Swami Ramanand teerth Marathwada University, Nanded

M. Sc. Electronics First Year
Sem. I and II

M. Sc. Electronics

The following shall be the scheme of First Semester examination:

Year	Theory/practical	No. of Papers	Duration of each paper	Marks for each paper	Total marks
M.Sc. First Semester	Theory	4	4 hrs	50	200
	Lab work	2	4 hrs	50	100

The following shall be the weekly teaching scheme

Year	Theory / Practical	No. of Papers	No. of hrs. per paper per week	Total hrs.
M.Sc. First Semester	Theory	4	4 hrs	16
	Lab work	2	4 hrs	8

M. Sc. Electronics (First Semester)

Syllabus of course

M.Sc. First semester	Title of paper	Maximum Marks	Hours per week
Paper- I	Fundamentals of electronic devices and circuits	50	4
Paper- II	Optoelectronic devices & circuits	50	4
Paper- III	Digital systems and design	50	4
Paper- IV	Programming in C	50	4
Paper- V	LAB-I	50	4
Paper- VI	LAB-II	50	4

Total marks (Theory and Laboratory Work) = 300

Paper-I: Fundamentals of electronic devices and circuits

(40 hours)

1. Conduction in Semiconductors **(8 hours)**

Semiconductors, brief idea about band theory of semiconductor, conduction mechanism, Carrier concentration and mobility, effect of temperature on electrical conductivity, intrinsic semiconductors, carrier concentration in an intrinsic semiconductor, conduction and valance band , carrier concentration in terms of band gap ,electrical conductivity, generation and recombination of charges, extrinsic semiconductor- P type and N type , Hall Effect.

2. Junction and Interface: **(8 hours)**

p-n junction , linearly graded and abrupt junctions, diode equation ,static I-V characteristics, break-down mechanisms in pn-junction , dynamic behavior of pn - junction, effect of temperature on pn-junction diode.

3. Semiconductor devices: **(8 hours)**

zener effect and zener diode, Tunnel diode and its characteristics, tunnel diode circuits, voltage variable capacitor diode, equivalent circuit, piezoelectric crystals, crystal equivalent circuit and performance, crystal oscillator.

4. Bipolar and unipolar semiconductor devices: **(8 hours)**

Bipolar junction transistor(BJT) , principle of operation , fabrication methods and doping profile , I-V characteristics ,Junction field effect transistors(JFET), principle of operation , I-V characteristics, MOSFET -basic structure and operating principle, I-V characteristics, charge coupled devices, MESFET's.

5. Microwave Devices **(8 hours)**

Transferred electron effect, Gun diode, IMPATT diode, TRAPATT diode, PIN diode (constructions, working and characteristics of all devices).

References:

1. Electronics Devices & Circuits –By Jacob Millman & Christors C. Halkias
2. Electronics Devices & Circuits – David A. Bell (PHI) Third Edition.
3. Electronic Devices and Circuits-Sanjeev gupta.
4. Principles of EDC-B. L. Thereja
5. Microvave devices & circuits - Liao (PHI)
6. Microwave Engineering – Sanjeev Gupta.

Paper II: Optoelectronic devices and circuits

(40 hours)

1. Optoelectronic devices **(16 hours)**

Photo conductive cell, photo diode, PIN photo diode, solar cell, light emitting diode, LDR, phototransistors (constructions, working and characteristics of all devices).

Semiconductor laser: stimulated emission, population inversion at a junction, emission spectra for a p-n junction laser, basic semiconductor laser. Avalanche photodiode detectors and photomultiplier tubes (APD designs, bandwidth, noise, photomultiplier tube).

2. Optical Fiber Waveguide **(8 hours)**

Ray theory of transmission, electromagnetic mode theory for optical propagation, cylindrical fiber, single mode fibers.

3. Optical Fibers and Cables **(8 hours)**

Preparation of optical fibers, liquid phase techniques, vapour phase deposition techniques, optical fibers, optical fibers cable, cable design

4. Optical Fiber Connection **(8 hours)**

Joints and couplers fiber alignment and joint loss, fiber splices, fiber connectors, fiber Couplers.

References:

1. Optical Fiber Communication-John M. Senior
2. Optical Communication-John Gower
3. Optical Fiber Communication-Gard Keiser
4. Fiber Optic Communication-D.C Agarwal.
5. Principles of EDC-B. L. Thereja

Paper III: Digital systems and design (40 hours)

Review: (03 hours)
Number systems and codes, digital signals, basic digital circuits, NAND and NOR operations, Exclusive-OR operation, Boolean algebra.

1. Combinational Logic Design (06 hours)
Standard representations for logic functions, Karnaugh map representation of logical functions, simplification of logical functions using Karnaugh map, minimization of logical functions specified in minterms/maxterms or truth table, minimization of logical functions not specified in minterms/maxterms, don't care condition. Designed examples: Arithmetic circuits (half adder, half substractor, full adder and full substractor), BCD- to-7 segment decoder.

2. Combinational Logic Design using MSI Circuits (08 hours)
Multiplexers and their use in combinational logic design, demultiplexers/decoders and their use in combinational logic design, adder and their use in substractors, BCD adder and substractor, arithmetic and logic unit (ALU), digital comparators. Code converters: BCD to binary converters, binary to BCD converters, decimal to BCD encoder, octal to binary encoder, decoder/drivers for display devices.

3. A/D and D/A converters (05 hours)
Digital to analog converters: weighted-resistor D/A converters, R-2R ladder D/A converters, specification for D/A converters.
Analog to Digital converters: parallel-comparator A/D converters, successive approximation A/D converters, counting A/D converters, dual- slope A/D converters, specification for A/D converters.

4. SAP-1, SAP-2 and SAP-3 (18 hours)
Design and architecture of Simple as Possible (SAP-1) system: Architecture, instruction set, programming SAP-1, Fetch and execute cycle, microprogramming.
Design and architecture of Simple as Possible SAP-2: Bidirectional register, architecture, memory reference instructions, jump and call instructions, logic instructions, other instructions.
Design and architecture of simple as possible SAP-3: Programming model, MOV, MVI instructions, arithmetic instructions, increments, decrements and rotates, logic instructions, arithmetic and logic instructions, jump instructions, extended register instructions, indirect instructions, stack instructions.

References:
1. Modern Digital Electronics - R. P.Jain, Second Edition,(For Chapter 1, 2 and 3)
2. Digital Computer Electronics: An Introduction to Microcomputers- A. P. Malvino, Tata Mcgraw Hill (For Chapter 4)
3. Digital Electronics with Practical Approach-G. N. Shinde, Shivani Pub., Nanded

Paper- IV: Programming in C

(40 hours)

1. Introduction to C (08 hours)

The characteristic set, constant, variables and keywords, types of c-constants, types of c-variables, c-keywords. Operator: Arithmetic operator, relational, logical, assignment, increment and decrement, conditional, bit wise and special operator, precedence of operator. C-instruction: Type declaration instruction, arithmetic instruction, integer and float conversions, type conversions in assignment, Hierarchy of operation. Managing input and output operator: Reading a character, writing a character, formatted input and output.

2. Decision Control Structure (05 hours)

Introduction, decision making with if statement, the if else statement, the else if ladder, the switch … case statement, the ternary operator.

3. The Loop Control Structure (04 hours)

The while loop, for loop, the break, continue & goto statement.

4. Array (04 hours)

Array, initialization, passing array element to a function, initializing a 2-dimentional array.

5. Character String (02 hours)

String, standard library string function: strlen ( ), strcat ( ), strcmp ( ), and strcpy ( ).

6. Functions: (04 hours)

Arguments and local variables, returning function results, default return type and the type void, passing values between function, declaration of function type. Recursion, functions with variable argument.

7. Pointers (02 hours)

Introduction to pointer, operator on pointer, pointer and function, pointer array, pointer and structure, points on pointers.

8. Structure and Unions (02 hours)

Declaring structure, installing structure, structure variable, assessing structure element, array of structure, function within structure, introduction to Union.

9. Input/Output in C (06 hours)

Console I/O function: printf( ), scanf ( ), getch( ), getchar( ), putchar( ), gets ( ),puts(). Disk I/O function: High level file, I/O or standard function. fopen( ), putc ( ), getc ( ), fclose ( ), fgets ( ), fputs ( ), fread ( ), fwrite ( ), fseek ( ), feof( ), ffluish( ), use of command line arguments.

10. Computer Graphics (03 hours)

Graphics devices: Graphics modes, functions: Iinitgraph, auto-detect, drawing lines, circles, ellipse, rectangle, etc.

References:

1. Programming With C: B.S. Gottfried (Mcgraw Hill Book Company)
2. Let Us C: Y.Kanetkar.
3. Programming In ANSI C: E.Balgurusamy.
4. Turbo C/C++ The Complete Reference: H.Schildt.
5. C Application Programs and Projects-Pramod N. Vasambekar, Penram Int. Pub

Paper –V: LAB-I

Perform at least 10 Lab Experiments based on Paper-I & Paper-II.

Paper –VI: LAB-II

Perform at least 10 Lab Experiments based on Paper-III & Paper-IV.

M. Sc. Electronics (Second Semester)

Syllabus of course

M.Sc. Second semester	Title of paper	Maximum Marks	Hours per week
Paper- VII	Power electronic devices and circuits	50	4
Paper- VIII	Fiber optic communication & measurements	50	4
Paper- IX	Microprocessor interfacing techniques	50	4
Paper- X	Numerical methods(with algorithm & programming in C)	50	4
Paper- XI	LAB-III	50	4
Paper- XII	LAB-IV	50	4

Total marks (Theory and Laboratory Work) = 300

Paper-VII: Power electronic devices & circuits

(40 hours)

1. Thyristors **(12 hours)**

Principles and characteristics: Thyristor family, principle of operation of SCR, static anode-cathode characteristics of SCR, the two transistor model of SCR, thyristor construction, gate characteristics of SCR, turn-on methods of a thyristor, dynamic turn-on, switching characteristics, turn-off mechanism, turn-off methods, .thyristor ratings, measurements of .thyrister parameters.

Gate triggering circuits: Firing of .thyristor, pulse transformers, optical isolators, gate trigger circuits, unijunction transistor (UJT), programmable unijunction transistor (PUT), phase control using pedestal and ramp triggering, firing system for DC/DC choppers.

2. Series and Parallel Operations of Thyristor **(06 hours)**

Series operations of thyristors, need for equalizing networks, equalizing networks design, parallel operations of thyristor, methods of ensuring proper current sharing, triggering of thyristor in parallel, string efficiency, derating.

3. Phase Control Rectifier **(10 hours)**

Phase angle control, single phase half-wave controlled rectifier (one quadrant) single phase full-wave controlled rectifier (two quadrant), single phase half-wave controlled bridge rectifier, performance factor of line commutated converters, the performance measure of two-pulse converters, three phase controlled converters, three pulse converters (M_3 connections).

4. Inverters and Choppers **(12 hours)**

Basic series inverters, self commutated inverters, basic parallel inverters with feedback diode, single phase half bridge inverter, single phase full- bridge inverter. the McMurray inverter, current source inverters: single phase-capacitor commuted current source inverters with resistive load, single phase ASCI.

Choppers: Principle of chopper operation, control strategies, step-up chopper, step up/down chopper, chopper commutation, Jones chopper, Morgan chopper, a.c.choppers.

References:

1. Power Electronics –By M.D.Singh and K.B.Khanchandani, TMH Pub.Co.Ltd.
2. Industrial Electronics & Control –By S.K.Bhattacharya and S.Chatterjee, TMH Pub.Co.Ltd.
3. Thyristor and Applications-Sugandhi

Paper-VIII: Fiber optic communication and measurements

(40 hours)

1. Multiplexers and Demultiplexers (2 hours)
Introduction: Fiber optics switches (general), bypass switches, other optical switches

2. Communication System (general) (08 hours)
General, transmitter for fiber optics communication, high performance transmitter circuits, LED-analog transmitters, comparison between analog and digital transmitters, laser-transmitters, digital laser-transmitters, analog laser-transmitters with A/D conversion and digital multiplexing, transmitter design, bit stuffing, fiber optics receiver, a high performance receiver, fiber based modems: Transreceiver.

3. Fiber Optic Sensors (09 hours)
Introduction, fiber optics sensors, intensity modulated sensors, micro bend strain intensity modulated sensors, liquid level type hybrid sensors, internal effect intensity modulated sensors, phase sensors, diffraction grating sensor, sensors using single mode fiber, interferometric sensor, interferometric pressure sensor, interferrometric temperature sensor, distributed fiber optics sensors, polarization problem in interferometric sensor using single mode fiber, medical applications of fiber sensors, fiber fabry- parrot optics sensors, electric field and voltage sensors, chemical fiber optic gyerseopers, magnetic field and current fiber sensor, military and aerospace applications.

4. Modulation (03 hours)
Introduction, LED analog modulation, digital modulation, laser modulation, formats of modulation, pulse code modulation, (PCM), intensity modulation (IM)

5. Optical fiber Communication System (04 hours)
Introduction, important application of integrated optical fiber technology, long hall communication, coherent optical fiber communication ,principles of coherent detection, comparison of coherent and direct detections performance, local area network (LAN)

6. Special Applications (08 hours)
Introduction, angular division multiplexing (ADM), video link (fiber optical), satellite link, computer link, nuclear reactor link, community antenna television (CATV), switched star (CATV), networking, digital video transmissions in optical fiber networks, optical fiber networks and its prospect on future development in computer networking, special emphasis on video compression, some optical fiber products used in cable TV and other systems, new developments.

7. Measurements of Optical Fiber (06 Hours)

Introduction, measurement of numerical aperture (NA) and its related terms, fiber attenuation, measurement of optical time domain reflectometer(OTDR), loss measurement of each mode, scattering losses measurement, measurement of dispersion losses, measurement of refractive index, cut off wavelength measurement, measurement of dispersion together with cut-off wavelength, macro bending loss measurements, measurement of mode field diameter (MFD), near field scanning technique, indirect method, transverse offset technique and variable-aperture technique.

References:

1. Optical Fibers and Optical Fiber Communication System-Subir Kumar Sarkar, S. Chand and Company Ltd.

2. Optical Fiber Communication System-B.Keiser, Mcgraw Hill Publications Co. Ltd.

Paper-IX: Microprocessor interfacing techniques

.

(40 hours)

1. Parallel Input/Output and Interfacing Applications (10 hours)
Basic interfacing concepts, interfacing output display, interfacing input keyboard, memory mapped I/O, interfacing memory.

2. Interrupts (02 hours)
8085 interrupts, programmable interrupt controller: 8259A

3. Interfacing Data Converters (05 hours)
Digital to analog (D/A) converters, analog to digital (A/D) converters.

4. Programmable Interface Devices (09 hours)
Basics in programmable I/Os, the 8155/8156 and 8355/8755 multipurpose programmable devices, the 8279 programmable keyboard/display interface.

5. General Purpose Programmable Peripheral Devices (08 hours)
The 8255A programmable peripheral interface, the 8253 programmable interval timer, direct memory access (DMA), 8257 DMA controller.

6. Serial I/O and Data Communication (06 hours)
Basic concept in serial I/O, software controlled asynchronous serial I/O, the 8085 serial I/O lines, SOD and SID, hardware controlled serial I/O using programmable chips.

References:
1. Microprosser Architecture, Programming and Applications with 8085/8080 A-Gaonkar, (Wiley Estern).
2. 8085: 8080/8085 Assembly Language Programming- Lance A. Leventhal, TMH Publications.
3. Fundamental Of Microprocessor and Microcomputer- B. Ram,
4. Microprocessor & Program Logic Design- Kenneth Shon, PHI Publications.

Paper-X: Numerical methods (With algorithm & programming in C)

(40 hours)

1. Differential Equation and Their Series Solutions, Special functions (12 periods)
Basic concept and theory, power series method, theory of power series method, Legendre's equation, Legenders polynomial's $P_n(x)$, Bessel's functions $J_n(x)$ (only first kind), Sturm-Liouville problems, orthoganality.

2. Fourier Analysis (08 hours)
Periodic functions, trigonometric series, fourier series, even and odd functions, half range expansions, fourier integrals, fourier cosine and sine transform, fourier transforms.

3. Roots of Equations: Iterative Method (08 hours)
Introduction, properties of polynomial equations, transcendental equations, approximate value of roots, evaluations of polynomial, solutions of quadratic equations, Bisectier method, Newton Raphson method to find roots of polynomial.

4. Solution of Linear Algebraic equations (06 hours)
Introductions, Gauss-Jordon elimination, Gaussian elimination with baci substutions, iterative improvement of a solution to linear equation, Gauss-Jordon matrix inversion.

5. Integration of functions and integration of ordinary differential equations
Introduction, classical formula for equally spared abscissas, Runge-Kutta method for integration of ordinary differential equations. (06 hours)

References:

1. Advanced Engineering Mathematics Erwin Kreyszing, Fifth or Seventh Edition- John Wiley & Sons.
2. Numerical Recipes In C- W. H. Press, S. A.Teukolsy, W. T. Vellerling & S. P. Flannery, Second Edition, Cambridge Univ.Press.
3. Numerical Methods For Engineers- S. C. Chopra and Raymond P. Canale, Second Edition, McGraw Hill International Edition (Applied Mathematics Series).
4. Computer Oriented Statistical & Numerical Methods- E. Balaguruswamy, Mcmilan Series In Computer Series.
5. Computer Oriented Numerical Methods- V. Rajaraman, Third Edition, PHI.
6. Introductory Methods For Numerical Analysis- S. S. Sastry, Second Edition, PHI.
7. Applied Numerical Methods For The Microcomputer- Shaup T. E., P. H. Inc., 1984.
8. Mathematical Methods For Physics- Arfken A. G., Academic Press.
9. Computer Oriented Numerical Methods- Baphna, TMH.

Paper –XI: LAB-III

Perform at least 10 Lab Experiments based on Paper-VII & Paper-VIII.

Paper –XII: LAB-IV

Perform at least 10 Lab Experiments based on Paper-IX & Paper-X.