EI 201	Microcontrollers and Interfacing	4	1		85	15	100	40	4
EI 202	Analog and Digital communications	4	1		85	15	100	40	4
EI 203	Power Electronics	4	1		85	15	100	40	4
EI 204	Control Systems	4	1		85	15	100	40	4
EI 205	Antennas and Microwave Devices	4	1		85	15	100	40	4
*	NON-CORE Paper	4	-		85	15	100	40	4
EI 206	Microcontrollers Laboratory			8			100	50	4
EI 207	Digital Signal Processing Laboratory			8			100	50	4
						Total	800		32

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Second Semester

SYLLABUS

EI 201– Microcontrollers and Interfacing
(Effective from the admitted batch of 2013-2014)

Unit-1: Overview of 8051 microcontroller

Microprocessors Vs Microcontrollers-Harvard and von Neumann architectures- An overview of Architecture of 8051 microcontrollers-Pin description-8051 instruction set - Addressing modes - assembling and running an 8051 assembly language program-data types and directives-loops and counters-I/O port programming

Unit-2: Microcontroller 8051 **Interfacing**
Programming 8051 timers-Counter programming - RS232 Max buffer – NULL modem connectors Max232 - Serial port programming-8051 interrupts-programming the 8051 interrupts-LCD interfacing-keyboard interfacing-ADC, DAC and Sensor interfacing-external memory interfacing-8255 interfacing-Stepper motor interfacing

Unit-3: PIC Microcontrollers
PIC microcontroller's overview and features- Architecture of 16C6X/7X- Memory structure-Instructions-addressing modes-I/O ports – interrupts in PIC16C61/71 - PIC 16C61/71 Timers
PIC 16F877 Flash Microcontrollers: Pin diagram-Registers-memory structure- interrupts - I/O ports-timers
Capture/compare/PWM Modules in PIC16F877-ON chip ADC and DAC-MSSP Module-USART

Unit-4: ARM CONTROLLER
ARM controller Architecture –Programming model: data types-processor modes-Registers-ARM Instruction set - THUMB instruction set –Addressing modes- memory system architecture-memory hierarchy-Cache and write buffers-Tightly coupled memory.

Text Books

1. 8051 Microcontroller & Embedded System – Mohammad Ali Mazidi
2. Microcontrollers [Theory and Applications]-Ajay V Deshmukh.
3. Design with PIC Microcontrollers – Peatman
4. ARM architecture reference manual-ARM limited.
5. The 8051 Microcontroller – Kenneth J Ayala
6. Embedded Systems Design – Steve Heath

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SYLLABUS

EI 202 – Analog and Digital Communications
(Effective from the admitted batch of 2013-2014)

Unit 1: Random Processes and Waveform Coding

Introduction, Random processes, Stationary processes – Mean, correlation and covariance functions, Ergodic processes, Transmission of a random process through a linear time invariant filter – Power spectral density – Gaussian process - Noises, Narrowband noise, Noise Temperature, Noise Figure – Representation of narrow band noises – Sine wave plus narrowband noise

Overview of Analog and Angle Modulation, Sampling theorem for low pass, band pass signals, Natural and Flat-top sampling - Quantization process, PAM, PWM and PPM, Pulse Code Modulation, PCM systems, Companding, Delta modulation, Differential PCM, Noise in PCM,DM,DPCM Systems - Time Division Multiplexing , FDMA.

Unit – 2: Digital Modulation and Detection

Conceptualized model of a digital communication systems, Gram Schmidt procedures, Matched filter, correlation receivers, likelihood function and maximum likelihood detection, Digital modulation formats, BPSK,QPSK, FSK and MSK schemes bit and symbol error properties, performance comparisons.

Unit – 3: Information theory and Coding

Discrete Messages, The concept of amount of information, Average Information, Entropy, Information Rate , source-coding theorem, Discrete Memoryless channels, Channel Capacity , Channel-coding theorem.

Coding: introduction, Parity Check bit coding for error detection, coding for error detection and correction, Linear block codes, hamming codes, cyclic codes, CRC codes, BCH codes, RS codes, Convolution coding and decoding

Unit - 4: Data Communications

Introduction, History of Data communications, Standards Organizations for data communication, data communication circuits, data communication codes, Error control, Error Detection, Error correction, Data communication Hardware, serial and parallel interfaces, data modems, Asynchronous modem, Synchronous modem, low-speed modem, medium and high speed modem, modem control.

Text Books

1. Communication Systems - Simon Haykins
2. Principles of Communication System – Herbert Taub and D L Schilling
3. Digital Communication – Simon Haykin
4. Advanced Electronic Communication Systems - Wayne Tomasi
5. Modern Digital and Analog Communication Systems – Lathi

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EI 203 – Power electronics
(Effective from the admitted batch of 2013-2014)

Unit-1: Power Semiconductor Devices

Classification – Characteristics – Ratings – Typical power electronic system – Types of power electronic circuits – Power diodes – Thyristors – Switching characteristics of thyristors – Thyristor gate characteristics – Thyristor commutation methods – Thyristor protection – Thyristor ratings – Series and parallel operation of thyristors – Triggering of thyristors – Heat sinks, heating, cooling and mounting of thyristors – TRIAC – DIAC – LASCR – Power transistor – Power MOSFET – Insulated Gate Bipolar Transistor (IGBT) – MOS controlled thyristor (MCT).

Unit-2: AC to DC Converters

The principle of phase control – Converter classifications – Single phase half wave thyristor rectifier with RL load – Single phase half wave thyristor rectifier with RL load and free-wheeling diode – Single phase half wave thyristor rectifier with RLE load – Single phase full wave mid-point thyristor converter – Single phase full wave bridge converters – Full wave bridge rectifier feeding RLE load – Single phase semi-converter – Calculation of active and reactive power inputs – Three-phase half wave thyristor converter – Three phase full converters – Three phase semi-converters.

Unit-3: AC to AC Converters

Types of AC voltage controllers – Single phase AC voltage controller supplying R loads (Phase control, Integral cycle control) – Three phase AC voltage controller – Single - phase transformer tap changer – Cycloconverters – Single phase to single phase cycloconverters – Three phase to single phase cyclo-converters – Three-phase to three-phase cycloconverters.

DC to DC converters

Principle of chopper operation – Control schemes – Step-up choppers – Chopper circuits – Steady state time domain analysis of type A chopper – Thyristor-based chopper circuits – Multi-phase choppers.

Unit-4: Inverters and Power Controllers

Classification – Parallel inverters – Series inverters – Single-phase bridge voltage source inverter – Three-phase bridge inverters.

DC motor speed control – Stepper motor – synchronous motor – three phase controlled rectifier – Switch mode power supply – Uninterrupted power supply.

Text Books

1. Introduction to Power Electronics – Jagannathan
2. Industrial and Power Electronics – Mithal and Gupta
3. Power Electronics – Bhimbra
4. Power Electronic Circuits, Devices and Applications – Rashid M.H.
5. Power Electronics Systems – Jai P.Agarwal
6. Modern Power Electronics and AC Drives – Bimal K.Bose
7. Modern Power Electronics – P. C. Sen

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SYLLABUS

EI 204 – Control systems
(Effective from the admitted batch of 2013-2014)

Unit-1: General Concepts and Mathematical Techniques

Open- and closed-loop control systems – Transfer function concept – Transfer functions of common networks – Block diagrams – Signal flow diagrams – Mason's theorems – Reduction of signal flow diagrams – Application of signal flow diagram to multiple feedback systems – State space concepts – State variable diagram – Transition matrix – Application of state space method.

Unit-2: State Equations and Transfer Function Representation of physical Elements

State equations of electrical networks – Transfer function and state space representation of typical mechanical, electrical, hydraulic and thermal systems – A generalized approach for modeling – Characteristic response of typical feedback control systems – State variable signal flow diagram of second order systems.

Unit-3: Performance Criteria and Techniques for Determining Control System Stability

Stability – Sensitivity – Static accuracy – Transient response – Performance indices – Zero error systems – State space determination of characteristic equation – Routh - Hurwitz stability criterion – Nyquist stability criterion – Bode diagram approach – Root-locus method for negative feedback systems – Root-locus method for positive feedback systems.

Unit-4: Design of control systems

Introduction – Design with the PD Controller – Design with the PI Controller – Design with the PID Controller – Design with phase lead, Phase lag, Lead lag controller – Forward and feed forward controllers – Design of Robust control systems – Minor loop feedback control

Text Books

1. Automatic Control Systems – Benjamin C. Kuo
2. Modern Control Engineering - Ogata
3. Modern Control System Theory and Application – Shinners

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First Semester

SYLLABUS

EI 205 – Antennas and Microwave Devices
(Effective from the admitted batch of 2013-2014)

Unit – 1: Antennas and Transmission Lines

Maxwell's equations – Time varying fields – Wave equation and its solution – Poynting vector – Transmission lines – Characteristics of impedance matching – Smith chart – Ideal coaxial line – Coaxial line with small losses – Higher order modes – Unbalance characteristics of coaxial lines – Planar transmission lines – Strip lines – Higher order modes in strip lines – Microstrip lines – Losses in microstrip lines – Slot lines – Antenna parameters – Half-wave antenna – Propagation of wave in ionosphere.

Unit – 2: Waveguides

Rectangular waveguides – TE waves solution – TM waves solution – Dominant mode – Degenerate modes – Power flow in rectangular waveguides – Attenuation in rectangular waveguides – Methods of excitation of modes – Circular waveguides – Ridge waveguides – Surface waveguides – Dielectric rod waveguides – Excitation of dielectric waveguides.

Unit – 3: Microwave network theory and passive devices

Scattering matrix representation of multiport network – Properties of S-parameters –Waveguide sections – Circular waveguide sections – Waveguide flanges – Rotary joints – Strip and microstrip line sections – Matched terminations – Short circuit plunger – Rectangular to circular waveguide transition – Waveguide corners, bends and twists – Coaxial line to waveguide adapters – Coupling loops – Coupling apertures – Attenuators – Phase shifters – E-plane T – H-plane T – Magic T – Isolators – Faraday rotation isolator – Circulators – YIG filters and oscillators – Directional couplers – Power dividers and combiners – Rectangular cavity resonator – Circular cavity resonator – Q factor of a cavity resonator – Microwave low-pass filters – Microwave high-pass filters – Microwave band-pass filters.

Unit – 4: Microwave vacuum tubes and solid state devices

High frequency limitations of conventional tubes – Klystron – Reentrant cavities – Velocity modulation process – Bunching process – Output power – Reflex klystron – Velocity modulation – Power output and efficiency – Cylindrical magnetron – Gunn diode – Two-valley model theory – High-field domain – Modes of operation – PIN diode – Crystal detector – GaAs FET.

Reference books

Microwave Devices and Circuits – Samuel Y. Liao
Microwave Engineering – Annapurna Das & Sisir K Das
Electronic Communication Systems – George Kennedy

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Second Semester

EI 206 - Microcontrollers Laboratory

(Effective from the admitted batch of 2013-2014)

1. Write a C program for 8051 to toggle the bits of port P1 continuously with a 250 ms delay.
2. Write an assembly program to add the first ten natural numbers and save the result in RAM location 40H.
3. Write a program to create a square wave on bit '0' of port 1
4. Write a program to convert hexadecimal number to decimal number
5. Write a program to convert a binary to ASCII
6. With a frequency of 11.0592 MHz, generate a frequency of 100 KHz on pin P1.3 by using timer 1 model
7. Write an 8051 C program to transfer the message DSD serially at 9600 band rate, continuously
8. Write a program for interfacing of ADC with AT 89C51
9. Write a program for interfacing of DAC with AT 89C51
10. Write a program for blinking of LED using AT 89C51
11. In a semester, a student has to take six courses. The marks of the student (out of 25) are stored in RAM locations from 47H onwards. Write a program to find the average marks and output it on port 1.

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Second Semester

EI 207 – Digital Signal Processing Laboratory
(TMS 320C6X DSP kit and Code Composer Studio)
(Effective from the admitted batch of 2013-2014)

1. Procedure to work on Code Composer Studio (CCS) with functions like addition, multiplication and subtraction.
2. Executing vector addition and dot product on CCS.
3. Implementation / verification of linear convolution on CCS
4. Implementation / verification of circular convolution on CCS
5. Design and implementation of IIR filter using kit
6. Design and implementation of FIR filter using kit
7. Radix-2 DIT FFT implementation
8. Radix-2 DIF FFT implementation
9. Implementing loop back through Mc BSP
10. Sine wave generation with user controllable amplitude and frequency
11. Audio effects (echo and reverb, harmonics, and distortion)
12. Voice detection and reverse playback
13. Spectrum display through EMIF using a bank of 32 LEDs
14. Spectrum display through EMIF using a LCD
15. PID controller