Gondwana University, Gadchiroli

Scheme of Examination

&

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**

<table>
<thead>
<tr>
<th>Code</th>
<th>Paper</th>
<th>Marks</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ELE 101</td>
<td>Fundamentals of Semiconductor Devices</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>ELE 102</td>
<td>Digital Design and Applications</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>ELE 103</td>
<td>Advanced Microprocessors</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>ELE 104</td>
<td>Programming in C</td>
<td>100</td>
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</table>

**Practicals**

<table>
<thead>
<tr>
<th>Code</th>
<th>Practical</th>
<th>Marks</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ELE 1P1</td>
<td>Lab Course I- Analog and Digital Electronics Lab</td>
<td>100</td>
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</tr>
<tr>
<td>ELE 1P2</td>
<td>Lab Course II- Computer Interfacing and Programming in C</td>
<td>100</td>
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**Semester II**

<table>
<thead>
<tr>
<th>Code</th>
<th>Paper</th>
<th>Marks</th>
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<tbody>
<tr>
<td>ELE 201</td>
<td>Embedded Systems and Applications</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>ELE 202</td>
<td>Biomedical Instrumentation</td>
<td>100</td>
<td>4</td>
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<tr>
<td>ELE 203</td>
<td>Computer Organisation and Interfacing</td>
<td>100</td>
<td>4</td>
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<tr>
<td>ELE 204</td>
<td>Virtual Instrumentation</td>
<td>100</td>
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**Practicals**

<table>
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<tr>
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<th>Credits</th>
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<tbody>
<tr>
<td>ELE 2P1</td>
<td>Lab Course III – Microcontroller and Interfacing</td>
<td>100</td>
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<tr>
<td>ELE 2P2</td>
<td>Lab Course IV- Virtual instrumentation and Programming in Lab VIEW</td>
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**Seminar**

- 25 credits
### Semester III

<table>
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<tr>
<th>Code</th>
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<tr>
<td>ELE 301</td>
<td>Network Analysis and Synthesis</td>
<td>100</td>
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<tr>
<td>ELE 302</td>
<td>Fuzzy Logic and Artificial Neural Networks</td>
<td>100</td>
<td>4</td>
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<tr>
<td>ELE 303</td>
<td>Digital signal Processing</td>
<td>100</td>
<td>4</td>
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<tr>
<td>ELE 304</td>
<td>Mechatronics</td>
<td>100</td>
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### Practicals

<table>
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<tr>
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<tr>
<td>ELE 3P1</td>
<td>Lab Course V - Fuzzy Logic and Artificial Neural Network</td>
<td>100</td>
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<tr>
<td>ELE 3P2</td>
<td>Lab Course VI- Digital Signal and Image Processing</td>
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### Semester IV

<table>
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<tr>
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<th>Paper</th>
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<tr>
<td>ELE 401</td>
<td>Electromagnetic Fields and Antennas</td>
<td>100</td>
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<tr>
<td>ELE 402</td>
<td>Digital Communication</td>
<td>100</td>
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<tr>
<td>ELE 403</td>
<td>Microwave and Optical Communication</td>
<td>100</td>
<td>4</td>
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<tr>
<td>ELE 404</td>
<td>Mobile and Satellite Communication</td>
<td>100</td>
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</table>

### Practicals

<table>
<thead>
<tr>
<th>Code</th>
<th>Practical</th>
<th>Marks</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ELE 4P1</td>
<td>Lab Course VII – Communication Lab</td>
<td>100</td>
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<tr>
<td>ELE 4P2</td>
<td>Project and Seminar</td>
<td>100</td>
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<td></td>
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</table>
### Master of Science in Electronics

#### Teaching Work Load per Week

<table>
<thead>
<tr>
<th>Class</th>
<th>Theory</th>
<th>Practical</th>
<th>Seminar/</th>
<th>Total Theory</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>M. Sc. I</td>
<td>4 Hrs/paper</td>
<td>8 Hrs/pract</td>
<td>2</td>
<td>16 Hrs</td>
<td>34 Hrs</td>
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<tr>
<td>For each Semester</td>
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<tr>
<td>M. Sc. II</td>
<td>4 Hrs/paper</td>
<td>8 Hrs/pract</td>
<td>2</td>
<td>16 Hrs</td>
<td>34 Hrs</td>
</tr>
<tr>
<td>For each Semester</td>
<td></td>
<td>8 Hrs/project</td>
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</table>
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

References:
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

References:
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:
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

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 (I²C), serial communication with other microcontrollers/devices using I²C, 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 I²C 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:
2. The 8051 microcontroller: Kenneth Ayala, Thomson Delmar Learning, New Delhi
3. 8051 Microcontroller: Mazidi & Mazidi, Penram Publishers, New Delhi
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
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 gastroscope

Unit IV: Biomedical Instruments

Electroencephalography (EEG), Electrocardiography (ECG), Electromyography (EMG), hemodialysis 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:
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
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  
Pipe lining 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:  
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:
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 zeros 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
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:**

2. Neural Networks, A comprehensive Foundation: Simon Haykin, Pearson Education, Asia

**Other Books:**

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:
2. DSP Processor Fundamentals: Architectures and Features: Phil Lapsley, Jeff Bier, Amit Shoham & Edward A. Lee
4. Introduction to Digital Signal Processing: Roman Kuc (MGH)

References:
1. Introduction to Digital Signal Processing: Johny R. Johnson (PHI, New Delhi)
2. Digital Signal Processing: Sanjit K. Mitra (TMH, New Delhi)
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 inertia, 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:
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 $E \times H$, 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:
2. Antennas: For All Applications: John D. Kraus and R. J. Marhefka, TMH, New Delhi
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)
3. Analog and Digital Communications: Hwei Hsu (Schaum Outline MGH)

References:
1. Digital communications: Symon Haykin (John Wiley & Sons)
3. Digital communications: J. G. Proakis (MGH)
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)
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:
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.