Solapur University, Solapur

M.Sc - Electronics (Communication Science)

Structure of the course

(w. e. f. June 2010-11)

Semester - I

ECS - I - Mathematical Techniques(C)	- 100
ECS - II - Instrumentation (C)	- 100
ECS - III- Introduction to MATLAB & Labview	- 100
ECS - IV - Communication Systems (C)	- 100
Practical - I	- 100
Practical - II	- 100

Semester - II

ECS - V - Computational methods & programming (C)	- 100
ECS - VI – Digital Design and VHDL Programming	- 100
ECS - VII – Microwave Engineering	-100
ECS - VIII – Microprocessor & Advanced Microcontroller	- 100
Practical - III	- 100
Practical - IV	- 100

Semester - III

ECS - IX – Communication System Design	- 100
ECS - X - Satellite Communication	- 100
ECS - XI – Digital communication	- 100
ECS - XII – Internetworking & Data communication	- 100
Practical - V	- 100
Practical & Project - I	- 100

Semester - IV

ECS - XIII – Broadband Communication	- 100
ECS - XIV - Mobile Communication	- 100
ECS - XV - Fiber Optic Communication	- 100
ECS - XVI – Communication Protocols	- 100
Practical - VI	- 100
Practical & Project - II	- 100

The students has to perform 4 practicals of 50 marks each which totals to 200 marks for semester I & II, while, for Sem. III & IV, 3 practicals of 50 marks each and a project demonstration of 50 marks will be given.

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M.Sc - Electronics (Communication Science)
M.Sc. I, Semester I
ECS - I - Mathematical Techniques(C)
(w. e. f. June 2010-11)

Unit 1: Calculus of Residues (6)

COMPLEX VARIABLE AND REPRESENTATIONS: Algebraic Operations, Argand Diagram: Vector Representation, Complex Conjugate, Euler's Formula, De Moiver's Theorem, The nth Root or Power of a complex number. ANALYTICAL FUNCTIONS OF A COMPLEX VARIABLE : The Derivative fo f (Z) and Analyticity, Harmonic Functions, Contour Integrals, Cauchy's Integral Theorem, Cauchy's Integral Formula, Differentiation inside the Sign of Integration.

Unit 2: Operator and Matrix Analysis 8

Vector Space and its dimensionality, Vector Spaces and Matrices, Linear independence; Bases; Dimensionality, linear dependence, Inner product Hilbert space, linear operators. Matrix operations, properties of matrices, Inverse, Orthogonal and unitary matrices; Independent elements of a matrix Diaglonization; Complete otrhonormal sets of functions, special square matrices, Eigenvalues and eigenvectors; Eigenvalue problem.

Unit 3: Differential Equations 8

ORDINARY DIFFERENTIAL EQUATIONS: First-Order Homogeneous and Nonhomogeneous equations with variable coefficients. The superposition principle, Second-order homogeneous equations with constant coefficient. Second-order nonhomegeneous equations with constant coefficients, Second-Order Nonhomogeneous with Variable Coefficients, Second-Order Homogeneous equations with Variable Coefficient.

Unit 4: Fourier series and Integral Transforms 8

Fourier's theorem; consine, sine and complex Fourier series, Applications to saw footh and square waves and full wave rectifier. FS of arbitary period; Half wave expansions; Partial sums Fourier integral and transforms; consine since complex forms, Parsevals relation, Applcationf to Gaussian distribution, box and exponential functions; FT of delta function Laprace transforms of common functions, First and second shifting theorems; inverse LT by partial fractions; LT of derivative and integral of a function. Applications of laplace transform to LCR circuit.

Unit 5: Special Functions 15

Spherical harmones, Recurrence Relations, Application to Hydrogeon Atom Problem. Legendrees equation and Polynomials, Generating function, Application uncharged conducting sphere in uniform electric field. Bessels equation and its solutions, characteristics of various Bessel functions, Application - vibrating stretched membrane. Hermites equation and polynomials, Generating functions, Application - linear harmonic oscillator in quantum mechanics.

Reference Books:

1. **Introduction to Mathematical Physics by** C. Harpcr, Prcnticc - Hall of India Ltd. N.Delhi 1993,(Chapters 2,4,6,9)
2. **Mathematical Physics** by A.G. Ghatak, I.C.Goyal and S.J.Chua, McMillan India Ltd. New Delhi 1995 (Chapters 4,7,9,10)
3. **Quantum Mechanics** by Thankappan, Wiley Fastern Ltd. N.Delhi 1993, Second Edition
4. **Matrices and Tensors for Physicists,**by A W Joshi
5. **Advanced Engineering Mathematics,** by E Keryszig
6. **Special Functions,** by E D Rainville
7. **Spccial Functions** by W W Bell
8. **Mathematical Method for Physicits and Engineers**, by K F Reily, M P Hobson and S J Bence
9. **Mathematics for Physicists** by Mary L B
10. **Mathematical Methods for Physics,** by G Arfken

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M.Sc - Electronics (Communication Science)
M.Sc. I, Semester I
ECS -II : INSTRUMENTATION (C)

Unit 1: Transducers (Basic concepts and schematic of interface circuits) (14)

Transducers classification Resistance, Capacitance, Inductance, Piezoelectric, Thermoelectric, Hall effect, Tachogenerator, Optical and Digital transducers, Measurements of displacement, Velocity, Acceleration, Force, Torque, Strain, Speed and Sound, flow humidity, thickness, PH, position, Ferroelectric sensors.

Unit 2: Instrumentation Electronics: (06)

Instrumentation Amplifiers, basic characteristics, D.C. Amplifiers, Isolation amplifiers, feedback transducers system, feedback fundamentals, Inverse transducers, temperature balance system,

Unit 3: Signal processing circuits: (10)

Phase sensitive detection, Absolute value circuit, peak detector, sample and hold circuits, RMS converter, Logarithm (Amplifier, Frequency to Voltage and Voltage to Frequency Converter, Wave Generator Lock in Amplifiers, SMPS, UPS) V to I and I to V converter.

Unit 4: Measurements Instruments: (08)

Measurements of R,L, C bridge and potentiometer, Voltage, Current, Energy, Power, Frequency /Time, Phase, Digital Voltmeter, Digital multimeters, Digital Frequency meter, Q meter, CRO, DSO, Logic Stale Analyzer, Spectrum Analyzer, Proximity detector.

Unit 5: Interface Systems and Standards: (04)

Single channel and multichannel DAS and P.C. interface, Block diagram of typical interface. Standard interface Systems (Transducers, Termination, Protection, Static Signal Conditions, Dynamic Signal filtering, Signal manipulation).

Reference Books:

1. Transducer Theory and Application: Jhon A Alloca, Allen Stuart (Reston Publishing Company Inc.)
2. Transducer and Display Devices: B. S. Sonde.
3. Integrated Electronics: K. R. Botkar.

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M.Sc. I, Semester I

ECS - III- Introduction to MATLAB & Labview

(w. e. f. June 2010-11)

Unit 1: Introduction to MATLAB (03)

MATLAB environment, help feature, types of files, Data types, constants, variables, operators, assignments statement.

Unit 2: Vector and Matrices (05)

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.

Unit 3: Control Structure and functions (06)

Loops, Branches control structures, Function subprograms, types of functions, MATLAB Debugger.

Unit4: **Introduction to VI** (08)

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.

Unit 5: **Modular Programming** (08)

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 6: **Data Acquisition** (08)

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

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.

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M.Sc - Electronics (Communication Science)

M.Sc. I, Semester I

ECS - IV - Communication Systems - (C)

(w. e. f. June 2010-11)

Unit 1. A.M. Transmitters 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. (08)

Block diagram of A.M. receiver and A.M. Detectors , (circuits to be discussed) , Class B audio amplifier (04)

Unit 2. F.M. Transmitters and Receiver :

F.M. radio frequency band, Block diagram of F.M. transmitter , block diagram of VCO, frequency doubler , tripler. (08)

Block diagram of F.M. receiver , F.M. detector (Slope and dual slope detector) , PLL as FM detector. (circuits to be discussed) (04)

Unit 3. Digital Modulation and techniques:

Pulse: Modulation systems: Sampling theorem, low pass and Band pass signals, PAM,PWM , PPM, Quantization of signals, Delta modulation (Basic introduction). (06)

(Modulation and Demodulation Circuits) , TDM, FDM, Cross talk in TDM , Pulse time modulation, Generation of PTM, Demodulation of PTM, (04)

Unit 4. Data formats: (6)

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 5. Spread Spectrum modulation: (8)

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)

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M.Sc - Electronics (Communication Science)

M.Sc. I, Semester II

ECS - V - Computational Methods & programming (C)

(w. e. f. June 2010-11)

Unit 1: Ordinary Differential Equations:

Types of Differential Equations, Euler Method, Applications to non-linear and vector equations. The leap-Frog method, Runge Kutta method, The Predictor-Corrector method, The Intrinsic Method. (14)

Unit 2: Partial Differential Equations:

Types of Equations, Elliptic equations- Laplace's equation, Hyperbolic equations-wave equation, Eulerian and Lagrangian methods, Parabolic equations-Diffusion, Conservative Methods- The equation of continuity, Maxwell's equations, Dispersion. (13)

Unit 3 : Matrix Algebra:

Types of Matrics, Simple matrix problems, Elliptic equations- Poissons equations, Systems of equation and Matrix inversion, Iterative methods- The Jacobi Method, Matrix Eigenvalue Problems-Schrodingers equation. (08)

Unit 4: Monte Carlo methods and Simulation:

Random number generators, Monte Carlo integration, the metropolis algorithm, The Ising model, Quantum Monte Carlo. (05)

Text and Reference Books:

1. Potter D, Computational Physics, Wiley, Chichester, 1973.
2. Press W H et. al, Numerical Recipes: The Art of Scientific Computing CUP, Cambridge, 1992.
3. Wolfrom S, Mathematica - A System For Doing Mathematics By Computer, Addison Wesley, 1991.
4. Angus Mekinnon, Computational Physics - 3rd/ 4th Year Option, Notes in. pdf. Fromat.

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M.Sc - Electronics (Communication Science)

M.Sc. I, Semester II

ECS - VI - Digital Design and VHDL Programming

(w. e. f. June 2010-11)

Section – I

1. **Combinational Logic Design:**

   Multiplexer, Demultiplexer, Encoder, Decoder, Half adder, Full adder, Carry look ahead adder, - bit adder, Full substractor, Comparator, 4- bit comparator, BCD adder, (Design of all is expected).
2. **Sequential Logic Design:**

   Design of ripple counter, ring counter, synchronous counter, Johnson's counter, Up – down counter, Shift registers, bi – directed shift register, Universal Shift register.
3. **Synchronous Sequence Machines** (05)

   State diagram, State reduction, State assignment, implementation using filp flop.
4. **PLD's :** (05)

   Detail architecture, study of PROM, PAL, PLA, design using PLD's.
5. **VHDL Programming:** (07)

   Introduction to VHDL, Variables, Signals, Constants, Arrays, VHDL, Procedures, Packages, Libraries, Attributes, delays, overloading, generics, generate statement, case statement, IEEE std. Logic.
6. **VHDL model for combination Logic:** (05)

   4 – bit binary adder, Multiplexer, Comparator, decoder.
7. **VHDL Model for Sequential Logic:** (08)

   Flip – Flops, Latches, Counters, Shift Register, State Machine, Simple Processor.
8. **Architecture of commercial devices:** (05)

   Simple PLD, CPLD, FPGA, Altera Flex 10K, Altera Max 7000, Implementation of logic design in SPLD, CPLD, FPGA.

Practical's: (Programming in VHDL)

1. 16:1 multiplexer using 4:1 mux as a component.
2. 8 – bit comparator using generate statement.
3. 4 –bit up – down counter.
4. Bi – directional shift register.
5. 4 – bit full adder.

Text Books:

a. Fundamentals of Digital logic Design with VHDL – Brown, Vranesic – SiE (2^{nd} edition).

b. Digital Systems Design using VHDL Charles H. Roth – PWS.

c. VHDL primer, J. Bhasker – Prentice Hall.

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M.Sc - Electronics (Communication Science)

M.Sc. I, Semester II

ECS - VII – Microwave Engineering (C)

(w. e. f. June 2010-11)

1. F.M. Fields and Waves: Microwave spectrum,

Microwave applications, Electronic and Magnetic fields, Fields in conductors and Insulators, Maxwells equations and boundary conditions, wave propagation in perfect Insulations, Wave Polarization.

2. Mircrowave Tubes: Sources: Basic principles of two cavity Klystrons (Velocity modulation), Reflex Klystrons, TWT, Gunn effect, principle of operation. (08)

3. Microwave Transmission Lines: Basic concepts of the open two-wire line, the coaxial line, strip type transmission lines, Rectangular and circular wave-guides, Theory of rectangular wave-guide transmission. (08)

4. Coaxial and Stripline Components: 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 stripline shifters. (10)

5. Waveguide comoponents: Terminations, Matched loads, Standard mismatches, adjustable short circuits, Attentuators and phase shifters, Waveguides attenuators, waveguide phase shifters. (10)

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.

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M.Sc - Electronics (Communication Science)

M.Sc. I, Semester II

ECS - VIII – Microprocessor and Advanced Microcontrollers

(w. e. f. June 2010-11)

Unit 1. Architecture and Instruction Set for 8086 (10)

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. Programming of microprocessor 8086 assembler directives and operators, assembly process, translation of assembler instructions.

Unit 2. System Bus Structure (8)

Basic 8086/8088 system bus architecture, minimum mode configuration, maximum mode configuration, memory interfacing with 8086/8088 in minimum and maximum mode, system bus timings, bus standards, interrupts of microprocessor 8086.

Unit 3. . Multiprocessor Configuration and Interfacing (14)

Numeric data processor 8087, I/O processor 8089, communication between CPU and IOP, related instructions, interfacing and programming of programmable peripheral interface 8255 and programmable interrupt controller 8259 with microprocessor 8086.

Unit 4. PIC Microcontroller overview & features PIC 16 F8XX Flash microcontroller: Introduction, Architecture , functional pin description , various registers , program memory and data memory organization , Input / Output ports , Timers & Interrupts.

Unit 5. Capture/Compare / PWM (CCP) modules in PIC 16F8XX , Master synchronous serial port module: SPI , I2C , USART , and ADC (6)

Unit 6. Interfacing of following devices with PIC microcontroller
Switches , LED , LCD display , keyboard , Buzzer , Relay

Reference Books-

1.Microcomputer System-The 8086/8088
Family,Architecture,Programming & Design - Y. U. Cheng Liu & A.Gibson, PHL. 15
2.Microprocessor & Interfacing - Doughlas V.Hall,Tata McgrawHill.
3.The Intel Microprocessor - Barry&Barry,PHL
4. Advance microprocessors and peripheral - Roy and Bhurchandi
5.80386 Microprocessor Handbook - C.H. Pappas and W.H. Murray
Osborne McGraw Hill

Solapur University, Solapur
M.Sc. - Electronics (Communication Science)
(Laboratory Exercises- Semester – I)
(w. e. f. June 2010-11)

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 Transforms)
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 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
25. Study of FM modulation and demodulation

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M.Sc. - Electronics & Communication Science
(Laboratory Exercises- Semester – II)
(w. e. f. June 2010-11)

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. Study of SMPS (IC – 3524)
12. Design of ON/OFF controller
13. Interfacing Transducer with 8051
14. Study of Klystron
15. Study of Gunn Diode
16. Addition of two numbers using different addressing modes (8086).
17. Block transfer using string instruction(8086)
18. Lookup table (XLAT) (8086)
19. Multiplication of two 16 bit number (16 x 16 bit numbers) (8086)
20. Password checking (Dos interrupt) (8086)
21. Interfacing LED to PIC
22. Interfacing LCD to PIC
23. Interfacing Relay to PIC
24. DC Motor Control Using PIC (PWM)