M.Sc. - Electronics (Communication Science)

Structure of the course

(w.e.f.June 2014 - 15)

Semester - I

ECS -I - Control Theory	- 100 (70 + 30)
ECS II: Microprocessor and Microcontroller	- 100 (70 + 30)
ECS III: Communication Systems(C)	- 100 (70 + 30)
ECS IV: Introduction to MATLAB and LabVIEW	- 100 (70 + 30)
Practical - P_1	- 100 (70 + 30)
Practical - P_2	- 100 (70 + 30)

Each of the P1 and P 2 will consists of two experiments of 35 marks each and an internal evaluation of 30 marks.

Semester - II

ECS V Modern Antenna Design	- 100 (70 + 30)
ECS VI: Microwave Engineering (C)	- 100 (70 + 30)
ECS VII: Advanced Microcontrollers	- 100 (70 + 30)
ECS VIII: Digital Design and VHDL programming	- 100 (70 + 30)
Practical - P_3 & P_4 (as that of Semester I)	- 200 (140 + 60)

***Mathematical Techniques – This will be Non-Credit Course, and faculty will teach these contents during M.Sc. I.**

Complex Algebra, F.S.F.T., L.T. Z -transform, Introduction to wavelet transformation, Interpolation & Extrapolation techniques.

M.SC-I, SEME. I, ELECTRONICS (Communication Science)

Paper – I - ECS: CONTROL THEORY

(Revised syllabus w. e. f. June 2014-2015)

Unit 1: Introduction [12]

Basic Concepts of Control System, Open loop and Closed loop systems, Classifications, effect of feedbacks on Control System performance, Transfer function, modeling and representation of Control system, concept of pole and zero, Linear mathematical physical systems, Electrical analogy, Block reduction techniques, Signal flow graph, Mason's gain formula

Unit 2: Time Domain Analysis and stability [12]

Type and Order of Control system, Time Response of first and second order systems to unit step input. Steady state errors, Time Domain Specifications of Second Order System, Concept of Stability: absolute, relative and marginal, nature of system response, stability analysis using Hurwitz's criterion, Routh's criterion, Basic properties of Root Loci, construction of Root loci. Angle and magnitude condition for stable systems, concept of inverse root locus and root contour

Unit 3: Frequency Domain and State Variable Analysis [12]

Steady state response of a system to sinusoidal input, Relation between time and frequency response for second order systems, Frequency response specifications, Stability Analysis with Bode Plots, Introduction to state space analysis, State space representation for i) Electrical Network ii) nth order differential equation iii) Transfer function, State model from transfer function using: Direct, parallel, cascade, decomposition methods

Unit 4: Control system components and controllers (only theoretical treatments) [12]

Modeling and transfer function of control system components- Potentiometer, DC and AC Servomotors, gear trains, tacho-generators. Design concepts of ON-OFF, P, PI, PD, PID controllers, Compensator Networks-lag and lead.

Reference Books:

1. I.J. Nagrath, M.Gopal "Control Systems Engineering", 5th Edition, New Age International Publication

2. Ogata Katsuhiko, "Modern Control Engineering", 4th Edition, PHI.

3. Kuo B.C. Automatic Control System, PHI, New Delhi

4. Schaum's Series book "Feedback Control Systems"

5. Les Fenical "Control Systems", 1st Edition, Cengage Learning India.

6. Norman S. Nise "Control Systems Engineering", 4th edition, Wiley

7. SamarjeetGhosh, "Control Systems Theory & Applications", 1st edition, Pearson education.

8. S.K. Bhattacharya, "Control Systems Engineering", 1st edition, Pearson education.

M.SC-I, SEME. I, ELECTRONICS (Communication Science)

Paper – II - ECS: MICROPROCESSOR AND MICROCONTROLLER

(Revised syllabus w. e. f. June 2014-2015)

Unit 1: Architecture and Instruction Set for 8086 [12]

Architecture and pin configuration of 8086, instruction format; addressing modes, data transfer instruction, arithmetic instructions, branching and looping instructions, NOP and Halt, flag manipulation instructions, logical, shift and rotate instruction, byte and string manipulation, string instruction, REP prefix, table translation, number format conversions. System bus architecture of 8086 , minimum mode and maximum mode configuration. Programming of microprocessor 8086 assembler directives and operators, assembly process, translation of assembler instructions, interrupts of microprocessor 8086, interfacing and programming of PPI 8255 and PIC 8259 with microprocessor 8086.

Unit 2: PIC Microcontroller 18FXXXX [12]

Introduction: PIC microcontroller features, PIC Architecture, Program memory, Instruction set, Instruction Format, Byte-Oriented Instructions, Bit-Oriented Instructions, Literal Instructions, Control Instructions (CALL and GOTO), Destination Designator (d), Addressing Modes CPU Overview & features PIC 18 FXXXX Flash microcontroller: Introduction, Architecture, functional pin description, various registers, program memory and data memory organization, Input / Output ports, Timers & Interrupts.

UNIT 3: Instruction set – interrupts- Timers and Programming [12]

PIC Hardware: reset, clock, control registers, register banks, program memory paging, Ports, interrupts, Timer and Counter, watchdog timer, power up timer, sleep mode, configuration register, state machine programming,
MPLAB overview: Using MPLAB, Toolbars, Select Development Mode and Device Type, Project, Text Editor, Assembler, MPLAB Operations.

UNIT 4: INTERFACING USING PIC [12]

Interfacing of IO devices to the ports, Memory interface, I/O interface, Capture/Compare / PWM (CCP) modules in PIC 18FXXXX, Interfacing –UART-Master synchronous serial port module: SPI, I2C, USART, and ADC, interfacing smart LCD, relay opt coupler, interfacing ADC& DAC, firing of Thyristor, PWM motor speed controller. Introduction to PICkit 3 In-Circuit Debugger

TEXT / REFERENCE BOOKS:

1. Barry B. Brey, “The Intel Microprocessors: Architecture, Programming & Interfacing” PHI
2. D. V. Hall, “Microprocessor and Interfacing Programming & Hardware” TMH
3. Uffenback, “The 8086 Family Design” PHI,
4. Lice & Gibson, “Microcomputer System 8086 / 8088” PHI
5. Y. U. Cheng Liu & A. Gibson Daniel Tabak, “Microcomputer System-The 8086/8088 Family, Architecture, Programming & Design, PHI.
6. Doughlas V.Hall, “Microprocessor & Interfacing”, Tata McGraw Hill.
7. C.H. Pappas and W.H. Murray, “80386 Microprocessor Handbook”, Osborne McGraw Hill
8. James L. Antonakos , “ The Pentium Microprocessor ‘’ Pearson Education
9. John .B.Peatman , “ Design with PIC Microcontroller , Prentice hall,
10. Martin P. Bates, “PIC Microcontrollers : An Introduction to Microelectronics”, Elsevier.
11. John B. Peatman, “Embedded Design with the PIC18F452:
12. Myke Predko, “Programming & Customizing PIC micro Microcontrollers”, TMH.
13. Han-Way Huang, “PIC Microcontroller: An Introduction to Software & Hardware Interfacing”, Thomson.

M.SC-I, SEME. I, ELECTRONICS (Communication Science)

Paper – III – ECS/PHAE: COMMUNICATION SYSTEMS (C)

(Revised syllabus w. e. f. June 2014-2015)

Unit 1. A.M.& F.M. Transmitters and Receivers: [20]

A.M Transmitter and Receiver:

Block diagram of High and Low level modulated A.M. Transmitters. The exciter, Class A, Class B, Class C modulated power amplifier circuits of sidebands and sideband transmission, balanced modulators.

Block diagram of A.M. receiver and A.M. Detectors, (circuits to be discussed), Class B audio amplifier

F.M. Transmitter and Receiver:

F.M. radio frequency band, Block diagram of F.M. transmitter, block diagram of VCO, frequency doubler , tripler.

Block diagram of F.M. receiver, F.M. detector (Slope and dual slope detector), PLL as FM detector. (Circuits to be discussed)

Unit 2. Digital Modulation and Techniques: [8]

Pulse: Modulation systems: Sampling theorem, low pass and Band pass signals, PAM, PWM, PPM, Quantization of signals, Delta modulation (Basic introduction).

(Modulation and Demodulation Circuits) , TDM, FDM, Cross talk in TDM , Pulse time modulation, Generation of PTM, Demodulation of PTM,

Unit 3. Data formats: [8]

Unipolar, Bipolar, RZ, NRZ, Transmission modes, simplex, Half duplex, full duplex, Asynchronous transmission. Amplitude shift keying, Frequency shift keying, Phase shift keying, Differential phase shift keying..

Unit 4. Spread Spectrum modulation: [12]

Introduction, direct sequence spread spectrum, use of spread spectrum with code division multiple access (CDMA), Ranging using spread spectrum, frequency hopping spread spectrum, generation and characteristics of PN sequences, Acquisition (course synchronization) of a FM signal, acquisition of a DS signal, tracking of a DS signal.

Text Books:

1) Communication System, Analog and Digital
R.P. Singh and S.D. Sapre (THM)
2) Electronic Telecommunication System (4th Edition)
George Kennedy and Bernard Devise (MGH)

M.SC-I, SEME. I, ELECTRONICS (Communication Science)

Paper – IV - ECS: INTRODUCTION TO MATLAB AND LabVIEW

(Revised syllabus w. e. f. June 2014-2015)

Unit 1: Introduction to MATLAB, Vector and Matrices [10]

Introduction to MATLAB:
MATLAB environment, help feature, types of files, Data types, constants, variables, operators, assignments statement.
Vector and Matrices:
Vectors and Scalars, defining data use matrix, matrix subscripts, multi – dimensional matrices and arrays, matrix manipulation, matrix and array operation. Function with array inputs, structure arrays, cell arrays.

Unit2: Control Structures, functions and MATLAB programming Applications: [14]
Control Structures, functions:
Loops, Branches control structures, Function subprograms, types of functions, MATLAB Debugger
MATLAB programming Applications:
MATLAB program applications for communication systems analysis and design. Program to study filter design, Communication channel (Transmission line, antenna parameters, free space and guided wave propagation) analysis
.

Unit3: **Introduction to VI and Modular Programming: [12]**
Introduction to VI:
Graphical System Design (GSD) model. Embedded system design flow, Virtual Instrumentation.
Lab View: Introduction, Software environment, front panel, block diagram, palettes (tools & control, function), loops, structures, arrays, clusters, plotting data.
Modular Programming:
Modular programming in Lab VIEW, creating an icon, displaying sub Vis and express Vis as icons or expandable nodes, creating sub Vis (operating, editing and placing sub VIs) creating stand alone applications. String and File I / O: Creating and configuring string controls and indicators, basics of file input / output.

Unit 4: **Data Acquisition and LabVIEW programming Applications: [12]**
Data Acquisition:
Transducers, signal conditioning, DAQ hardware configuration, DAQ hardware, Analog, & Digital I/O, DAQ assistant / Data logger. Image processing and analysis. NI – DAQ Card Interface for data acquisition on PC
LabVIEW programming Applications:
LabVIEW programs for test and measurement set ups of on-line signal monitoring, Spectrum analysis, Study of frequency response characteristics of an Amplifier and filters, AM/FM modulation/demodulation simulations

TEXT / REFERENCE BOOKS:

1. Virtual Instrumentation using LabVIEW, Jovitha Jerome, PHI, ISBN 978 – 81- 203- 40305, 2010.
2. Gary Johnson (1979) – Labview Graphical Programming, Second edition, McGraw Hill.
3. MATLAB and its applications in Engineering by Raj Kumar Bansal, Ashok kumar Goel, Manoj kumar Sharma – Pearson Education.

M.SC-I, SEME. II, ELECTRONICS (Communication Science)

Paper – V- ECS: MODERN ANTENNA DESIGN

(Revised syllabus w. e. f. June 2014-2015)

UNIT I: Antenna Fundamentals: Introduction, Radiation Mechanism – single wire, 2 wire, dipoles, Current Distribution on a thin wire antenna . Antenna Parameters] - Radiation Patterns, Patterns in Principal Planes, Main Lobe and Side Lobes, Beam widths, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Antenna Apertures, Aperture Efficiency, Effective Height. Related Problems. **[12]**

UNIT II: Thin Linear Wire Antennas: Retarded Potentials, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Evaluation of Field Components, Power Radiated, Radiation Resistance, Beam widths, Directivity, Effective Area and Effective Hight. Natural current distributions, fields and patterns of Thin Linear Center-fed Antennas of different lengths, Radiation Resistance at a point which is not current maximum. **[12]**

UNIT III: Antenna Arrays : 2 element arrays – different cases, Principle of Pattern Multiplication, N element Uniform Linear Arrays – Broadside, Endfire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison; Concept of Scanning Arrays. **[12]**

UNIT IV: VHF, UHF and Microwave Antenna – I and II:
Arrays with Parasitic Elements, Yagi - Uda Arrays, Folded Dipoles & their characteristics. Reflector Antennas : Flat Sheet and Corner Reflectors. Paraboloidal Reflectors – Geometry, characteristics, types of feeds, F/D Ratio, Spill Over, Back Lobes, Aperture Blocking, Off-set Feeds, Cassegrainian Feeds].
Microwave Antenna - II: Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns; Lens Antennas – Geometry, Features, Dielectric Lenses and Zoning, Applications. Antenna Measurements – Patterns Required, Set Up, Distance Criterion, Directivity and Gain Measurements (Comparison, Absolute and 3-Antenna Methods). **[12]**

TEXT BOOKS :

1. Antennas for All Applications – John D. Kraus and Ronald J. Marhefka, TMHl, 3rd Edn., 2003.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd ed., 2000.

REFERENCES :

1. Antenna Theory - C.A. Balanis, John Wiley & Sons, 2nd ed., 2001.
2. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.
3. Transmission and Propagation – E.V.D. Glazier and H.R.L. Lamont, The Services Text Book of Radio, vol. 5, Standard Publishers Distributors, Delhi.
4. Electronic and Radio Engineering – F.E. Terman, McGraw-Hill, 4th edition, 1955.
5. Antennas – John D. Kraus, McGraw-Hill, SECOND EDITION, 1988.

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M.SC-I, SEME. II, ELECTRONICS (Communication Science)

Paper – VI- ECS / PHAE: MICROWAVE ENGINEERING (C)

(Revised syllabus w. e. f. June 2014-2015)

Unit 1:**E.M. Fields and Waves: (10)**

Microwave spectrum**,** Microwave applications, Electronic and Magnetic fields, Fields in conductors and Insulators, Maxwell's equations and boundary conditions, wave propagation in perfect Insulations, Wave Polarization.

Unit 2: **Microwave Tubes and Microwave Transmission Lines: (18)**

Microwave Tubes:

Sources: Basic principles of two cavity Klystrons (Velocity modulation), Reflex Klystrons, TWT, Gunn Effect, principle of operation.

Microwave Transmission Lines:

Basic concepts of the open two-wire line, the coaxial line, and strip type transmission lines, Rectangular and circular wave-guides, Theory of rectangular wave-guide transmission.

Unit 3: **Coaxial and Stripline Components: (10)**

Terminations, matched loads, short and open circuits, standard mismatches, connectors and transitions, Dielectric bead supports, standard coaxial connectors, TEM to TEM transitions, Attenuators and phase shifters, coaxial and striplinge attenuators, coaxial and strip line shifters.

Unit 4: **Waveguide components: (10)**

Terminations, Matched loads, Standard mismatches, adjustable short circuits, Attenuators and phase shifters, Waveguides attenuators, waveguide phase shifters.

Reference Books:

1. Microwave Engineering: Peter Rizzi(PHI)
2. Microwave Devices and Circuits : S Y Liao (PHI)
3. Foundation for Microwave Engineering: R E Collin (MGH).
4. Microwave Integrated Circuits: K C Gupta and Amarjit Singh.

Topic for tutorials:

The problems /exercise/short questions answers/ circuit diagrams given in the Text and Reference Books will for Tutorial Course.

M.SC-I, SEME. II, ELECTRONICS (Communication Science)

Paper – VII- ECS: ADVANCED MICROCONTROLLERS

(Revised syllabus w. e. f. June 2014-2015)

UNIT 1: AVR Microcontroller Architecture [12]

Introduction to AVR, Architecture and Hardware Resources of AVR Microcontrollers. Architecture: The Arithmetic Logic Unit, Program and Data Memories, Downloadable Flash Program Memory, SRAM Data Memory, General-Purpose Register File, I/O Register, Data Memory, Peripherals, Timer/Counter, Watchdog Timer, Serial Peripheral Interface SPI, Universal Asynchronous Receiver and Transmitter, Analog Comparator, I/O Ports, Reset and Interrupt System, Interrupt Vector Table

UNIT 2: AVR Programming [12]

AVR programming model and Instruction set: Memory Addressing Modes, Register Direct Addressing, I/O Direct Addressing, SRAM Direct Addressing, SRAM Indirect Addressing, Constant Addressing Using the LPM Instruction, Jumps and Calls, Instruction Set, Reset and Interrupt Handling, Watchdog Handling, Stack, Program Constructs, Conditional Branches, Program Loops, Refreshing Port Pins and Important Registers, Polling Inputs

UNIT3: High Performance RISC Architecture [12]

Introduction: RISC/ARM Design Philosophy, ARM 9 Core, 32- Bit ARM920T Processor, About the ARM920T Core, Processor Functional Block Diagram Programmers Model: Data Types, Processor modes, Registers, General Purpose Registers, Program Status Register, CP15 Coprocessor, Memory and memory mapped I/O, Pipeline, Exceptions, Interrupts and Vector table, Architecture revisions, ARM Processor Families.

UNIT 4: ARM Programming [12]

Memory Management Units: How virtual memory works, Details of the ARM MMU, Page Tables, Translation Look-aside Buffer, Domains and Memory access Permissions

ARM Instruction Set: Data Processing instructions, Branch instructions, Load - Store instructions, Software Interrupt Instruction, Program Status Register Instruction, Loading Constants

Thumb Instruction Set: Thumb register usage, ARM-Thumb interworking, Branch instruction, Data processing instructions, Load - store instructions, stack instructions, software interrupt instructions.

TEXT/REFERENCE BOOKS:

1. Richard H. Barnett, Sarah A. Cox, Larry D. O'Cull, “Embedded C Programming and the Atmel AVR”, Thomson.
2. John Morton, “AVR: An Introductory Course”, Newnes.
3. Claus Kuhnel, “AVR RISC Microcontroller Handbook”, Newnes.
4. Dhananjay Gadre, “Programming and Customizing the AVR Microcontroller”, TMH.
5. Steve Furber , “ARM System –On –Chip architecture”, Addision Wesley.
6. David Seal “ARM Architecture Reference Manual”, Addison Wesley, England; Morgan Kaufmann Publishers
7. Andrew N Sloss, Dominic Symes, Chris Wright, “ARM System Developer's Guide - Designing and Optimizing System Software”, Elsevier

M.SC-I, SEME. II, ELECTRONICS (Communication Science)

Paper – VIII- ECS: DIGITAL DESIGN AND VHDL PROGRAMMING

(Revised syllabus w. e. f. June 2014-2015)

Unit1: **Combinational and Sequential Logic Designs:** **[15]**

Combinational Logic Designs:

Multiplexer, Demultiplexer, Encoder, Decoder, Arithmetic and Logic circuits, adder- Half adder, Full adder, Carry look ahead adder, n- bit adder, BCD adder, Full subs tractor, binary multiplication and division, floating and fixed point arithmetic, Comparison circuits, comparator, 4 - bit comparator, parity generator/checker, ALU design (Design of all is expected).

Sequential Logic Designs:

Design of ripple counter, ring counter, synchronous counter, Johnson's counter. Up - down counter, Shift registers, bi – directed shift register, Universal Shift resister.

Unit 2: **Synchronous Sequence Machines** **[05]**

State diagram, State reduction, State assignment, implementation using filp flop. Finites state machines, Control Unit design

Unit 3: **PLD's and Architecture of commercial devices:** **[10]**

Detail architecture, study of PROM, Simple PLD, PAL, PLA, Digital System design using PLD's.

CPLD, FPGA, Xilinx XC95xx CPLDs and Virtex and Spartan Series FPGAs, Altera Flex 10K, Altera Max 7000,

Unit 4: **VHDL Programming and model for combinational and sequential logic: [18]**

Introduction to VHDL, Variables, Signals, Constants, Arrays, VHDL, Procedures, Packages, Libraries, Attributes, delays, overloading, generics, generate statement, case statement, IEEE std. Logic.

VHDL model for combination Logic:

Behavioral and Structural Models, VHDL Programming Examples-basic gates, 4 - bit binary adder, Multiplexer, Comparator, decoder.

VHDL Model for Sequential Logic:

Flip - Flops, Latches, counters, Shift Register, State Machine, Simple Processor. Simulation and Synthesis of logic designs and their Implementation .in CPLD, FPGA.

Tex Books:

a. Fundamentals of Digital logic Design with VHDL – Brown, Vranesic – SiE (2nd edition).
b. Digital Systems Design using VHDL Charles H. Roth – PWS.
c. Digital System design, Gajeski
d. Digital System design and Principles, Wakerly, PHI
e. VHDL primer, J. Bhasker – Prentic Hall.

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M.Sc. I , Semester – I - Electronics (Communication Science)

(Laboratory Exercises)

(w. e. f. June 2014-15)

1. MATLAB – I (Curve Tracings)
2. MATLAB – II (Matrix operations)
3. MATLAB – III (Solving Differential Equations)
4. MATLAB – IV (Fourier Series & Transform)
5. MATLAB – V (Laplace Transform)
6. MATLAB-VI(Bessel's Equation & Solution)
7. Study of A.M. Modulator(Balanced Modulator)
8. Data formatting ; RZ & NRZ
9. Manchester coding.
10. Measurement of Temperature (LM – 335 or AD 590)
11. Measurement of Temperature (Using Thermistor/thermocouple)
12. Measurement of Displacement (LVDT)
13. Strain gauge
14. Phase Locked Loop
15. Study of Instrumentation Amplifier(AD – 524)
16. F to V and V to F conversions
17. Waveform Generator (IC – 8038)
18. Study of Nyquist Criteria (Sampling & Construction)
19. Study of Nyquist Criteria (Aliasing signal on reconstruction)
20. Study of signals using MATLAB (continuous & Discrete)
21. Study of linear time invariant system(Using MATLAB Simulink)
22. Design of filter (IIR Using MATLAB)
23. Design filter (FIR using MATLAB)
24. Study of DSB & SSB modulation & demodulation techniques
25. Study of FM modulation and demodulation techniques

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M.Sc. I, Semester – II - Electronics (Communication Science)

(Laboratory Exercises)

(w. e. f. June 2014-15)

1. MATLAB – I (Partial differential equation)
2. MATLAB-II (Curve Fitting)
3. MATLAB – III (Eulers Method)
4. MATLAB – IV(Leap frog Method)
5. MATLAB – V(Runge Kutta method)
6. C – Programming – I (Eulers Method)
7. C – Programming – II (Leap frog method)
8. C – Programming – III (Runge Kutta method)
9. C – Programming – IV(Predictor corrector method)
10. C – Programming – V(Itterative method)
11. 8051 LED interface
12. 8051 LCD interface
13. 8051 DC- Motor interface
14. 8051 seven-segment interface
15. 8051 stepper interface
16. 8051 servo interface
17. Study of Klystron
18. Study of Gunn Diode
19. Addition of two numbers using different addressing modes (8086).
20. Block transfer using string instruction(8086)
21. Multiplication of two 16 bit number (16 x 16 bit numbers) (8086)
22. Password checking (Dos interrupt) (8086)
23. Interfacing LED to PIC
24. Interfacing LCD to PIC
25. Interfacing Relay to PIC
26. DC Motor Control Using PIC (PWM)