VIDYASAGAR UNIVERSITY

MIDNAPORE - 721 102, WEST BENGAL
INDIA

M.Sc. in Electronics 4- Semester Syllabus

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Semester I

Theory (200 Marks): 4 papers, 50 marks each

Practical (100 Marks): 2 Labs, 50 marks each

Semester II

Theory (200 Marks): 4 papers, 50 marks each

Practical (100 Marks): 2 Labs, 50 marks each

Semester III

Theory (200 Marks): 4 papers, 50 marks each

Practical (100 Marks): 2 Labs, 50 marks each

Semester IV

Theory (200 Marks): 4 papers, 50 marks each

Practical (50 Marks): 1Lab, 50 marks
Project work / Industrial Training / Field Study: 50 marks

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Semester – I

Theory

Paper	Topic	Marks
EL 1101	Mathematical methods and numerical Analysis	50
EL 1102	Electromagnetic fields and Plasma electronics	50
EL 1103	Network analysis and synthesis	50
EL 1104	Analog Electronics	50

Practical

EL 1111	Computation lab	50
EL 1112	Electronics circuits lab	50

Semester – II

Theory

Paper	Topic	Marks
EL1201	Applied optics and optoelectronics	50
EL1202	Digital Electronics	50
EL1203	Electronic Material	50
EL1204	Semiconductor devices	50

Practical

EL1211	Optoelectronics lab	50
EL1212	Electronic materials and devices Lab	50

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Semester – III

Theory

Paper	Topic	Marks
EL2101	Microprocessor and its applications	50
EL2102	Control system and instrumentation	50
EL2103	Communication Engineering	50
EL2104	Optical Communication and information processing	50

Practical

EL2111	Microprocessor Lab	50
EL2112	Communication system Lab	50

Semester – IV

Theory

Paper	Topic	Marks
EL2201	Microwave devices and circuits	50
EL2202	Computer networking	50
EL2203	Quantum electronics	50
EL2204	VLSI Technology	50

Practical

EL2211	Advanced Electronics Lab	50
EL2212	Project Work / Industrial training / Field Study	50

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Semester –I

Paper – EL1101 (Theory)

Full Marks: 50
(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

Mathematical Methods and Numerical Analysis

1. Integral transforms, special functions, Introduction complex variables.

   a) Integral transforms: Laplace transform: Properties of Laplace transform, Inversion formula, Convolution, Application to ordinary and partial differential equations, Fourier transform: Properties of Fourier transform, Inversion formula, Convolution, Parseval's relation, Application to ordinary and partial differential equations.

   b) Special Functions: Legrendre equation: Generating function, Legendre functions of the first kind and second kind, orthogonal properties, Rodrigue's formula, Bessel Equation: Bessel function, Series solution of Bessel equation, Recurrence relations.

   c) Complex variables: Function of a complex variable, Limit, Continuity, Differentiability, the definition of an analytic function, Cauchy-Riemann equation, construction of analytic function, complex integration, Jordan arc, Cauchy's theorem, Cauchy's integral formula, More's theorem, Liouville's theorem, Taylor's and Laurent's series.

2. Realization of following numerical techniques in FORTRAN and C languages:

   a) Computer Arithmetic: Representation of integers, real numbers, floating point representation, floating point operators, IEEE standards of floating point numbers. Absolute and relative error, Error propagation, stability and ill conditioning. Order of approximation, Truncation error.

   b) Numerical differentiation: Derivatives from Divided - Difference Table, Central difference formula.

   c) Numerical integration: Trapezoidal rule, Newton - Cotes formula.

   d) Interpolation and extrapolation: Lagrange's, spline and rational function interpolation and extrapolation.

   e) Solving of polynomial equations: Bisection, Regula - Falsi methods.

   f) Solving set of linear equation: Gauss and Gauss - Jordan methods. III conditioned systems.

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g) Ordinary differential equation: Runge - Kutta method, Adams – Moulton, Adams - Bashforth method.

3. Programming for C & C^{++}: Introduction, Operators, Loop, Array, String handling, Function, Structure, Pointer, File handling.

4. Simulation: Monte Carlo and Molecular dynamic simulation, Random numbers, properties of Random numbers, functions of random variables, Monte Carlo integration, Metropolis algorithm, Transport equation simulation.

Paper – EL1102 (Theory)

Full Marks: 50

(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

Electromagnetic fields and Plasma Electronics

1. Transmission Lines: Line, parameters, characteristic impedance and propagation constant of a transmission line, voltage and current equations of transmission line, attenuation constant, phase constant, Reflection co-efficient and transmission co-efficient of a line, velocity of signal in a line, line at radio frequency, distortion less line, Smith chart, Impedance matching, Standing ware ratio, Stubs and Baluns, Co-axial cables, Twin wire transmission line.

2. Wave Guides: Propagation of waves in rectangular and circular wave guides, Different modes of wave guide, Wave guide coupling, Power transmission and power losses, matching and attenuation, Measurement of impedance, Microwave grating, Excitation of modes on wave guides.

3. Antennas: Radiation from elementary dipole, Directivity, Gain and Effective aperture, Resonant and non-resonant antennas, Field pattern Radiation resistance and radiation power, antenna resistance, band width, grounded antenna, effects of antenna heights, linear antenna, antenna arrays, array of arrays.

   Microwave antennas: Antenna with parabolic reflectors, horn antennas, lens antennas. Wide band and special purpose antennas, Helical antennas, Discone antenna, Log-periodic antennas, Loop antennas, Practical transmitting antennas, Behaviour of receiving antennas.

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4. Radio Wave propagation: Ground waves, Space wave, Ionospheric wave and their characteristics, reflection and refraction of radio waves in ionosphere, critical frequency, skip distance, Maximum useable frequency, fading, secant law, duct propagation.

5. Plasma Electronics: Introduction, Types of Discharge, characteristics of plasma, types of emission sources, Plasma power supply, Inductive, capacitive RF and Microwave electrical discharges in gases, Plasma Oscillations, Short-wavelength limit for Plasma oscillations and Debye screening distance, Wave propagation in a plasma.

Paper – EL1103 (Theory)

Full Marks: 50

(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

Network Analysis and Synthesis

1. Network Theorems: Review of network theorems, Foster's reactance theorem, Tellegen's theorem.

2. Network Graphs, Matrices associated with graphs, Incidence, Fundamental cut set and fundamental circuit matrices.

3. Analysis: Equivalent circuits, two-port parameters, hybrid parameters, Topological descriptions of different commonly used networks, π to T and T to π conversions, reduction of complicated network. Image impedance of a network, symmetrical network, characteristic impedance and propagation constant of a network

   Time domain response of linear L, C, R circuits and combinations. Frequency domain networks, transformation of R L, C mutual inductances and combination networks in frequency domain. Phasor diagram, driving point impedance and transfer impedances.

4. Fitter circuits: L fitter, π filter, Methods of development of different filters like high pass, low pass, band pass and band stop filter circuits

5. Fourier series, Application of Fourier Series, Fourier transform, concept of frequency spectrum, Laplace transform.

6. Network analysis using Laplace Transform, concept of Impedance Function and its application, Partial Fraction Expansion, Poles and Zeros, Time - domain behaviour from Pole-Zero plot, Convolution integral, concept of Transfer functions.

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7. Network Synthesis, Definition of Positive Real Functions, Testing procedure for P. R. functions, Derivation of Synthesis technique for one-port passive network (Foster and Caner form), Synthesis of two-port networks by ladder technique

8. Frequency Response of Networks, Frequency Response Plots for Impedance Functions, Bode Diagram, Frequency response analysis of two-port network.

Paper – EL1104 (Theory)

Full Marks: 50

(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

Analog Electronics

1. Operational Amplifier: OP-Amp. Architecture, OP-Amp as Differential Amplifier, OP-Amp as Comparator, Solution of 2^{nd} order differential equation using OP-Amp, OP-Amp as analog computer. Bridge Amplifier, Instrumentation Amplifiers, Logarithmic Amplifiers, Anti-log amplifiers, Analog multiplier, modulation, demodulation and frequency change using multipliers, summing integrator, chopper modulator, chopper-stabilized amplifier, pulse width modulator, voltage to frequency and frequency to voltage converters, precision detector, Schmitt trigger, Active filters, 1^{st}, 2^{nd} and higher order low pass and high pass active filters, Butterworth, Chebychev and Bessel response, band-pass and band-stop active filters, State variable analysis, State variable filter.

2. Voltage Regulator: Regulated power supply, series regulation using OP-Amp, Monolithic voltage regulator, details of standard power supply unit, switch mode power supply (SMPS), Precision current and voltage sources.

3. Signal Generator: Crystal oscillator, tuned oscillator, voltage controlled oscillator (VCO), pulse generator, ramp generator, square and triangular wave generator.

4. Phase Locked Loop (PLL) & Applications: PLL operating principles, monolithic PLLs. Applications of PLL - Frequency multiplication, tracking, FM demodulation.

5. Television: Working principles, TV camera, picture tube, scanning and deflection, synchronization, composite video signal, Transmitting and Receiving systems, Principles of colour television.

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6. Tuned voltage and power amplifiers: Class C operation, unsaturated and saturated class C amplifier, Harmonic generator.

7. Transducers and Sensors: Photo-transducer, thermistor, photoelectric transducer, photo-conductors, phototransistors.

Paper –EL1111 (Practical)

Full Marks: 50

Computation Laboratory

Programming in FORTRAN, C and C^{++}, Numerical problems: solutions with FORTRAN, C and C^{++} programmings, Solutions of differential equations to obtain different circuit parameters by FORTRAN, C and C^{++} programmings. Computer aided drawing of electronic circuits using suitable database.

Paper –EL1112 (Practical)

Full Marks: 50

Electronic circuit Lab

1. Design a R-C coupled amplifier of given gain using transistors in CE mode.
   i) Study the frequency response and calculate its bandwidth.
   ii) Connect a buffer (C-C amplifier) at the final stage and find its effect.

2. Construct a regulated power supply using a power transistor as a pass element and (i) a transistor as a comparator, (ii) an op-AMP as a comparator.

3. Study the transistorized version of VTVM and find out its characteristics and different parameters.

4. Design a transistorized push- pull audio power amplifier using complementary pair of transistor. Measure its efficiency, B.W. and total harmonic distortion. Compare the data using a standard IC audio power amplifier (IC).

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5. To study the characteristics of an analog multiplier chip (say NC 1496), Generate DSB- TC and DSB-SC signal using this chip.

6. Design an active second order Butterworth filter and study its frequency response characteristics and find the cut-off frequencies.

7. Design a logarithmic and anti logarithmic amplifier using OP-AMP and draw the transfer characteristics.

8. (i) Design a regulated power supply using IC 78xx (find output voltage).
(ii) Design a regulated power supply using LM 317 (Variable output).

Semester –II

Paper – EL1201 (Theory)

Full Marks: 50

(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

Applied optics and optoelectronics

1. Laser: Different types of Lasers- CO_2 laser, Nd:YAG laser, solid-state laser, and semiconductor laser, Three levels and four level lasers, Q factor of laser resonator, Different types of Q switching (Electro-optic, Electro-mechanical, passive, Accousto - optic, magneto - optic).

2. Photo detector: PIN and Avalanche photodiode.

3. Optical fibre: Application of optical fibre in communication and its advantages, Different types of optical numerical aperture and pulse broadening of optical fibre, Geometrical propagation of light in optical fibre.

4. Optical sources: LED, LDR, and ILD.

5. Holography: Recording and reconstruction of objects in hologram, basic holographic equation.

6. Nonlinearities in optics: 2nd harmonic and fourth harmonic generation.

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Paper – EL1202 **(Theory)**

Full Marks: 50

(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

Digital Electronics

1. Logic gates (using transistor, diode etc.) (Revision).

2. Combination of logic gates: Karnaugh mapping, Methods of Minimization of Product of sum (POS) and sum of Product (SOP), Logical implementation.

3. Multivibrator: Astable and Monostable (Principles, Circuits and Operations) Timer circuit with 555, Application of XR 2240 as Timer / Counter.

4. Digital Display: Seven segment display, developing of display system for BCD, Octal number system.

5. Implementation of logic gates using MOS / CMOS.

6. Bipolar and MOS Memories: ROM, PROM, EPROM, RAM, Charge-Couple Devices (CCD), Introduction of several ICs used as memory and CCD.

7. MUX and DMUX: Digital Multiplexer, Analog Multiplexer, Digital Demultiplexer and Analog Demultiplexer, Introduction of related ICs.

8. D/A and A/D: The sampling theorem, Time-Division Multiplexing, Quantization, The weighted register, D/A Converter, R - 2R ladder D/A Converter, Specification of D/A Converter, Introduction to DAC 0800.

   A/D Converter, Successive Approximation Converter, The Dual Slope Converter, A/D Converter specifications. Introduction to ADC 0804 and ADC 0808/0809.

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Paper – EL1203 **(Theory)**

Full Marks: 50

(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

Electronic materials

1. Lattice defects: Point defects, line defects and planar defects.

2. Electrical properties of metals, Boltzmann transport equation, Quantized free electron gas.

3. Semiconducting materials: Classification, elemental compound and oxide semiconductors, scattering mechanism and mobility, optical and thermal process, Hall effect, High field transport in semiconductors, low dimension structures: quantum wells, wire and dots.

4. Dielectric materials: Polarization, Non liner effects, Ferroelectricity and piezoelectricity.

5. Superconducting materials: Josephson effect high T_c superconductivity.

6. Ferrites spin waves, electrical conduction in polymers, Ceramics and amorphous materials.

7. Photo conductors, optoelectronic materials, Materials for Solar cells, materials for VLSI.

Paper –EL1204 **(Theory)**

Full Marks: 50

(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

Semiconductor Devices

1. P-N junction diode, Depletion region and depletion capacitance, Abrupt junction, Diffusion potential and depletion layer width, linearly graded junctions, current voltage characteristics, Shockley equation, Diffusion capacitance, Junction breakdown, Tunneling effect, Avalanche multiplication, Transient behaviour and noise. Varistor, Varactor, Charge storage diode, P – I - N diode.

2. Metal - Semiconductor Junction: Energy band diagram, Surface states, Depletion layer, Schottky effect, Current transport processes. Thermionic emission theory. Diffusion theory, Tunneling current, Minority - carrier injection ratio, Characterization of barrier height, Ohmic contact.

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3. Bipolar transistor: Device modelling, Ebers - Moll model, Gummer - Poon model, Microwave transistor, Cut off frequency, Microwave characterization, Power transistor, Switching transistor, Hot - electron transistor.

4. JFET and MESFET: Basic characteristics, uniform charge distribution, Arbitrary charge distribution. Field dependence mobility, Two-region model, Saturated velocity model, Microwave performance,' Related field effect devices, current limitation, Multichannel FET.

5. Semiconductor power devices: UJT, Schockley diode, SCR, Diac, Triac, Thyristor.

6. Advanced semiconductor devices: HEMT, Resonant-tunneling devices, IMPATTS and TUNNETS.

Paper –EL1211 (Practical)

Full Marks: 50

Optoelectronics Lab

1. Study of the characteristics of LED & LDR.

2. Numerical aperture of optical fibre.

3. Frequency response character of LDR.

4. Optical conversion of digital to analog signal.

5. Holography recording and reconstruction.

6. Measurement of dimension of circular aperture by laser.

7. Study of broadening character of a pulse in an optical fibre.

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Paper –EL1212 (Practical)

Full Marks: 50

Electronic Material and device lab

1. B-H loops of ferrite *I* ferromagnetic sample.
2. C-V characteristics of the junction capacitance.
3. Study of the operational characteristics of (i) SCR (ii) DIAC (iii) TRIAC and their uses.
4. Measurement of the band gap of semiconductor.
5. Design a 4-bit shift register using Flip-Flops and basic gates and compare its performance with a standard IC shift register (7495). Extend the above design to make a 4-bit IC ripple counter 7493.
6. Test the performance of a 4 bit binary full adder IC (7483) Design a 4bit subtractor using the same chip. Also design a one digit BCD adder using two 7483 ICs and some basic gates.
7. Design a DAC and ADC using 741 IC.
8. Digital multiplexer and demultiplexer design.

Semester –III

Paper – EL2101 (Theory)

Full Marks: 50
(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

Microprocessor and its applications

1. Computer, Microprocessor and Microcomputer, Microcomputer application, Microprocessor architecture and its operation, Data transfer between memory, 8085 μP architecture, and input/output 8088/8086 μP architecture overview.
2. Basic interfacing concepts, memory mapped and I/O mapped interfacing,

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Serial and parallel data transfer, Interfacing ADC and DAC to interrupts, Interrupt circuits, DMA.

3. Assembly language programming for one specific processor (say 8085μP), Arithmetic and logical processing, time delay loop, procedures, data tables, macro - modulator programming, Hardware and software integration.

4. 8255A programmable peripheral interfaces, 8259 programmable interrupts controllers, 8251 USART.

5. Current loop interface, RS232 serial interface standard, IEEE 488 standard, Error detection and correction.

6. DAS, Transducers used in displacements, temperature, pressure, flow measurement systems.

Paper – EL2102 **(Theory)**

Full Marks: 50
(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

Control system and Instrumentation

1. Concept of closed-loop and open-loop systems: Types of feedback control system-continuous and discrete data systems. General feedback theory.

2. Representation of feedback control systems: Block diagram, signal flow graphs, Transfer function concepts - Time and frequency domain analysis, polar and Bode plot, stability, gain and phase margins.

3. Discrete control systems: Z-transform, simulation diagram and flow graphs.

4. Control system design: Effects of proportional, integral and derivative control, Discrete vs. continuous control systems.

5. Basic Instrumentation Circuits: OP-AMP application, Instrumentation amplifier, Noise measurements and noise reduction techniques.

6. Time Domain Instruments: CRO-dual and multi channel oscilloscopes, storage oscilloscopes, High and low frequency limitations, curve tracers.

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7. Frequency Domain Instruments: Distortion analyzer, wave and spectrum analyzer, signal generators.

8. Digital Instruments: Digital measurement techniques, time and frequency measurements, interfacing instruments with computers.

Paper – EL2103 **(Theory)**

Full Marks: 50

(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

Communication Engineering

1. Introduction to electronic communications, difference between analog and digital communication processes, simplex and duplex processes.

2. Signal processing technique: Fourier transforms, DFT, FFT, convolution, correlation.

3. Analog Communication:

   i) Basic Signal theory, Fourier transform, transform pairs, standard functions and their transform, transform theorems, Perseval power theorem and Raylaigh's energy theorem, spectral density, linear time invariant systems and their analysis, convolution and convolution theory, transfer functions, Ideal filters and their transfer function, Real passive and active filters, Noise and noise analysis.

   ii) Amplitude Modulation: Basic principle of DSB, SSB, and VSB-AM systems, Modulation and Demodulation principles. Modulators and Demodulators, Super heterodyne receivers, Quadrature amplitude Modulation (QAM), Principle of stores effect, noise in AM systems.
   iii) Frequency and Phase modulation: Basic principles of angle modulation, Frequency and Phase modulation, Modulators and demodulators, Frequency discriminators and Phase Locked Loops Receivers, Noise in FM and PM systems, comparison of the effect of noise in different modulation processes, comparison of receivers etc.

4. Digital communication:

   i) Basic principles of Digital Communication: Principles of data transmission, Elementary data transmission, Nyquist theorem applied to data transmission, Data transmission in presence of noise, matched filters, Fundamentals of digital signal processing, sampling theorem, operations on discrete time signals, correlations and autocorrelations, convolution,

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Finite length and periodic sequence, Discrete time random processes, strength of discrete time signals, uncertainty principle and notion of Aliasing, Fourier transform of discrete time signals, Linear time invariant discrete time systems, Z-transform.

ii) Digital filters and FIR filters, IIR filters, all pass filters.

iii) Pulse Code Modulation: Basic principle, Introduction to quantization, companding, Basic idea of digital compression of speech signals, Echo control, Delta modulation, etc.

iv) Pulse Modulation: PAM, PWM, PPM, TOM, FDM, FSK, PSK and others.

5. General Communication Applications: Basic principles of telephony, Mobile and cellular telephony, Satellite communications.

Paper – EL2104 **(Theory)**

Full Marks: 50

(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

Optical communication and Information Processing

1. Parallel Optical Computation and data processing: Digital optics, Optical logic and arithmetic operations, Image edge detection and enhancement, Logical operations between the images.

2. Fibre optic Communication: Communication through step index and graded index optical fibre, modal analysis of optical fibre, laser and LED as source in fibre optic communication, pulse coding principle, sampling of signal through optical fibre, Multiplexing and de-multiplexing of signal, losses in fibre optic communication. Data communication through optical fibre, Bending of optical fibre and micro bending, coupler used for linking two fibres.

   Communication with laser as source (Channel based and channel less), LIDAR.

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Paper – EL2111 **(Practical)**

Full Marks: 50

Microprocessor Programming

1. Assembly language / machine language programming of 8085/8086 based on arithmetic's and logical processing, time delay loop etc.
2. Memory interface with 8085/8086 using IC8255.
3. Keyboard and display interface with 8085/8086.
4. Test and program the peripheral IC 8255 in different modes using 8085.

Paper – EL2112 **(Practical)**

Full Marks: 50

Electronics And Optical Communication

1. Generation and characteristic studies of Amplitude Modulation (AM) and Demodulation Techniques.
2. Generation and characteristic studies of DSBSC and Demodulation techniques.
3. Generation and Characteristic studies of SSBSC and Demodulation techniques.
4. Generation and characteristic studies of FM and Demodulation techniques.
5. Generation and characteristic study of Pulse Amplitude Modulation (PAM).
6. Generation and characteristic study of Pulse Width Modulation (PWM).
7. Communication of digital signal through Optical Fibre.

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Semester –IV

Paper – EL2201 (Theory)

Full Marks: 50

(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

Microwave Devices and Circuits

1. Microwave and millimeter wave frequencies, Microwave devices and systems, Microwave Cavities, Rectangular, Circular and Semicircular Cavity resonators, Q-factor, Attenuators and directional couples, Isolator, Microwave hybrid circuits, Wave guide tees, hybrid rings, Wave guide Corners, bends and twists, Microwave linear beam tubes: Klystrons, TWT.

2 Microwave crossed field tubes: Magnetron Oscillator, Microwave bipolar transistors, Varactor, Step recovery diodes, Microwave JFET and MOSFETS, Small signal equivalent circuit.

3. Avalanche Transit Time diodes, IMPATTS, Small signal and large signal properties, High frequency limitations.

4. Quantum effect microwave devices, QWITIS, Microwave strip lines, parallel, Coplanar and Shielded strip lines, Monolithic microwave Integrated Circuits and fabrication.

Paper – EL2202 (Theory)

Full Marks: 50

(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

Computer Networking

1. Data communication fundamentals: Serial and parallel communications, protocols, error checking and correction.

2. Network configurations: Bus, Star, Ring etc.

3. Communication Hardware and Software: Ethernet, Token Ring, FDDI, CDDI etc. Concept of packet, Cell etc. TCP/IP, X 25, ISO-7 layer protocol, ATM.

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4. Network Hardware: HUB, Bridge, Switch, Router etc.

5. Basic switching: PCM Fundamentals, PCM hierarchies (PDH), Digital switching concepts, Basic architecture of a digital switch, signaling (including R2, CCS7).

6. Basic Transmission: PDH, OFC (2, 8, 34, 140. 565 Mbps), Digital Microwave systems (6, 11, 7, 13 GHz).

7. PSTN Topology and Planning: Hierarchies of a typical telecom network, subscriber access network, Network planning.

8. Services: Value added and intelligent network, ISDN and leased line.

9. Mobile Communication Networks: Wireless links, FDMA, COMA, Base station and controller, Mobile Switching Centre, Call authentication and billing - HLR, VLR, Queries etc. based mobile telephony.

Paper – EL2203 (Theory)

Full Marks: 50

(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

Quantum Electronics

1. Perturbation theory: Time independent and time dependent, Fermi's Golden rule for transitions.

2. MASERS

3. Hetero junction lasers, Quantum well, Quantum wire and Quantum dot lasers, MQW, SCH and GRINSCH lasers.

4. Super lattice and Quantum well APDS Noise in APDS, Graded gap, SAM and Stair case APDS, Solid State Photomultiplier tube.

5. Quantum well Infrared photo detectors.

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Paper – EL2204 (Theory)

Full Marks: 50

(University Written Examination – 40 Marks & Internal Assessment- 10 Marks)

VLSI Technology

1. Process steps for VLSI technology: Cleaning, oxidation, diffusion, ion implantation, advanced lithography, etching, metallization, Vacuum evaporation, DC and RF sputtering, Poly-silicon and nitride deposition.

2. Fabrication of monolithic Integrated Circuits. Fabrication of n-channel enhancement and depletion MOSFETS, The CMOS process, Bi CMOS fabrication, Scaled down devices, Effect on system parameters, VLSI design, design rules, stick diagram,

3. Chip assembly and packaging techniques.

4. MOS physics and technology, Advanced MOSFET structures, change coupled devices, MOS tunnel devices.

Paper – EL2211 (Theory)

Full Marks: 50

Advanced Electronics Lab

1. Design and study a Switch Mode Power Supply (SMPS).

2. Fabrication of a Synchronous Counter.

3. Implementation of Logic Gates Using MOSFETs.

4. Design of a PLL using Pspice.

5. Design of an Amplifier using Pspice.

6. Design of a VCO Using Pspice.

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Paper – EL2212 (Theory)

Full Marks: 50

Project Work / Industrial Training / Field Study

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