Rs. 20/-

NORTH MAHARASHTRA UNIVERSITY
JALGAON - 425 001

SYLLABUS

FOR

M.Sc. [ELECTRONICS]

FROM JUNE 1992

SEMESTER I TO IV

DEPARTMENT OF PHYSICAL SCIENCES

SYLLABUS
for
M. Sc. ELECTRONICS

SEMESTER I

EL 101 : Mathematical Methods in Electronics

EL 102 : Quantum Mechanics

EL 103 : Basic Electronics

EL 104 : Physics of Electronics Materials

EL 105 : General Laboratory I

SEMESTER II

EL 201 : Statistical Mechanics

EL 202 : Electrodynamics

EL 203 : Computational Methods and Computer Programming

EL 204 : Digital Electronics

EL 205 : General Laboratory II

SEMESTER III

EL 301 : Physics of Semiconductor Devices

EL 302 : Optoelectronics

EL 303 : Microprocessors and Applications I

EL 304 : Special Laboratory I

EL 305 : Project

SEMESTER IV

EL 401 : Microprocessors and Applications II

EL 402 : Communication Electronics

EL 403 : Semiconductor Science and Technology

EL 404 : Special Laboratory II

EL 405 : Project

4. LAPLACE TRANSFORMS :

Definition, Important theorems on Laplace transforms, Inverse Laplace transform, Methods of finding inverse Laplace transform by partial fractions, Convolution theorm, Applications of Laplace transform to electronics.

5. Z TRANSFORMS :

Definitions of one and two sided Z transforms, Important theorems of Z transform, inverse Z transform, Applications of Z transform to electronics.

6. SIGNAL AND SYSTEM MODELLING CONCEPT :

Examples of Systems, signal modes, energy and power spectral densities, Introduction to system modelling concepts, Impulse response of a fixed linear system.

REFERENCES :

1. Mathematical methods for Physicist
   G. Arfken, Academic Press, 1985.
2. Mathematical Methods in Physical Sciences, Ed.II
   M.L.Boas, John Wiley and Sons.
3. Mathematical Methods for Physics
   J.Mathew and R.L.Walker, Benjamin (IBH), 1979.
4. Linear Algebra
   Lipsuitz, Schaum's Series.
5. Mathematics for Physics and Chemistry, Vol.I
   H.M.Margenau and G.M.Murphy, East-West Press.

EL 101 : MATHEMATICAL METHODS IN ELECTRONICS

1. SPECIAL FUNCTIONS :

Bessel functions - generating function, Orthogonality of Bessel functions, Properties of Bessel functions, Intoduction to second kind Bessel function.

Hermite functions - generating function, orthogonality of Hermite functions, properties of Hermite functions.

Legendre functions - generating function, orthogonality of Legendre functions, properties of Legendre functions.

2. MATRICES :

Special matrices - Symmetric, Orthogonal, Hermitian and unitary, Eigenvalue equation, eigen vectors and eigen values, Similarity transformations, Diagonalisation.

3. FOURIER SERIES AND TRANSFORMS :

Fourier series, odd and even functions, half range Fourier Sine and Cosine series, Complex form of Fourier series, Parseaval's identity for Fourier series, Finite Fourier transform, Fourier integral, Fourier transform - sine and cosine transform, the convolution theorem, Parseaval's identity for Fourier transform, Applications to electronics.

4. LAPLACE TRANSFORMS

EL 102 : QUANTUM MECHANICS

1. GENERAL FORMULATION OF WAVE MECHANICS :

Fundamental postulates of wave mechanics, correspondance principle, eigenvalues, eigenfunctions, completeness and normalisation of wavefunctions, closure property, expansion coefficients, eigen functions in momentum space, introduction to bra and ket notation and their properties.

2. OPERATORS IN QUANTUM MECHANICS :

Operators, their eigenvalues and eigenfunctions, Hermitian, Unitary, parity operators and their properties, Commutators- definition, commutator algebra, fundamental commutators in quantum mechanics, commuting operators and their physical significance. Solution of 1-D Harmonic Oscillator using ladder operators.

3. ANGULAR MOMENTUM :

Angular momentum operator, Linear momentum operator as generator of translation, orbital angular momentum operator as generator of rotation, eigen values and eigenfunctions of L^2 and L_z using explicit forms of L^2 and L_z in spherical co-ordinates, Various commutation relations between L^2, L_x,L_y and L_z. determination of eigenvalue spectrum of J^2, J_z where J is any angular momnetum operator, Addition of two angular momenta : development of the necessary theory, Clebesch-Gordon coefficients.

4. MATRIX FORMULATION IN QUANTUM MECHANICS :

Matrices in Quantum Mechanics, transformation theory, Unitary matrix, Projection operator.

5. APPROXIMATE METHODS IN QUANTUM MECHANICS :

Variational method : General characteristics of the method, application to estimation of energy of ground state and excited state.

Time independent perturbation theory : Stationary perturbation theory for degenerate and non-degenerate case, first order and second order perturbation, Applications to problems such as perturbation of an oscillator, Zeeman effect without electron spin, first order Stark effect in Hydrogen.

REFERENCES :

1. Quantum Mechanics
   L.I. Schiff, Mc Graw Hill, Koga Kusha, 1968.
2. A text book of Quantum Mechanics
   P.M.Mathew and K.Venkatesan, Tata Mc Graw Hill, 1981.
3. Quantum Mechanics, Vol.I
   A. Messiah, North Holland, 1972.
4. Quantum Mechanics,
   E.Merzbacher, Wiley Eastern, 1970.
5. Quantum Mechanics,
   A.K.Ghatak and S.Lokanathan, MacMillan India, 1979.
6. Quantum Mechanics,
   A.S.Davydov, Pergamon Press, 1976.

EL 103 : BASIC ELECTRONICS

1. DIODES AND CIRCUIT APPLICATIONS :

Ideal diode - large signal and small signal model, Applications: Rectifiers, Clipping and Clamping circuits, Voltage multipliers, Amplitude demodulation, zener diode as a voltage regulator.

2. BIPOLAR JUNCTION TRANSISTORS :

Small signal and large signal models, Design of Biasing circuit, load line(ac and dc), Transistor as an amplifier, Hybrid pi-equivalent circuit for CE amplifier, Transistor as a switch, FET and MOSFET (depletion and enhancement type).

3. MULTIPLE TRANSISTOR AMPLIFIERS :

Darlington configuration, Common collector pair, Cascaded BJT common emitter amplifier, Differential amplifier, Analysis, CMRR etc. Power amplifiers: classification, Push-pull amplifiers (class A, class B, class AB and class C), calculation of conversion efficiency, complementary.push-pull output stage.

4. FREQUENCY RESPONSE OF AMPLIFIERS :

Typical Amplifier Frequency Characteristics, Frequency Response, Low frequency and high frequency equivalent circuit and response, Effect of bypass and coupling capacitors.

5. FEEDBACK AMPLIFIERS AND OSCILLATORS :

Basic concept of feedback, positive feedback, negative feedback, Effect of negative feedback on gain, input impedance, output impedance, bandwidth, noise and distortion.

Feedback configurations: shunt-shunt, series-series, series-shunt and shunt-series. Frequency response of feedback amplifiers, Oscillators: Sinusoidal oscillators, nonsinusoidal oscillators, RC and LC oscillators- Phase shift, Wien bridge, Colpitt, Hartley and tuned circuit, crystal oscillators.

6. OPAMP and APPLICATIONS :

Basic circuit block, input and output offset current and voltages, bias current, slew rate, Inverting amplifier, non-inverting amplifier, voltage follower, comparator, Schmitt trigger, integrator and differentiator, logrithmic amplifier, instrumentation amplifier, function generator, active filters, precision rectifiers, instrumentation amplifier and analog computation.

7. TUNED AMPLIFIERS AND FREQUENCY SELECTIVE CIRCUITS:

Single tuned BJT circuit, Inductor quality factor, Transformer coupling, Synchronous and stagger tuning, Phase locked loop, Voltage controlled oscillator.

8. TRANSIENT RESPONSE AND SWITCHING SPEED :

Step response of an amplifier,Step response: low pass and high pass case, sag calculation, switching charcteristics of diode and transistor,delay time,rise time,storage time, fall time,speed up capacitor,circuits that avoid saturation.

NOTE : Emphasis must be given on design aspects.

REFERENCES :

1. Electronic Principles,
   A.P.Malvino, McGraw Hill Company.

2. Electronic Fundamentals and Applications,Edition 5
   J.D.Ryder, Prentice Hall of India, 1981.

3. Integrated Electronics
   J.Millman and C.C.Halkias, Mc Graw Hill Company, 1981.

4. Electronic Devices and Circuits,
   A.Mottershead, Prentics Hall of India, 1981.

5. Operational Amplifiers,
   G.B.Clayton, Butterworth.

EL 104 : PHYSICS OF ELECTRONIC MATERIALS

1. CRYSTAL STRUCTURES :

Classification of crystals, Lattice, Miller indices, Crystal structures such as NaCl, CsCl, Wurtzite, Diamond, HCP etc. Reciporcal lattice, Ewald's construction, Brillouin zones, Wigner-Seitz cell, X-ray diffraction, Laue theory, geometrical structure factor, atomic structure factor for FCC, BCC and diamond structure. X-ray diffraction methods - Laue, rotating crystal and powder method.

2. ELECTRONIC STRUCTURE AND RELATED PROPERTIES :

Free electron model, energy levels and density of orbitals in one dimension and three dimensions, Band theory of solids, origin of energy gap, Kroning penny model and its solution, concept of effective mass of electron and hole, Umpklapp processes with application to conductivity, motion of electrons in 3-dimensions, tight bound electron approximation, application to simple cubic lattice. Overlapping of energy bands.

3. FERMI SURFACES :

Characteristics and construction of Fermi surfaces, Fermi surface and Brillouin zones, Fermi surfaces of metals such as aluminium, copper and gold. Effect of electric field on Fermi surfaces, Experimental study of Fermi surfaces.

4. DIELECTRIC PROPERTIES :

Polarization, depolarization field, Lorentz field, dielectric constant and polarizability, Clausius Mossotti relation, atomic polarizability [electronic, ionic and dipolar].

5. MAGNETIC PROPERTIES :

Diamagnetism, Paramagnetism, Ferromagnetism, Ferrites and their behaviour at high frequencies.

6. DEFECTS IN SOLIDS :

Point, line and planer defects in crystals, Schottky and Frankel defects,estimation of vacancies, Diffusion, color centres, dislocations.

REFERENCES

1. Solid State Physics,
   A.J.Dekkar, Mc Millan Students Ed.
2. Introduction to Solid State Physics,
   C.Kittel, Wiley Eastern Ltd., Edition 5
3. Solid State Physics,
   C.M.Kachhava, Tata Mc Graw Hill Edition.
4. Solid State Physics,
   N.W.Ashcroft and N.D.Mermin, Holt- Saunders International Ed.
5. Solid State Physics,
   L.Azzroff, Tata Mc Graw Hill Edition.

EL 105 : GENERAL LABORATORY I

1. To study the switching characteristics of electronic devices.
2. To design, build and test a discrete component schmitt trigger.
3. To design, build and test electronically regulated power supplies using zener diodes, Three pin regulators (using 78XX/79XX) and using IC 723.
4. To measure dynamic and static value of forward current gain of BJT using IC 741.
5. To study the characteristics of second order active filters.
6. To measure the parameters of a sample and hold circuit.
7. To study the phase locked loop and it's application.
8. To design, build and test a function generator circuit using linear integrated circuits.
9. To design and calibrate a linear temperature to frequency circuit.
10. To study the performance of class AB push pull amplifier.
11. To measure the resistivity of sample at various temperatures by Four probe method.
12. To analyze a given function using Fourier analysis.
13. Measurement of Hall coefficient.
14. Energy band gap measurement of a semiconductor.

NOTE : Minimum 12 experiments must be completed by the student.

EL 201 : STATISTICAL MECHANICS

1. Specification of the state of system (classical as well as quantum), Phase space, Liouville's theorem, statistical ensemble, accessible states, postulate of equal a priori probability, density of states and its behaviour for ideal monoatomic gas in classical limit, statistical definition of entropy.

2. ENSEMBLES AND THERMODYNAMIC QUANTITIES :

Microcanonical ensemble, canonical ensemble, Grand canonical ensemble, partition function, evaluation of thermodynamic quantities from partition function, application to ideal gas, Gibb's paradox.

3. MAXWELL BOLTZMANN, BOSE EINSTEIN AND FERMI DIRAC STATISTICS :

Quantum distribution functions, the Boltzmann limit of Bose Einstein and Fermi Dirac gas, evaluation of the partition function, partition function of diatomic molecules, equation of state of an ideal gas.

4. IDEAL BOSE SYSTEM :

Photon gas, Planck's law, Bose Einstein condensation.

5 IDEAL FERMI SYSTEM :
Fermi energy, mean energy of Fermion at T= o K, electron gas, Fermi energy as a function of temperature, electronic specific heat.

6. Boltzmann transport equation and its application to electrical conductivity.

REFERENCES :

1. Fundamentals of Statistical and Thermal Physics,
F.Reif, Mc Graw Hill Company.

2. Statistical Mechanics,
Kerson Huang, Wiley Eastern Ltd., 1963.

3. Introduction to Statistical Mechanics,
B.B.Laud, Macmillan, India, 1981.

4. Statistical Mechanics,
J.E.Mayer and M.G.Mayer, John Wiley, 1940.

5. Statistical Physics, Ed.II
L.D.Landau and E.M.Lifshitz, Pergamon Press, 1958.

6. Statistical Physics,
R.K.Pathria, Pergamon Press, 1972.

EL 202 : ELECTRODYNAMICS

1. MAXWELL'S EQUATIONS :

Electrodynamics before Maxwell, modification of Ampere's law, Maxwell's equations, magnetic charge, Faraday's law for moving media, Maxwell's equations for moving media.

2. ENERGY, FORCE AND MOMENTUM RELATION IN ELECTROMAGNETIC FIELD

Energy relations in quasi stationary current system, force on a current stystem, Inductance, Magnetic volume force, general expressions for electromagnetic energy-Poynting's theorem.

3. WAVE EQUATION FOR ELECTROMAGNETIC FIELDS :

The wave equations, plane waves, radiation pressure, plane waves in moving media, reflection and refractions at plane boundaries, the waves in conducting media, metallic reflection.

4. THE INHOMOGENEOUS WAVE EQUATION :

Scalar and vector potentials, Gauge transformations, Coulomb gauge and Lorentz gauge, the wave equation for potentials, solution by Fourier analysis, radiation fields, Hertz potential, electric dipole radiation.

5. COVARIANT FORMULATION OF ELECTRODYNAMICS :

Experimental basis for special relativity, the Lorentz transformations, law of velocity addition, the Lorentz transformation of Four vector, four velocity, four accelaration, four momentum, relation between energy momentum and mass, the Minkowski force, four vectors to charge and potential, electromagnetic field tensor, Lorentz force, invariance of Maxwell's field equations under relativistic (Lorentz's) transformation, covarience and tensor form of Maxwell's field equation, covarience form of Lorentz transformation.

REFERENCES

1. Classical Electrodynamics,Ed.II
   W.K.H. Panfsky and M.Philips, Addison-Wesley, 1962.

2. Classical Electrodynamics,Ed.II
   J.D.Jackson, Wiley Eastern Company Ltd.,1978.

3. Foundations of Electromagnetic Theory, Ed.II
   J.R.Reitz and F.J.Milford, Addison Wesley,1967.

4. Introduction to Electromagnetic Fields and waves,
   D.R.Corson and P.Lorrain, Freeman, 1962.

5. Classical Electrodynamics, Ed.II
   Griffits, Prentice Hall of India.

6. Electromagnetics, Ed.II
   B.B.Laud, Wiley Eastern Ltd.

EL 203 : COMPUTATIONAL METHODS AND COMPUTER PROGRAMMING

I. Some Computer Programming Topics :

Functions and Subroutines, Common Block and Equivalence declarations.

II. Numerical Methods in FORTRAN :

In the following topics on numerical methods, students are expected to be able to write programs, subprograms or program segments as well as perform numerical calculations using electronic calculators and mathematical tables.

1. ITERATIVE METHOD FOR SOLUTION OF ALGEBRAIC EQUATIONS

Newton Raphson method, iteration method, method of false position, rate of convergence, comparision of these methods, choice of an iterative method and implementation.

2. SOLUTION OF SIMULTANEOUS EQUATIONS

Directs methods - Cramer rule, Gauss elimination method, pivotal condensation, iterative methods -Gauss Seidal method, Jacobi method.

3. INTERPOLATION

Lagrange and Newton interpolation methods, Finite differences operators, interpolating polynomials using finite differences, difference tables- central, forward, backward.

4. NUMERICAL INTEGRATION

Methods based on interpolation, methods based on undetermined coefficients, composite integration methods- Trapezoidal and Simpson's rules, double integration [derivation, applications and errors in the formulae, comparison of two formulae].

5. NUMERICAL DIFFERENTIATION

Methods based on interpolation, finite differences and undetermined coefficients

6. SOLUTION OF DIFFERENTIAL EQUATIONS

Numerical methods-Euler's method, Modified Euler's method, Single step methods- Taylor series method, Runge Kutta methods, Multistep methods, Stability analysis.

REFERENCES

1. Programming with FORTRAN 77,
   Ram Kumar, Tata Mc Graw Hill Company.
2. Introductory methods of Numerical Analysis,
   S.S.Sastry, Prentice Hall of India.
3. Numerical Mathematical Analysis,
   J.B.Scarborough, Oxford, 1964.
4. Computer Programming in FORTRAN IV,
   V.Rajaraman, Prentice Hall of India, 1974.
5. Computer Oriented Numerical Methods,
   V.Rajaraman, Prentice Hall of India.

EL 204 : DIGITAL ELECTRONICS

1. Codes and arithmetic

BCD code, excess 3 code, gray code, ASCII code, EBCDIC code, addition, subtraction, multiplication and division using binary, octal and hexadecimal number system.

2. Boolean Algebra

Complement of function, DeMorgan's theorems, Boolean identities and their applications for reduction of logical expressions, standard SOP form, numerical representation of SOP form, POS form, numerical representation, Truth table verification, K-map, 5 variable K-map, minimization of logic equation using K-map.

3. Logic families

Introduction of IC families, TTL, ECL and CMOS gates, characteristics of logic families, open collector gates, wire ANDing, three state devices, AND-OR-INVERT gates, Expanders.

4. Flip Flops

Flip Flop as a bistable multivibrator, Flip Flop using NAND and NOR gates, RS Flip Flop, JK Flip Flop, Race around condition, Direct sets and direct clears, D Flip Flop, T Flip Flop, JK Master Slave Flip Flop, edge triggered flip flops, Flip Flop parameters, Uses of Flip Flops, Glitches.

5. Counters and Shift Registers

Ripple counters, up-down counter, divide by N counter, Synchronous counters, Irregular and truncated counters, IC counters using IC 7490, IC 7493. Presetable counters, counters using IC 74192, IC 74193, Johnson counter, Timing diagram and state transition diagrams of above counters, Applications.

Shift Register: Basic Register, Left and right shift register, Serial and parallel loading of shift register, applications.

6. Multiplexers and Demultiplexers

Multiplexer, encoder, demultiplexer, decoder, BCD to decimal decoder, Decimal to BCD encoder, Keyboard encoder, applications.

7. Memories

Memory types, Semiconductor memories, core memories, static RAM, dynamic RAM, PAL and PLA, Expansion of RAM.

8. DAC and ADC

Binary weighted resistor network, R-2R ladder type DAC, DAC parameters, Simultaneous/Flash type ADC, Counter type ADC, tracking type ADC, successive approximation type ADC, Single slope and dual slope ADC, ADC parameters.

9. Applications

Multiplexing displays, frequency counters, Time measurement and digital voltmeter.

REFERENCES :

1. Digital Principes and Applications
Malvino and Leach, Mc-Graw hill.

2. Digital Electronics
Strangio C. E., PHI.

3. Digital Instrumentation
Bouwens, Mc-Graw Hill.

4. Digital System Design and Microprocessors
J.P.Hayes, Mc-Graw Hill.

5. Digital Electronics
W. Gothmann, Printice Hall Of India.

EL 205 : GENERAL LABORATORY II

Part : A

1. To study the time multiplexing concept using dynamic display.
2. To design, build and test a code converter circuit .
3. To study the parity generation (odd and even) and parity checking using proper circuit.
4. To generate a n-bit pulse train using multiplexer.
5. To study the state transition diagram using Johnson counter.
6. To design, build and test BCD adder circuit using IC 7483.
7. To design, build and test astable multivibrator using IC 74123.
8. Study of J-K master slave flip flop.

Part : B

1. Draw the flow-chart and write a programm to find the root of the equation F(x) = 0 by Newton Raphson method.
2. Draw the flow-chart and write a programm to find the root of the equation F(x) = 0 by Iteration method.
3. Draw the flow-chart and write a programm to find the root of the equation F(x) = 0 by False position method.
4. Draw the flow-chart and write a programm to integrate the given function using Trapezoidal rule.
5. Draw the flow-chart and write a programm to integrate the given function using Simpson's 1/3 and 3/8 rule.
6. Draw a flow-chart and write a programm for fitting of a polynomial of degree n using Lagrange's interpolation formula.
7. Draw a flow-chart and write a programm to solve a given differential equation using Euler's simple and modified method.
8. Draw a flow-chart and write a programm to solve a given differential equation using Runge Kutta method.
9. Draw a flow-chart and write a programm to solve given set of simultaneous equations using Gauss elimination method.
10. Draw a flow-chart and write a programm to solve given set of simultaneous equations using Gauss Seidal elimination method.

NOTE : Minimum 6 experiemnts must be completed by the student from each part.

EL 301 : PHYSICS OF SEMICONDUCTOR DEVICES

1. PROPERTIES OF SEMICONDUCTORS

Review of crystal structures and Energy bands of semiconductors (Ge, Si, GaAs, IV-V, III-V, II-VI compound semiconductors), charge carriers, minority and majority carriers, excess carriers and life time, diffusion of carriers and Einstein's relation, Intrinsic and extrinsic semiconductors, Position of Fermi level, degenerate and non-degenerate semiconductors, carrier concentration in degenerate and non-degenerate cases, current transport, internal field in a semiconductor with non-uniform doping.

2. MEASUREMENT OF ELECTRICAL PARAMETERS OF SEMICONDUCTOR

Resistivity, mobility, carrier concentration, carrier types by Hall effect, Haynes-Schockley experiment-mobility, diffusion constant and life time of minority carriers.

3. P-N JUNCTION DEVICES

The junction diode : Junction in equilibrium, junction with forward and reverse bias, current-voltage characteristic of junction diode, electron hole injection efficiency, the geometry of the depletion layer, depletion layer capacitance, diffusion capacitance, Small signal equivalent circuit of a P-N junction, switching characteristic, Breakdowns in P-N junctions.

Zener Diode :. Reverse bias breakdown, principle of operation, device design for particular breakdown voltage.

Varactor Diode : Capacitance of p-n junction, principle of operation, equivalent circuit, power relation, applications.

Tunnel Diode : Degenerate semiconductors, principle of operation, circuit operation, applications as an oscillator.

P-I-N Diode : Intrinsic layer, principle of operation behaviour of forward and reverse bias, equivalent circuit, applications.

4. METAL-SEMICONDUCTOR JUNCTION DIODE

Structure, metal-semiconductor contact, energy band diagram for different cases, barrier formation, Schottky diodes-principle of operation, current transport theory and applications.

5. BIPOLAR JUNCTION TRANSISTOR

Structure, the principles of operation, the Ebers-Moll equations and large signal transistor model, the dependence of Ebers-Moll parameters on the structure and operating point, maximum transistor current, voltage and power rating, transistor as a switch.

6. FIELD EFFECT TRANSISTOR

JFET, Principle of IGFET, MOS capacitor, MOS transistor operation, charge coupled devices (CCD), MOS transistor as a memory elements.

7. POWER SEMICONDUCTOR DEVICES

General consideration, bipolar power transistor, thyristor family - the SCR , diac and triac.

8. NEGATIVE CONDUCTANCE MICROWAVE DEVICES

IMPATT devices - Read diode, principle of operation, applications, other structures.

GUNN devices - two valley semiconductors, transferred electron mechanism, formation and drift of space charge domain, applications in resonant circuits.

REFERENCES

1. Solid State Electronic Devices
   B. G. Streetman, Printice Hall of India

2. Semiconductor and Electronic Devices
   Adhir Bar-Lev,Printice Hall of India.

3. Physics of Semiconductor Devices
   S.M.Sze, Wiley Eastern Ltd.

4. Semiconductor Devices and Circuits
   Henry Zanger, John Wiley and Sons.

5. Physics of Microwave Semiconductor Devices and their application
   H.A.Watson

EL 302 OPTOELECTRONICS

1. INTRODUCTION

Optoelectronics as application oriented science, basic elements of optoelectronic system, Dual nature of light, study of e.m. spectrum, photometric and radiometric systems for measuring intensity of light, different units for it and their interconversion.

2. LIGHT SOURCES

Natural, artificial and specialized light sources, their characterization based on intensity , spectrum emission, spectral distribution, conversion efficiency, Experimental methods for studying these characteristics, Use of monochromater and optical filters, their necessity, merits and demerits.

3. LIGHT DETECTORS

Idea of light detectors, Natural and specialized light detectors, types of special light detectors-thermal and quantum detectors, types of quantum photodetectors-photoresistive, photovoltaic and photoemissive detectors, photoelectric cell, photomultiplier tube, important characteristics of light detectors- spectral response, efficiency, materials used for photodetectors.

4. OPTICAL DISPLAYS

Necessity of optical displays, different categories of optical displays - indicators - numeric, alphanumeric and special function displays, characteristics of displays- view ability, response time, power requirements, reliability, Study of LED's, study of LCDS, dynamic, static and field effect LCDS, dynamic display-necessity and principle of operation, contrast improvance ratio, consideration of displays.

5. OPTICAL FIBER: Theory and Applications

Action of optical fiber as a waveguide, advantage of optical fiber communications, Necessary conditions for waveguiding mechanism of optical fiber, construction of a fiber, materials used for optical fibers, construction of a optical fiber cable, role of strength materials, types of optical fibers, step index and graded index fibers, Comparision of waveguiding actions, numerical aperture, time dispersion, splicing and fiber connectors, requirements and practical methods of splicing, Optical fiber connectors, losses in optical fiber communication, Fiber losses, intrinsic and extrinsic losses, Comparision between lossses, Modes of transmission and dispersion in optical fibers, double crucible and chemical deposition, methods of manufacturing optic fibers, applications of optical fibers.

6. APPLICATIONS OF OPTOELECTRONICS

Remote control, burglar alarm, shaft position encoder, level indicator, RPM counter, speed control

7. OPTICAL COMPUTING AND HOLOGRAPHY

Limitation of electronic computation, Advantage of optical computation, elements of optoelectronic computer, idea of SCM's, types of SCM's, Holography- basic principle, coherent requirements, applications.

8. LASERS

LASER as an amplifier of light, necoessary condition for amplification, special properties of LASER, study of three and four level lasers, study of tunable and semiconductor laser, applications of laser.

REFERENCES

1. An introduction to Optical fibers
   Cherin A.H.,Mc.Graw Hill, Int.Student Ed.

2. Optical fiber communication,
   Keiser.G., Mc.Graw Hill,Int.Student Ed.

3. Introduction to Optical Electronic
   K.A.Jones,Harper and Row

4. Optical Comminication system
   John Gower, Prentice Hall,Ind.

5. The Laser
   Hecht, Mc.Graw Hill

6. Optical electronics
   Ghatak and Thyagarajan, Cambridge university Press.

7. Optoelectronic :Fiber optics and Lasers
   A text Lab Manual , Morris Tischler, McGraw.Hill

EL 303 MICROPROCESSOR AND APPLICATIONS - I

1. MICROPROCESSOR ARCHITECTURE

Microprocessor architecture : Arithmetic and logic unit, timing and control section, registers. 8085 architecture, pin connections and signals.

2. MICROPROCESSOR TIMINGS

Opcode fetch operation, execute cycle, T-state, machine cycle, instruction cycle, wait state, instruction timings and state transition sequence.

3. PROGRAMMING WITH 8085

Assembly language instruction format, instruction set, writing assembly language programs, programming techniques, Arithmetic programs, code conversions, string handling; use of subroutines, recursive subroutines, use of stack.

4. INTERFACING MEMORY AND I/O DEVICES

Basic interfacing concepts, address space, address map, address decoding, interfacing o/p display, interfacing input keyboards, Interfacing memory, Memory mapped I/O, bus contension, synchronous transfer, Asynchronous transfer, interrupt driven data transfer, multiple interrupts, enabling, disabling and masking of interrupts, multiple DMA devices, DMA transfer.

5. INTERFACING DEVICES AND APPLICATIONS

Types of interfacing devices, programmable peripheral interface IC 8255, programmable interrupt controller IC 8259, programmable DMA controller IC 8257, programmable communication interface IC 8251, programmable interval timer IC 8253, programmable keyboard/display interface IC 8279.

Applications : Printer interfacing, ADC and DAC interfacing. Data acquisition system, GPIB interface.

6. DEVELOPMENT AIDS AND TROUBLESHOOTING TECHNIQUES

Microprocessor development system : Flowchart for program development, development board and target boards, hardware and software debugging, PMDS, troubleshooting tools, Hardware/Software integration , emulator.

7. APPLICATIONS OF MICROPROCESSORS

Temp. control system, speed control of d.c. motor, automatic traffic light control, flow control system, machine tool control.

8. SINGLE CHIP MICROCONTROLLER IC 8051

Architecture and instruction set.

REFERENCES

1. Introduction to Microprocessors
   A.P.Mathur,TMH New Delhi, Edition,1989

2. Introduction to microprocessors of Programming,Hardware and Software
   Lance Levanthal, Prentice Hall of India

3. Microprocessor and Digital system
   D.V.Hall,Mc.Graw Hill

4. Microprocessor-Principle and application
   Ajit Pal,TMH

5. Microprocessor-architecture,programming and application with 8085/8085
   R.S.Gaonkar, Wiley Eastern Limited

6. 8080/8085 Assembly language programming
   L. Levanthal, Prentice Hall of India

EL-304 SPECIAL LABORATORY I

PART A

1. To study 8085 signals and pin connections.

2. Write the arithmetic programs

   (a) To compute the factorial of a given number using Stack,
   (b) To compute the GCD of two numbers,
   (c) To arrange the given numbers in ascending/descending order.

3. Write code conversion programs to covert the decimal number to Hexadecimal number, Hexadecimal to BCD, ASCII to binary,using 8085 assembly language.

4. To study string processing using 8085 assembly language.

5. Interfacing stepper motor with 8085 microprocessor.

6. Interfacing Unencoded keyboard with 8085 microprocessor.

7. Interfacing Elevator/Simulator with 8085 microprocessor.

8. Interfacing multiplexed display with 8085 microprocessor.

9. To study different modes of IC 8253.

10. To study following features of IC 8279
    (a) N-Key roll over
    (b) 2-Key lockout
    (c) Right and Left entry display.

11. Study of microcontroller IC 8051 kit.

12. Writing Short programs for microcontroller.

13. Study of serial communication using 8085.

14. To convert firing angle of an SCR using 8085 microprocessor.

NOTE : Minimum 9 experiemnts must be completed by the student from part B.

PART B

1. To study characteristics of optoelectronic devices like LED, Photodiode, Phototransistor etc.

2. To study characteristics of solar cell-V_{oc}, I_{sc},R_s, dark and illuminated, temperature dependance, spectral,distribution, C-V measurements.

3. Study of Haynes-Schockley experiment for the determination of mobility and diffusion constant of minority carriers.

4. To measure the divergence of Laser beam and beam spot size.

NOTE : Minimum 3 experiemnts must be completed by the student from part B.

EL 421 MICROPROCESSORS AND APPLICATIONS II

1. 8086 ARCHITECTURE

Execution unit and Bus interface Unit, Registers, Instruction queue, segmentation, pin functions, maximum mode and minimum mode configuration, Comparision with 8088.

2. 8086 INSTRUCTION DESCRIPTION AND ADDRESSING MODES

Assembler instruction format, Addressing modes; Data and branch addressing, Data transfer instructions, Arithmetic instructions; Binary, Packed and unpacked BCD, Branch instruction: conditional and unconditional loop instructions, NOP and HLT instructions, flag manipulation instrucftions, logical instructions, shift and rotate instructions, string instructions, Directives of operators.

3. ASSEMBLY LANGUAGE PROGRAMMING

Segment definition, simple arithmetic programs, code conversions, use of stacks, procedures, recursive procedures, use of macros; use of REP prefix, programmed I/O.

4. INTERRUPTS AND ISR

8086 interrupts and responses, interrupt pointer table, interrupt priority, uses of interrupts.

5. INTERFACING APPLICATIONS

Interfacing keyboard, alphanumeric displays, multiplexed displays, centronix parallel input printer, stepper motor, force measurment, microprocessor based industrial process control system ,temperature controller. Digital data transmission using modems and standard phone lines. Asynchoronous communication, software on IBM PC, GPIB, HPIB and IEEE-488 bus.

6. MULTIPLE MICROPROCESSOR SYSTEMS

DMA data transfer, coprocessor 8087 math coprocessor, 8087-8086 cooperation, 8087 instruction set, 8089 I/O processor, architecture, communication between CPU IOP instruction set.

7. CAD

Introduction,Design Process,Applications of computer for design,Benifits of CAD,Software configuration of graphic system, function of graphic package, constructing the geometry, transformation.

8. NUMERIC CONTROL

The beginning of CAM, Basic components of NC system, NC procedure, NC coordinate systems, NC motion control systems, Applications of NC, CNC, DNC, combined CNC/DNC systems, Adaptive control

9. NC PART PROGRAMING

Punched tape in NC,Tape Coding and Format, Manual part programming, Computer assisted part programming, APT Language, MACRO statement in APT,NC programming with interactive graphics, Voice NC programming, manual data input.

10. INDUSTRIAL ROBOTICS

Robot technology: Robot physical configurations,Basic Robot motions, Other technical features,programming the Robot,Robot Programming languages,End effectors,Work cell control and interlocks, Robotic sensors, Robot applications; material transfer, machine loading, spray coating, processing operations.

11.ADVANCED MICROPROCESSORS

Basic features of the advanced microprocessors, Introduction to 80186, 80286, 68020, 68030 single chip microcomputers, digital signal procesing microprocessors, RISC microprocessors, INMOS transputer.

REFERENCES

1. Microprocessor and interfacing programming and hardware Douglas Hall, Mc.Graw Hill International Editions 1986.

2. Microcomputer systems The 8086/8088 family,architechture, programming and design
   Yu-Cheng Liu, Glenn A.Gibson,PHI

3. Microprocessor based process control
   C.D.Johnson,PHI

4. CAD/CAM -Computer Aided Design and Manufacturing
   M.P. Grover and E.W..Zimmers,Jr, PHI New Delhi,1985

5. Microprocessors with application in process control
   S.I.Ahson, TMH Co Ltd.

6. Computer contrclled Industrial machines:process and Robots
   Gupton, PHI

7. The CAD CAM process
   Hawkes Barry,Wheeler, Allahabad

8. Microprocessor and Microcomputer based system design
   Mohamed Rafiquzzaman,Universal book stall, New Delhi

EL402 COMMUNICATION ELECTRONICS

1. INTRODUCTION

Communication, signals and their classifications, Fourier analysis of signals and systems, Elements of communication system (Shanon model), Transmission of message signals, Limitation and resources of communication systems.

2. ANTENNAS

Fundamentals of antenna, antenna parameters, Dipole Antenna, resonant and non-resonant antenna, arrays of antenna, Yagi-Uda array log periodic antenna, broad side array, end fire rhombic antenna, reflector antenas, Horn antenna, Helix antena, Arrays of array, Loop antennas, Turnstile antenna, Dielectric rod (polyrod) antennas, slot antennas, supergain antennas, practical transmitting and receiving antennas.

3. ANALOG SIGNAL TRANSMISSION

Frequency division multiplexing. time division multiplexing, pulse amplitude modulation, pulse width modulation, Pulse position modulation, multiplier modulation and demodulation circuits, PLL modulation and demodulation circuits. Comparision of CW modulation schemes. commercial TV broadcasting and reception system.

4. DIGITAL AND DATA COMMUNICATION

Pulse code modulation : sampling theorem, generate and reconstruction, Delta modulation, Differential PCM, Baseband PCM transmission (RZ and NRZ AMI scheme), Error control codes: Error control strategies, Block codes, cyclic codes, convolutional codes.

Digital Modulation Methods : Frequency shift keying, Binary PSK, Quarature PSK, M-array PSK, Differential binary PSK, Minimum Shift keying, Quadrature amplitude modulation.

5. INFORMATION THEORY

Discerte messages, the concept of amount of information, Average information, entrpy, information rate, coding to increase average information per bit, Shannon's theorem, channel capacity of Gaussian channel.

6. MICROWAVE COMMUNICATION SYSTEM

Microwave frequency range, correspondance between field and circuit concepts, applications of microwaves, principles of microwave communication, various types of microwave radio communication systems: line of sight systems and tropospheric microwave systems, Radar system.

7. OPTICAL COMMUNICATION SYSTEM

Block diagram of transmitter and receiver, Block diagram of simple point to point link, A flowchart for a typical fibre optic link design, line codes for optical fibre links, wavelength division multiplexing, Data buses, LAN systems, coherent optic fibre receiver systems.

8. SATELLITE COMMUNICATION

Introduction, satellite links, Eclipses, orbits and inclination, satellite construction, satellite communication frequency.

9. TELEPHONE NETWORK

Elemental phone system, public telephone network, central switching, Hierarchy of Switching offices, Switched lines and leasad lines, the crossbar switch common control, mobile telephone communication,the callular concept.

REFERENCES

1. Antennas
   R.E.Collin,Mc.Graw Hill

2. Principles of Communication Systems
   Taub and Schilling,Mc.Graw Hill

3. Digital Satellite Communication
   Tri T.Ha,Mc.Graw Hill.

4. Fiber Optical Communication
   D.C.Agrawal,A.H.Wheeler and Co.

5. Digital and Analog Communication Systems
   K.Sam Shanmugan,John Willey.

6. Principles of Digital and Analog Communication
   Jerry D.Gibson,Maxwell Mc.Millan Int.Editions.

7. An Introduction to the Principles of Communication Theory
   John C.Hancock,TMH

8 Electronic Communication Technology
   Edward Wilson,PHI

KLE 403 SEMICONDUCTOR SCIENCE AND TECHONOLOGY

1. CRYSTAL GROWTH AND WAFER PREPARATION

Ca and Bridgeman techniques, zone refining, Ingot shaping, polishing, cutting, wagering, Scribe lines, cleavage.

2. DIFFUSION

Nature of diffusion, Interstial and substitutional gradient, The diffusion concentration, field aided motion, iteration with charged defects, the dissociative process,Impurity behaviour in silicon,substitutional diffusers, interstial substitutional diffusers.

3. EPITAXY

Vapour phase epitaxy, Basic transport process and reaction kinetics, reaction at the substrate, Elements of nucleation and growth, Doping and autodoping, Process selection and capabilities, buried layer epitaxial defects. Formation of GaAs (reactions involved) liquid phase epitaxy, Tilt type growth furnace, Slider boat arrangement. Reactors for Si and GaAs growth ,Molecular Beam Epitaxy (MBE), Silicon,insulators, sapphire and amorphous substrates. Evaluation of Epi-layers : Sheet resistance, Mobility and carrier concentration and impurity profile measurements.

4. OXIDATION

Thermal oxidation of silicon, intrinsic and extrinsic silica - glass, oxide formation, kinetics of oxide growth, network formers, Network Breakers bridging oxygen.

Thermal oxidation : Dry, wet, rapid thermal, pyrogenic oxidation. Halogenic low pressure oxidations. Techniques and oxidation (chlorine enhanced oxidation), Oxidation furnaces, high and low pressure oxidations. Techniques and difficulties in growing good quality thin oxide layers. Oxidation induced stacking faults.

Anodic oxidation systems : thermal oxidation of GaAs difficulties in growing oxide layer on GaAs with thermal oxidation.

Plasma oxidation : Deal grove model assumptions, the agreement with experimental results, segregation coefficient, impurity redistribution during oxidation, failure of Deal grove model in initial stages, Model micropores field enhanced oxidation. Properties of thermal, anodic and plasma oxides evaluation of oxide layers.

5. DEPOSITION TECHNIQUES

Vaccum deposition, chemical vapour deposition, plasma assisted deposition, electroplating. Deposition techniques specifically for metal, dielectric, polysilicon and polymer films.

EE 404 SPECIAL LABORATORY II

PART A

1. To study 8086 signals and pin connections.
2. Write arithmetic programs
   (a) To compute the factorial of a given number using Stack,
   (b) To compute the GCD of two numbers,
   (c) To arrange the given numbers in ascending/descending order,
   using 8086 MACRO/PROCEDURE.
3. Write code conversion programs to covert the decimal number to Hexadecimal number, Hexadecimal to BCD, ASCII to binary,using MACRO/PROCEDURE.
4. To study string processing using 8086 assembly language.
5. Study of 8086 interrupts.
6. Interfacing Simple Key switches and displays.
7. Interfacing thumbwheel switch.
8. Interfacing DAC / ADC.
9. Interfacing relay.
10. Music generation using IC 8255.

NOTE : Minimum 3 experiemnts must be completed by the student from part A.

PART B

1. To study Communication between microprocessor and PC.
2. PAM, PDM and PPM using IC 555 and PLL.
3. Design, built and test Time Division Multiplexer.
4. Design,built and test amplifiers (Power and Voltage) in communication.
5. Charasteristics of audio transducers- Microphone,Loudspeaker.
6. Designing, building and testing of oscillators AF,RF,Local in communication system.
7. Code generation using convolution method.
8. Frequency modulation and demodulation using PLL.
9. Built and test Digital transmitter/receiver circuit.
10. Built and test 1MHz NRZ transmitter.
11. To study LED modulation
12. Study of AM communication system(transmitter and receiver)

NOTE : Minimum 7 experiemnts must be completed by the student from part B.

PART C

1. To determine the pumping speed of rotary pump.
2. Thin film deposition by evaporation technique.
3. Characteristics of PEC cell.
4. Electroplating and study of adhesion, porosity and etching.

NOTE : Minimum 2 experiemnts must be completed by the student from part C.