Gondwana University, Gadchiroli

Scheme of Examination

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Syllabus

For Semester Pattern with Credit Based System

in

M. Sc. Electronics

(Under the Faculty of Science)

Approved by the Board of Studies in Electronics

Effective from the session 2012-2013 and subsequently

Syllabus

M. Sc. Electronics

Semester I

Code	Paper	Marks	Credits
ELE 101	Fundamentals of Semiconductor Devices	100	4
ELE 102	Digital Design and Applications	100	4
ELE 103	Advanced Microprocessors	100	4
ELE 104	Programming in C	100	4

Practicals

Code	Practical	Marks	Credits
ELE 1P1	Lab Course I- Analog and Digital Electronics Lab	100	4
ELE 1P2	Lab Course II- Computer Interfacing and Programming in C	100	4
	Seminar	25	1

Semester II

Code	Paper	Marks	Credits
ELE 201	Embedded Systems and Applications	100	4
ELE 202	Biomedical Instrumentation	100	4
ELE 203	Computer Organisation and Interfacing	100	4
ELE 204	Virtual Instrumentation	100	4

Practicals

Code	Practical	Marks	Credits
ELE 2P1	Lab Course III – Microcontroller and Interfacing	100	4
ELE 2P2	Lab Course IV- Virtual instrumentation and Programming in Lab VIEW	100	4
	Seminar	25	1

Semester III

Code	Paper	Marks	Credits
ELE 301	Network Analysis and Synthesis	100	4
ELE 302	Fuzzy Logic and Artificial Neural Networks	100	4
ELE 303	Digital signal Processing	100	4
ELE 304	Mechatronics	100	4

Practicals

Code	Practical	Marks	Credits
ELE 3P1	Lab Course V- Fuzzy Logic and Artificial Neural Network	100	4
ELE 3P2	Lab Course VI- Digital Signal and Image Processing	100	4
	Seminar	25	1

Semester IV

Code	Paper	Marks	Credits
ELE 401	Electromagnetic Fields and Antennas	100	4
ELE 402	Digital Communication	100	4
ELE 403	Microwave and Optical Communication	100	4
ELE 404	Mobile and Satellite Communication	100	4

Practicals

Code	Practical	Marks	Credits
ELE 4P1	Lab Course VII – Communication Lab	100	4
ELE 4P2	Project and Seminar	100	4
	Seminar	25	1

Master of Science in Electronics

Teaching Work Load per Week

Class	Theory	Practical	Seminar/	Total Theory	Total
M. Sc. I For each Semester	4 Hrs/paper	8 Hrs/pract	2	16 Hrs	34 Hrs
M. Sc. II For each Semester	4 Hrs/paper	8 Hrs/pract 8 Hrs/project	2	16 Hrs	34 Hrs

1. **Semester I** **M. Sc. (Electronics)**

Paper I (ELE 101): Fundamentals of Semiconductor Devices

Unit I: Semiconductors

Valence bond model of semiconductor- intrinsic and extrinsic semiconductors, the energy band model; p-n junction, depletion region and capacitance; the diode equation, I-V characteristics, temperature dependence, electrical breakdown in p-n junctions, Zener and avalanche breakdowns; IMPATT, TRAPATT, PIN diode

Unit II: Bi-polar Junction Transistors

Transistor action, the Ebres-Moll equations, CB, CE, CC configurations and characteristics, high frequency performance of transistor, alpha and beta cut-off frequencies, microwave transistor, switching transistor

Unit III: Unipolar Devices

Metal-semiconductor contacts, the Schottky effect, JFET and MESFET, device characteristics, MOSFET, basic characteristics, charge-coupled devices (CCD)

Unit IV: Optoelectronic Devices

Photovoltaic effect, the p-n junction solar cell, I-V characteristics, photodetectors: photoconductor, photodiode, avalanche photodiode;

LEDs: radiative and non-radiative transitions; semiconductor LASERS, population inversion

Books:

1. Introduction to Semiconductor Materials and Devices: M. S. Tyagi, Wiley India Ltd, New Delhi
2. Physics of Semiconductor Devices: Shur, Prentice Hall India, New Delhi

References:

1. Physics of Semiconductor Devices: S. M. Sze, Wiley eastern Publ.
2. Solid State Electronic Devices: Ben G. Streetman

Semester I M. Sc. (Electronics)

Paper II (ELE 102): Digital Design and Applications

Unit I: Combinational Logic Design

Simplification of logic functions using K-maps, don't care conditions, realization of Boolean functions using two level NAND-NAND, NOR-NOR logic, multiplexers, decoders, ROM, PLA; Interfacing of logic families: open- collector, totem-pole and tri-state outputs, TTL-CMOS interfacing, CMOS-TTL interfacing, loading rules, fan-out

Unit II: Analysis and Design of Sequential circuits:

State diagrams, characteristic equations of different flip-flops, conversion from one type to another type of flip flops, Mealy and Moore models, design of a sequence detector, minimization of states, design of counters with lockout prevention; Asynchronous sequential circuits; ripple counters, detection and removal of races and hazards

Unit III: VHDL: Implementation of Logic circuits

Combinational: Half adder, full adder and subtractor, decoder, encoder, multiplexer, DEMUX, ALU, 4x4 keyboard encoder, multiplier, divider; Sequential: Finite state machines, Mealy and Moore, State assignments, linear feedback, shift registers

Unit IV: VHDL Architecture

Architectures of ROM, PLA, PAL, CPLD (Xilinx/Altera), FPGA (Xilinx/ Altera)

Practicals:

1. Design of some combinational circuits using NAND and NOR gates
2. Design of circuits using multiplexers
3. Design of circuits using a decoder and gates
4. Design of circuits using PLA
5. Design of binary comparator circuit
6. Design of UP/DN synchronous counter using DFFs
7. Design of Ripple counter using TFFs
8. Design of sequence detector circuits
9. Design of pulse gulper circuit
10. Digital System Design Experiments based on CLPD kits
11. Digital System Design Experiments based on FPGA

Books:

1. Logic Design : Charles Roth, Jaico Publications, New Delhi
2. Digital Design : Morris Mano, Prentice Hall India, New Delhi
3. Digital Principles and Applications : A. P. Malvino, MGH
4. Digital System Design using VHDL: Charles H. Roth, Jaico Publishers, New Delhi
5. Fundamentals of Digital Logic with VHDL Design: Stephen Brown, TMH, New Delhi

References:

1. Modern Digital Electronics: R. P. Jain, Tata McGraw Hill, New Delhi
2. VHDL : Douglas Perry, Tata McGraw Hill, New Delhi
3. VHDL Primer: J. Bhaskar, Pearson Education, New Delhi

Semester I **M. Sc. (Electronics)**

Paper III (ELE 103): Advanced Microprocessors

Unit I: Microprocessor Architecture

Introduction to 16-bit microprocessors, 8086/8088 CPU architecture, memory segmentation, physical address generation, addressing modes, Instruction set: data transfer, arithmetic, logical, string manipulation, control transfer, unconditional branch, conditional branch, flag, processor control, 8087 coprocessor, data formats

Unit II: Assembly Language Programming

Assembler organization, assembler directives and operators, Assembly language programs, MASM and DEBUG utility, stack structure, PUSH and POP instructions, subroutine, procedure and macros, timing and delays

Unit III: Interfacing of Peripherals

Programmable peripheral interface 8255, internal architecture, control word register, operating modes; Timer/counter 8253/8254: functional block diagram, control word register, modes of operation, timing diagrams; keyboard interface/display controller 8279: internal architecture, 8279 commands, operating modes; programmable interrupt controller 8259A: architectural block diagram, command words

Unit IV: Architectures of 80x86 processors

Protected mode memory addressing, protected virtual addressing mode (PVAM), architecture, special features and overview of 80286, 80386 and 80486, Pentium Pro processors, superscalar architecture, MMX (Multimedia Extension) and SIMD (Single Instruction Multiple Data) technology

Books:

1. Advanced Microprocessors & Peripherals: A. K. Ray & Bhurchandi, TMH, New Delhi
2. Microprocessor based Systems: N. G. Palan, Tech-Max Publication, Pune
3. Assembly Language Programming: Peter Abel, PHI, New Delhi
4. 8086/8088 Family: Design, Programming and Interfacing: John Uffenbeck, Pearson Education
5. Intel Microprocessors 8086, 80286, 80386, 80486, Pentium Pro Programming and Interfacing: Barry and Brey, PHI, New Delhi

References:

1. Modern Digital Electronics: R. P. Jain, TMH, New Delhi
2. The 80x86 Family : Design, Programming and Interfacing: John Uffenbeck, Pearson Education

Semester I **M. Sc. (Electronics)**

Paper IV (ELE 104): Programming in C

Unit I: Data types

Basics of programming – algorithms, flow charts, pseudo codes; Structure of a C program, compilers, assembler, interpreters; C character set, constants, variables and keywords, types of constants and variables; type declaration and arithmetic instructions, Integer and float conversions; operators in C , hierarchy of operators, Input-Output statements in C (Formatted and Unformatted), tools for programming in C – data types, data storage, data access, operators, associativity of operators, operator precedence

Unit II: Control structure

Decision control structures- if, if-else, nested if, nested if-else, else-if ladder, switch-case; Loop control structures –while, do-while, for loop, Break statement, Continue statement

Unit III: Arrays, functions, Structures and Unions

Arrays and strings; One- dimensional, Two dimensional and multidimensional array, various string operations; Function definition and prototyping, types of functions, type of arguments, recursion, passing arrays to functions, passing structures to functions, storage class in C;
Structure and union: structure variable, accessing structure member, arrays of structure, union, bit fields

Unit IV: Pointers and file handling

Pointers: declaration of pointers, chain of pointers, pointer expression, pointer arrays, pointer to array, pointer to function; File handling- File opening modes, Text and Binary files, High level and Low level operations on files; pointers, file handling in C; hardware access using C program- serial and parallel port; limitations of C programming

Practicals:

Minimum 20 practicals covering file handling for various data types, sorting and searching, printer port access for input-output, serial port access, interfacing of character display (5x7)

Books:

1. C Programming - C. Balaguruswamy, TMH, New Delhi
2. Let Us C: Yashwant Kanetkar, BPB Publications, New Delhi
3. C Programming: Gottfried, Schaum Outline Series, MGH
4. Programming Languages: Concepts and Constructs: Ravi Sethi, Addison Wesley Publishers

Reference:

1. The ANSI 'C' Language: Kernighan and Ritchie, PHI, New Delhi, 1996

Semester II **M. Sc. (Electronics)**

Paper I (ELE 201): Embedded Systems and Applications

Unit I: Microcontrollers

Introduction to embedded systems, classifications, processor in the system, microcontroller, introduction: 8051 architecture, features of 8051, basic assembly language programming concepts, instruction set, data transfer, logical operations, arithmetic operations, jump/call instructions, interrupt handler, addressing modes, an 8051 microcontroller design & testing

Unit II: Interfacing

Interfacing of Keyboard, displays, ADC/DAC, stepper motor, dc motor; serial communication with PC using RS232, Serial Peripheral Interface (SPI), Inter-Integrated Circuit (I^2C), serial communication with other microcontrollers/devices using I^2C, SPI, RS232 and USB

Unit III: Other Microcontrollers

Introduction to 16-bit micro-controllers, ATMEGA, PIC and ARM processors: General architecture and their limitations, clocking unit, Real Time Clock and Timers, Reset Circuitry and Watchdog Timer; development tools: ATMEL assembler and simulator, ATMEL AVR studio; robotic control applications

Unit IV: Programmable Logic Controller

Basic functions of PLC, advantages over microcontroller, basic architecture, register basics, timer functions, counter function, ladder diagram, overview of PLC systems, I/O modules, power supplies, isolators, programming PLC, Alarm signal generation for a process (e.g. heating, cooling or threshold of a process etc.), direct digital control (DDC) algorithm

Practicals:

1. Interfacing of keyboard with microcontroller (8051)
2. Interfacing of LCD (16x2)
3. Interfacing of I^2C clock IC (DS1307)
4. Interfacing of stepper motor
5. Interfacing of ADC (0808)
6. Interfacing of DAC (0809)
7. Designing of temperature data logger interfaced with PC through serial port
8. Interfacing of 2 microcontrollers using serial port
9. Design of simple robotic system

Books:

1. Embedded Systems: Architecture, programming and Design: Raj Kamal, TMH New Delhi
2. The 8051 microcontroller : Kenneth Ayala, Thomson Delmar Learning, New Delhi
3. 8051 Microcontroller : Mazidi & Mazidi, Penram Publishers, New Delhi
4. Programmable Logic Controllers- Principles & Applications: John W. Webb & Ronald A. Reis, Prentice Hall Inc. New Jersey
5. Datasheet and user manuals of AVR, PIC, ARM microcontrollers

References:

1. Programming & Customizing the 8051 Microcontroller: Myke Predko, TMH, New Delhi
2. PIC Controllers: Mike Predko, MGH
3. Robotic Engineering: Richard D. Klafter, Thomas A. Chmielewski, Michael Negin TMH, New Delhi
4. Embedded System Design: F. Vahid & T. Gargivis, John Wiley and Sons
5. Embedded System Design: An Introduction to Process Tools and Techniques: A. S. Berger, CMP Books
6. Intelligent Robotic Systems: Spyros G. Tzafestas, Marcel Dekkar Inc. New York
7. Robotics: Control, Sensing, Vision and Intelligence : K. S. Fu, R. C. Gonzalez, C. S. G. Lee : MGH, Singapore

Semester II **M. Sc. (Electronics)**

Paper II (ELE 202): Biomedical Instrumentation

Unit I: Basic Principles of Biomedical Electronics

Bioelectrical signals, distribution of electrical potentials in different parts of the body, their magnitude and relationship to the physical status, processing of bio-electronic signals, different transducers for data acquisition; man-instrument system, biometrics

Unit II: Recording Systems

General consideration of electronic recording: preamplifier, main amplifier and driver amplifier; considerations of noise; display systems: Oscilloscopes- long persistence, memory facility, multi-channel displays, flat panel displays, touch screens

Unit III: Patient Safety and imaging techniques

Electronic shock hazards in biomedical instrumentation, Leakage current; grounding techniques; patient monitoring systems: foetus monitoring system and ICU; Need for imaging human body, imaging techniques: NMR, MRI, ultrasonic, X-ray tomography, endoscope, flexible bronchoscope and gastro scope

Unit IV: Biomedical Instruments

Electro-encephalography (EEG), Electrocardiography (ECG), Electromyography (EMG), hemo-dialysis machine, traction, cardiac pacemakers, cardiac defibrillators; use of telemetry in diagnosis, Lasers in biomedical field

Practicals:

1. Design and study of op-amp based EEG signal amplifier.(input through simulation)
2. Design and study of electronic stethoscope
3. Design and study of body temperature measuring system
4. Design and study of respiratory rate measuring system
5. Design and study of arm pressure measuring system
6. Design of digital heart rate measuring system

Books:

1. Handbook of Biomedical Instrumentation –R. S. Khandpur, TMH, New Delhi
2. Biomedical Instrumentation – Leslie Cromwell, PHI Publication, New Delhi
3. Biomedical Engineering System – Leslie Cromwell, PHI Publication, New Delhi
4. Biomedical Phenomenon – Robert Plonsay, John Wiley & Sons
5. Computers in medicine – R. D. Lele, TMH, New Delhi
6. Introduction to Biomedical Equipment Technology: J. J. Carr and J. M. Brown, Pearson Education Asia Publication, Singapore

Semester II **M. Sc. (Electronics)**

Paper III (ELE 203): Computer Organisation and Interfacing

Unit I: Computer Organisation

A functional view of the computer, Pentium and power PC evolution, computer function and inter-connection, PCI bus, cache/main memory structures, DMA module, the external interface: fire wire and infiniband

Unit II: Reduced Instruction Set Computers

Pipelining concepts, RISC architecture, comparison of complex instruction set computers (CISC) and RISC, RISC pipelining, organisation of pipelining, overview of super-scalar and super-pipelined organizations

Unit III: Data Acquisition Systems (DAQ)

Basic components of the DAQ system, functional block diagram of PC bus based DAQ system, data acquisition configurations, parallel port data acquisition; GPIB (IEEE-488), UART, USB interface; networked data acquisition

Unit IV: Hardware Organisation and PC interfacing

Expansion buses and I/O ports: ISA, EISA, PCI, USB port; Peripherals: Monitors, printers of different types; BIOS services; 8-bit ISA bus signals and their functions, timing diagrams of ISA bus cycles, interfacing to 8-bit ISA bus, interrupt handling, using DMA channels, limitation of 8-bit ISA bus; features of PCI bus, PCI system, standard parallel port (SPP), centronics, interfacing to parallel port and serial ports

Practicals

1. Study of expansion buses ISA, EISA, PCI and USB ports
2. Study of parallel port interfacing accessing
3. Study of serial/com port accessing
4. Interfacing of 5x7 display for character display
5. Interfacing of ADC 0808/DAC 0800
6. Interfacing of stepper motor to parallel port

References:

1. Computer Organisation and Architecture: William Stallings, Pearson Education, New Delhi
2. PC based Instrumentation: Concepts and Practice: N. Mathivanan, PHI, New Delhi

Semester II **M. Sc. (Electronics)**

Paper IV (ELE 204): Virtual Instrumentation

Unit I: Virtual Instrument (VI)

Definition of VI, architecture of VI, development of Lab VIEW, graphical programming, advantages of Lab VIEW, palettes, sub VI, express VI, data flow program, modular programming

Unit II: VI Programming Techniques

For and WHILE loops, feedback nodes, local and global variables, arrays, array functions, polymorphism, cluster operations, conversion between arrays and clusters, case and sequence structures, formula nodes, strings and file I/o, charts and graphs

Unit III: Instrument Control

Instrument I/o Assistant, VISA, instrument drivers, serial port communications with GPIB, RS-232, USB, firewire, ethernet and IEEE-1394 controllers,

Unit IV: Processing and Analysis tool kits

Control design and simulation tools, PID control, digital filter design and modulation tool kits, simulation of ECG signal, motion control systems, prototyping with Motion Assistant

Practicals:

1. Data acquisition using virtual instrumentation from temperature transducer
2. Data acquisition using virtual instrumentation from pressure transducer
3. Stepper motor control using virtual instrument
4. Creation of CRO using virtual instrument
5. Design of digital multi-meter using virtual instrument
6. Design of variable function generator using virtual instrument
7. Creation of digital temperature controller using virtual instrument
8. Machine vision concepts using virtual instrument

Books:

1. Virtual Instrumentation using Lab VIEW : Jovitha Jerome, PHI Learning Pvt. Ltd., New Delhi
2. Virtual Instrumentation using Lab VIEW : Sanjay Gupta and Joseph John, TMH, New Delhi

References:

1. Lab VIEW for Everyone: Jeffrey Travis and Jim Kring, Pearson Education, New Delhi
2. NI Lab VIEW user manual

Semester III **M. Sc. (Electronics)**

Paper I (ELE 301): Network Analysis and Synthesis

Unit I: Network Analysis

Mesh analysis, mesh equations, super-mesh analysis, nodal analysis, nodal equations, source transformation technique, state variable analysis

Unit II: Network Theorems and Applications

Star-delta transformations; Superposition, Thevenin's, Norton's and reciprocity theorems, duals and duality, Tellegen's and Millman's theorem

Unit III: Laplace Transform and Properties

Laplace transformation, properties of Laplace transforms, partial fraction expansion, Heaviside's expansion theorem: illustrative examples

Unit IV: Network Functions and synthesis Techniques

One-port and two-port networks, poles and zeors of network functions, time domain behavior from the pole zero plot; stability of active networks, Hurwitz polynomials, positive real functions, Ruth-Hurwitz array and R-H criteria, Foster and Cauer methods of synthesis of RC and LC networks

Books:

1. Network Analysis: M. E. Van Valkenberg, PHI, New Delhi
2. Circuits and Networks: Analysis and Synthesis: A. Sudhakar and S. P. Shyammohan, Tata McGraw Hill, New Delhi

Semester III **M. Sc. (Electronics)**

Paper II (ELE 302): Fuzzy Logic and Artificial Neural Networks

Unit- I: Fuzzy sets and Membership functions

Fuzzy set operations, properties of fuzzy sets, fuzzy relations, features of the membership function, Lambda – cuts, De-Fuzzification methods

Unit - II: Extension principle, Approximate reasoning, Representing set of rules, fuzzy rule-based systems. Graphical techniques of inference; Fuzzy classification, Fuzzy c-means clustering (FCM)

Unit- III: Fundamental concepts of ANN

Model of an artificial neural network (ANN), Network architectures, feed forward networks, Learning processes, Delta learning rules for multi-perception layer, back propagation algorithm

Unit- IV: Associative memories and self organizing networks:

Basic concepts and performance analysis of recurrent associative memory, bidirectional associative memory (BAM); the counter-propagation network (CPN), self-organising feature maps, Adoptive Resonance Theory (ART-I)

References:

1. Fuzzy Logic with Engineering Applications: Timothy J. Ross, McGraw Hill, Inc.
2. Neural Networks, A comprehensive Foundation: Simon Haykin, Pearson Education, Asia

Other Books:

1. Neural networks: Algorithms, applications & Programming Techniques: J.A. Freeman & D. M. Skapura, Pearson Education Asia
2. Artificial Neural Networks: K. Mehrotra, C. K. Mohan & Sanjay Ranka, Penram International Publications, New Delhi
3. Introduction to Artificial Neural Systems: J. M. Zurada, Jaico Publishing House, New Delhi

Semester III **M. Sc. (Electronics)**

Paper III (ELE 303): Digital signal Processing

Unit I: Discrete-time Signals and Systems

Discrete time signals, basic sequences and sequence operations, D-T systems, moving average, time-invariance, linearity, causality, stability criterion, properties of linear time-invariant systems; Linear convolution, linear constant-coefficient difference equations

Unit II: The z-transform

Definition, region of convergence (RoC), pole zero plot and region of convergence, properties of region of convergence, the inverse z-transform, power series expansion, z-transform properties

Unit III: Digital Filter Design

Design of D-T IIR filters from continuous time filters, frequency transformations of low pass IIR filters; Design of FIR filters by windowing technique, the Kaiser window filter design method, design procedure using frequency sampling method

Unit IV: DSP Chips and Applications

Introduction to DSP processors, types of DSP processors and architecture, general purpose DSP processors; Digital filter design using DSP chips, implementation of noise removal techniques, echo effect introduced in music

Practicals:

1. Study of some discrete- time signals
2. Design and study of some FIR filters
3. Study of triangular and Blackman windows
4. Design of FIR filters using windowing technique
5. Design of filters based on pole-zero placements
6. Study of linear convolution
7. Design and study of FFT using programming
8. Design and study of digital filters (HF and LF) using programming
9. Study of experiments based on DSP chips

Books:

1. Digital Signal Processing: N. G. Palan (Tech Max Publications, Pune)
2. DSP Processor Fundamentals: Architectures and Features: Phil Lapsley, Jeff Bier, Amit Shoham & Edward A. Lee
3. Discrete Time Signal Processing: Allen V. Oppeheim & Ronal W. Schafer (PHI, New Delhi)
4. Introduction to Digital Signal Processing: Roman Kuc (MGH)
5. Digital Signal Processing- Principles, Algorithms and Applications: J. G. Proakis and D. G. Manolakis (PHI, New Delhi)

References:

1. Introduction to Digital Signal Processing: Johny R. Johnson (PHI, New Delhi)
2. Digital Signal Processing: Sanjit K. Mitra (TMH, New Delhi)
3. Signal Processing using MATLAB: C. Sidney Burrus, J. K. Mc Clellan, A. V. Oppenheim, R. W. Schafer and H. W. Schuessler
4. Digital Filtering: An Introduction – Edward P. Cunningham

Semester III **M. Sc. (Electronics)**

Paper IV (ELE 304): Mechatronics

Unit I: Basic Elements of a mechatronic system

General introduction to mechatronic systems, traditional and mechatronics designs, control systems, open and closed-loop systems, sensors and transducers; performance parameters of transducers, static and dynamic characteristics, potentiometer sensor, LVDT, push-pull displacement sensor, eddy current proximity sensors, optical encoders

Unit II: Basic System Models

A mathematical model of a system, elements in mechanical system, mass, moment of intertia, elements in electrical systems, resistors, capacitors, inductors, comparison of elements in these systems and their defining equations, dynamic responses of systems: examples of first order systems

Unit III: System transfer Functions

Conversion of differential equation into Laplace transform, transfer function of R-C series circuit, first order system with step input: illustrative examples, systems with negative feedback, location of poles on the s-plane, poles of stable and unstable systems, frequency response of a system of sinusoidal input, phasor equations, frequency response for a first-order system, Bode plots

Unit IV: Closed-loop controllers

Lag, steady-state error, control modes, electronic proportional controller, system response, PD and PI control, PID controller, digital controllers, controller tuning, process reaction method, ultimate cycle method, Ziegler and Nichols criterion, adaptive control, self-tuning

Reference:

1. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Pearson Education Publishers, New Delhi

Semester IV **M. Sc. (Electronics)**

Paper I (ELE 401): Electromagnetic Fields and Antennas

Unit I: Electromagnetic waves

The equation of continuity for time varying fields, Maxwell's equations, EM waves in a homogeneous medium, wave equations for a conducting medium, conductors and dielectrics, Poynting's theorem, interpretation of E x H, complex Poynting vector

Unit II: Antenna Basics

Basic radiation equation, radiation resistance, antenna patterns, half-power bandwidth, radiation intensity, directivity and gain, resolution, apertures, effective heights, Fii's transmission formula, field zones, linear, elliptical and circular polarization

Unit III: Antenna types

The antenna family, short dipole antenna, antenna arrays, broad-side and end-fire arrays, linear arrays, folded dipole, Yagi-Uda array, helical beam antenna, horn antenna, rhombic antenna, parabolic reflectors

Unit IV: Antennas for mobile communications and antenna measurements

Antennas for terrestrial mobile communications, base station antennas, switched beam and beam forming antennas, antennas on cellular handsets, micro-strip lines and antenna

Antenna measurements: The reciprocity theorem, antenna ranges, compact antenna test ranges (CATR), instrumentation for measurement of radiation properties of antenna under test (AUT)

References:

1. Electromagnetic waves and Radiating Systems: E. C. Jordan and R. E. Balmain, PHI, New Delhi
2. Antennas: For All Applications: John D. Kraus and R. J. Marhefka, TMH, New Delhi
3. Antennas and Radiowave Propagation: R. E. Collin (MGH, International Edition)

Semester IV **M. Sc. (Electronics)**

Paper II (ELE 402): Digital Communication

Unit I: Signals and spectra

Classification of signals, energy and power signals, energy spectral density, power spectral density, unit impulse function, sifting property of the Dirac delta function, Fourier series, Parseval's theorem, Fourier transforms, properties of Fourier transforms, convolution properties, graphical convolution

Unit II: Digital Communication system

Elements of digital communication system, the sampling theorem, aliasing error, PAM, PPM & PWM signals generation and detection

Pulse code modulation, uniform and non-uniform quantization, SNR, companding characteristics, Inter-symbol interference, Nyquist criteria of zero ISI, eye pattern

Unit III: Digital Modulation Techniques

Coherent binary modulation techniques, PSK, FSK, QPSK, MSK differential pulse code modulation, predictor, delta modulation, adaptive delta modulation, slope overload and granular noise, M-ary signaling

Unit IV: Information Coding

Measure of information, entropy, mutual information, Shannon's coding theorem, channel capacity, capacity of Gaussian channel, source coding, Huffman code, channel coding, block codes, syndrome decoding, convolutional coding, code tree, spread spectrum communication: PN sequences, direct sequence and frequency hopping spread spectrum systems

Practicals:

1. Study of PCM circuit and quantization
2. Study of PAM, PWM and PPM circuits and detection of these signals
3. Study of a Delta modulator
4. Study of a DBPSK communication system
5. Study of an adaptive Delta modulator
6. Study of a convolutional encoder
7. study of a PN sequence generator
8. Study of a spread spectrum direct sequence communication system

Books:

1. Digital communications: Bernard Sklar (Pearson Education, Asia Publ)
2. Modern Digital and Analog Communications Systems: B. P. Lathi (Oxford Univ. Press)
3. Analog and Digital Communications: Hwei Hsu (Schaum Outline MGH)

References:

1. Digital communications: Symon Haykin (John Wiley & Sons)
2. Modern Digital communications Systems : Leon W. Couch (PHI, New Delhi)
3. Digital communications: J. G. Proakis (MGH)

Semester IV M. Sc. (Electronics)

Paper III (ELE 403): Microwave and Optical Communication

Unit I: Microwave Generators and wave guides

Failure of vacuum tubes at high frequency, Two cavity klystron, reflex klystron oscillator, magnetron oscillator, TWT amplifier, backward wave oscillator, GaAs oscillator;

Propagation of EM waves through wave guide, TE, TM and TEM waves

Unit II: Microwave components and Measurements

Microwave components: scattering matrix, attenuators, Tees, directional couplers, circulators, isolators, phase shifters, cavity resonators

Microwave measurements: Measurement of VSWR, phase shift, frequency, power, attenuation, dielectric constants of liquids and solids, Q of cavity

Unit III: Fiber optics

Principles of optical communication, single mode and multi mode fibers, step index, graded index, ray model, multi path dispersion, material dispersion, optical fiber as wave guide, fiber sources and detectors,

Unit IV: Manufacture and Measurements of fibers

Optical fiber cable, fiber joints, splices, couplers and connectors, measurement in optical fibers, attenuation measurement, dispersion measurement, refractive index profile measurement, transmission links, optical transmitters and receivers

Practicals:

Practicals on X-band test bench

1. Characteristics of reflex Klystron
2. Attenuation Measurement
3. Coupling and directivity of a directional coupler
4. Standing wave plotting and measurement of guide wavelength
5. Measurement of low VSWR and high VSWR
6. Measurement of unknown impedance using Smith chart

Practicals on optical fiber

1. Transmission characteristics of optical fiber link
2. Attenuation measurement
3. Dispersion measurement
4. Refractive index profile measurements

Books:

1. Microwave devices and Circuits: Liao
2. Microwave Engineering: David Pozar
3. Electronics and Radio Engineering: Terman
4. Introduction to Microwave Theory and Measurement: A. L .Lance
5. Optical Fiber Communication : B. Keiser (MGH)
6. Optical Communication Systems: J. Gower (Prentice Hall)
7. Optical Fiber Systems: Kao (MGH)
8. Fiber Optic Communication: D. C. Agrawal (A. H. Wheeler Co.)

Semester IV **M. Sc. (Electronics)**

Paper IV (ELE 404): Mobile and Satellite Communication

Unit I: Cellular Concepts and Equalization

Cellular telephone system, frequency reuse, channel assignment and land off strategies, elements of cellular radio system design, switching and traffic, data links and microwaves, system evaluation, interference and system capacity, Improving coverage capacity; Fundamentals of equalization, space polarization

Unit II: Diversity, channel coding and GSM system for Mobile

Frequency and time diversity techniques, channel coding; service and features, GSM system architecture, GSM channel types, GSM frame structure, intelligent cell concept and applications; Features of handset, SMS, security; Interfacing of mobile with computer, application of mobile handset as modem, data storage device, multimedia device; Measurement of signal strength; Introduction to CDMA digital cellular standard

Unit III: Satellite Communication

Satellite orbits, frequencies, stabilization, orbital parameters, coverage area, work angle, Attitude and orbit control system, telemetry tracking and command power system; Satellite Link design: system noise temperature and G*/*T ratio, down link design, domestic satellite system; eclipse on satellite

Unit IV: Multiple Access Techniques

FDMA and TDMA, TDMA synchronization and timing, code division multiple access. Applicability of CDMA to commercial system, Earth's path propagation effects; satellite services for communication – Weather forecasting, remote sensing, direct to home (DTH) TV

Practicals:

1. Measurement of field strength – mobile towers
2. Any suitable practicals on the above topics

Books:

1. Mobile Cellular Telecommunication: William C. Y. Lee (MGH Inc., 1995)
2. Mobile communication : Jochen Schiller (2^{nd} edition, Pearson Education, 2004)
3. Satellite Communication: T. Pratt, Wiley Eastern Publication
4. Satellite Communication: D. C. Agrawal, Khanna Publications, New Delhi

Semester IV **M. Sc. (Electronics)**

Project and Seminar

M. Sc.-II (Electronics)/Semester IV students will have project of 100 marks. It includes seminar on the project work of 20 marks, totaling 100 marks.

The Projects will be evaluated at the time of final examination, jointly by the external and internal examiners, by conducting viva and demonstration of the project work.

[Note:- Not more than 6 to 8 projects be evaluated by a single external examiner]

A copy of the project work be made available to the external examiner at least a day before the actual date of examination.

GUIDELINES FOR PROJECTS:

1. The Project experiment should be open ended
2. It may be based on any topics of the syllabus
3. It may be based on collection of data and then analysis leading to some meaningful conclusion
4. It may be based on review of a suitable research topic
5. It may be based on development of a new idea and design/fabrications
6. It may consist of hardware and software

PRESENTATION OF THE PROJECT:

Actual presentation format of the project may be decided by the teacher and the student. However, the following guidelines are given for general consideration.

1. At least four copies of the project be submitted.
2. It should be typed on sunlit bond A4 paper, single side with one and half/double - spacing.
3. The project should be of 30 to 40 pages.
4. It should be duly certified by the project supervisor and countersigned by the Head of the Department.
5. The project record should include information under the following/suitable heads:
    (a) Introduction
    (b) Theory (Related to the project)
    (c) Experimental details
    (d) Observations and Graphs, if any
    (e) Results and discussion
    (f) References

General Guidelines for Practical Examination (All Semesters) **M. Sc. (Electronics)**

(1) For each semester, there will be two practicals - practical I and practical II, each of six hours Duration.
(2) Each practical will have two parts, each of three hours duration.
(3) Practical's will be based on the theory papers, prescribed in each semester.
(4) Each practical will be of 100 marks or 4 credits. The distribution of marks will be
    (i) Record Book 20 Marks
    (ii) Viva-voce 20 Marks
    (iii) Experiments 60 Marks
(5) At the time of examination, students will have to submit the practical record book, duly

signed by the concerned teacher and certified by the Head of the department.

Guidelines: Seminar for all semesters

Each student has to prepare a power point presentation/OHP presentation and deliver a seminar of about half an hour on topics from the theory papers, practical or activity based.

The seminar carries 25 marks or 1 credit. The record of the performance of the student will be maintained at the department and the copy certified by the Head should be provided at the time of examination.