APPENDIX – AE29

MANONMANIAM SUNDARANAR UNIVERSITY

TIRUNELVELI – 627012

DIRECTORATE OF DISTANCE AND CONTINUING EDUCATION

M.SC. PHYSICS

Effective from the Academic Year 2016 – 2017 onwards

SCHEME OF EXAMINATION

I Year		**Credits**
Classical Mechanics & Statistical Mechanics	Paper - 1	4
Mathematical Physics	Paper – 2	4
Digital Electronics	Paper – 3	4
Electromagnetic theory	Paper – 4	4
Solid State Physics – I	Paper – 5	4
Nuclear Physics	Paper – 6	4
Practical – 1 (Electronics)	Paper – 7	6
Practical – II (C++ Programming)	Paper – 8	6
II Year		
Quantum Mechanics	Paper – 9	4
Molecular Spectroscopy	Paper – 10	4
Lasers and Opto Electronics	Paper – 11	4
Solid state Physics - II	Paper – 12	4
Microprocessor	Paper – 13	4
Numerical Methods	Paper – 14	4
Practical – III (Non – Electronics)	Paper – 15	6
Practical – IV (Microprocessor)	Paper – 16	6
Total No. of Credits		**72**

Eligibility: The eligibility for admission to M.Sc. Physics is a pass in B.Sc. Physics degree (with Mathematics as one of the allied subjects) or an equivalent degree

Duration: Two years. Examinations will be conducted at the end of the first year and the second year

PAPER 1 CLASSICAL MECHANICAL AND STATISTICAL MECHANICS

Unit I: Lagrangian and Hamiltonian formulations

Hamilton's principle, Derivation of Lagrange's equations from Hamilton's principle, Principle of Least Action and its applications, Canonical Transformation; The Hamiltonian Formalism: Canonical formalism, Hamiltonian equations of motion, Cyclic coordinates, Rauthian procedure and equations, Derivation of Generating functions, examples, properties, Derivation of Hamiltonian equations from variational principle.

Unit II: Poisson bracket and theory of small oscillations

Poisson bracket, special cases of Poisson bracket, Poisson theorem, Poisson bracket and canonical transformation, Jacobi identity and its derivation, Lagrange bracket and its properties, the relationship between Poisson and Lagrange brackets and its derivation, the angular momenta and Poisson bracket, Liouville's theorem and its applications; Theory of small oscillations: Formulation of the problem, Eigenvalue equation and the principle axis transformation, frequencies of free vibrations and normal coordinates, free vibrations of a linear triatomic molecule

Unit III: Two-body central force problem and H-J theory

Two body central force problem: Reduction to the equivalent one body problem, the equation of motion and first integrals, classification of orbits, the Virial theorem, the differential equation for the orbit, integrable power law in time in the Kepler's problem, scattering in central force field; H-J Theory: H-J equation and their solutions, use of H-J method for the solution of harmonic oscillator problem, Hamilton's principle function, Hamilton's characteristic function and their properties, Action angle variables for completely separable systems, the Kepler's pro blem in action angle variables

Unit IV: Classical Statistical Mechanics

Foundations of Statistical Mechanics: The macroscopic and microscopic states, Postulate of equal a priori probability, Contact between statistics and thermodynamics; Ensemble theory: Concept of ensemble, Phase space, Density function, Ensemble average, Liouville's theorem, Stationary ensemble; The microcanonical ensemble, Application to the classical ideal gas; The canonical and grand canonical ensembles, Canonical and grand canonical partition functions, Calculation of statistical quantities; Thermodynamics of a system of non-interacting classical harmonic oscillators using canonical ensemble, and of classical ideal gas using grand canonical ensemble,

Energy and density fluctuations; Entropy of mixing and the Gibbs paradox, Sackur-Tetrode equation.

Unit V: Quantum Statistical Mechanics

Quantum-mechanical ensemble theory: Density matrix, Equation of motion for density matrix, Quantum- mechanical ensemble average; Statistics of indistinguishable particles, Two types of quantum statistics- Fermi-Dirac and Bose-Einstein statistics, Fermi-Dirac and Bose-Einstein distribution functions using microcanonical and grand canonical ensembles (ideal gas only), Statistics of occupation numbers; Ideal Bose gas: Internal energy, Equation of state, Bose-Einstein Condensation and its critical conditions; Bose-Einstein condensation in ultra-cold atomic gases: its detection and thermodynamic properties; Ideal Fermi gas:Internal energy, Equation of state, Completely degenerate Fermi gas.

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Books for Study and Reference

1. Classical Mechanics (3rd ed., 2002) by H. Goldstein, C. Poole and J. Safko, Pearson Edition
2. Classical Mechanics-J. C. Upadhyaya- Second Edition-2005-Himalaya Publishing House
3. Classical Mechanics-G. Aruldhas-2008-PHI Learning Pvt.Ltd.
4. Classical Mechanics-A Text Book-Suresh Chandra-Narosa Publications
5. Statistical Mechanics by R. K. Pathria (2nd edition)
6. Statistical Mechanics by R. K. Pathria and P. D. Beale (3rd edition)
7. Statistical Mechanics by K. Huang
8. Statistical Mechanics by L. D. Landau and I. M. Lifshitz

PAPER 2 MATHEMATICAL PHYSICS

UNIT 1 Vector space and Matrices

Linear independence of vectors- Dimension- Basis- Inner product of two vectors- Properties of inner product- Schmidt's orthonormalisation method - Linear transformations- Matrices- inverse of a matrix- orthogonal matrix- unitary matrix- eigen value and eigen vectors of a matrix- Diagonalisation- Cayley-Hamilton Theorem

UNIT II Functions and polynomials

Beta, Gamma functions- Dirac delta function and its properties- Green's function- Bessel differential equation-Generating function for $J_n(x)$- Recurrence relation for $J_n(x)$- Legendre differential equation- Generating function for $P_n(x)$- Recurrence relation for $P_n(x)$- Hermite differential equation- Generating function $H_n(x)$- Reccurrence relation for $H_n(x)$

UNIT III Fourier and Laplace Transform

Fourier transform- Properties of Fourier transform- convolution- Fourier cosine and sine transform- Fourier transform of derivatives- Applications of Fourier transform- vibrations in a string- Laplace transform- Properties of Laplace transform- Inverse Laplace transform - Applications of Laplace transform- Simple harmonic motion

UNIT IV Complex analysis

Complex variables- complex conjugate and modulus of a complex number- Algebraic operations of complex numbers- Function of a complex variable- Analytic function-Cauchy-Riemann equation in the polar form- Line integral of a complex function- Cauchy Integral Theorem- Cauchy integral formula- Derivatives of an analytic function

UNIT V Group theory

Concept of a group- Group multiplication table of order 2, 3, 4 groups- Group symmetry of equilateral triangle- Group symmetry of a square- Permutation group- conjugate elements- Representation through similarity transformation- Reducible and irreducible representation- SU(2) group- SO(2) group

Books for Study and Reference

1. An Introduction to Mathematical Physics- Suresh Chandra & Mohet Kumar Sharma
2. Mathematical Physics- Satyaprakash
3. Applied Mathematics for Engineers and Physicists, Louis A. Pipes, Lawrence R
4. Mathematical Physics- Eugene Butkov

Paper 3 DIGITAL ELECTRONICS

UNIT I Number systems

Binary coded decimal number system, Grey code, Grey code to Binary conversion, Binary to Grey code, Excess 3 code, Decimal to excess 3 code, ASCII code.

Universal logic gates: NAND and NOR gates as universal logic gates – Simplification of logic circuits – De Morgan's laws – Boolean laws – Karnaugh maps – three variable and four variable maps – max and min terms.

UNIT II Arithematic circuits

Half adder – Truth table and circuit – Full adder – Truth table and circuit – Four bit adder – Half subtractor – Full subtractor – Multiplexer: Four input multiplexer – Applications of Multiplexer – demultiplexer – Decoders 2 to 4 decoder – BCD to seven segment decoder – encoders.

UNIT III Flipflops

Introduction – NAND LATCH, J K flipflop – J K Master – slave flipflop – D flipflop and T flipflop – Registers and Counters: Shift registers – serial in – parallelout, serial in – serial out, parallel in – serial out, parallel in – parallel out shift registers – wave forms for the above – Counters – up counters, down counters, decade counters, timing sequences, Mod – n counters.

UNIT IV Multivibrators

Classification of multivibrators – Astable, monostable, bistable multivibrators using operational amplifier.

D/A and A/D converters: Binary weighted register D/A converter using Op-Amp – R-2R ladder D/A converter with Op-Amp – Analog to Digital converters (ADC) – their characteristics.

UNIT V Semiconductor Memories

memory cell unit – ROM, RAM – Their classifications – ROM, PROM, EPROM, EEPROM, RAM,Static RAM, dynamic RAM, Memory read and memory write operations – Flash memory - Charge coupled Device (CCD).

Books for Study and Reference:

1. Digital Electronics principles and applications – Soumitra Kumar Mandal - Tata MCGraw Hill publications – New Delhi.

2. Integrated Electronics – Digital and Analog – V.Vijayendran (S.Viswanathan printers and publications) - 2005
3. Digital Electronics by Millman and Taub
4. Electronics Fundamentals and Applications- John D Ryder

PAPER 4 ELECTROMAGNETIC THEORY

UNIT I Electrostatics

Coulomb's Law-charge distributions- Lines of force and flux-Gauss's Law and its applications- The potential function- Poission's equation and laplace equation- Equi potential surfaces- field due to continues charge distribution- energy associated to an electrostatic field- Electrostatic uniqueness theorem.

UNIT II Magnetostatics

Lorentz force – Faraday's law – Magnetic field strength and Ampere's circuital law- Biot-Savart's law – Ampere's force law – magnetic vector potential – Equation of continuity. The far magnetic field of a current distribution- Magnetic field due to volume distribution of current

UNIT III Dielectrics;

Polarization – the electric field inside a dielectric medium – Gauss law in dielectric and the electric displacement – Electric susceptibility and dielectric constant – Boundary conditions on the field vectors – dielectric sphere in a uniform electric field- Force on a point charge embedded in a dielectric

UNIT IV Maxwell's equation and propagation of EM waves:

Maxwell's equations and their physical significance – plane wave equation in homogeneous medium and in free space – relation between E and H vectors in a uniform plane wave- the wave equation for a conducting medium - skin depth – wave propagation in dielectric. Poynting vector - Poynting's theorem

UNIT V Waves in bounded region and Radiation

Reflection and refraction of EM waves at the boundary of two conducting media – Normal incidence and oblique incidence – Brewster's angle- wave guides – rectangular wave guide – cavity resonators – radiation from and oscillating dipole –Transmission line theory –transmission line as distribution circuit- Basic transmission line equations

Books for Study and Reference

1. Foundation of EMT - third edition - John R. Reity, Frederick J. Milford, Robert W. Christy
2. Electromagnetic theory – Prabir K. Basu and Hrishikesh Dhasmana
3. Introduction to Electrodynamics, David J Griffiths
4. Electromagnetic fields and waves, P.Lorrain and D.Corson
5. Electrodynamics , B.P.Laud

PAPER 5 SOLID STATE PHYSICS –I

Unit I: Crystal Structure and Diffraction

Recapitulation of basic concepts- crystal systems- Bravais Lattice- Miller indices-symmetry elements- symmetry groups- simple crystal structures (sodium chloride, cesium chloride, diamond and zincblende structures)

Bragg's law- Laue equations- reciprocal lattice- Brillouine zones- atomic scattering factor- geometrical structure factor- experimental methods of structure analysis (the laue, rotating crystal and powder methods)

Unit II: Crystal Binding and Elastic properties of Solids

Crystal bindings: Ionic bond- covalent bond- molecular bond- Hydrogen bond- metallic bond- Vanderwaal's bond-Binding energy of crystals- polaron

Elastic properties: Stress components- displacement and strain components- elastic compliances and stiffness constants- relation between elastic compliances and stiffness constants -elastic constants for cubic isotropic crystals-elastic waves- experimental determination of elastic constants

Unit III: Lattice dynamics and thermal properties

Lattice dynamics: Concept of phonons- momentum of phonons- normal and Umklapp process- vibrations of one dimensional monoatomic and diatomic linear lattices- inelastic scattering of neutrons by phonons

Thermal properties: Theories of specific heat- Dulong and Petit's law- Einstein theory and Debye's theory- Widemann Franz law

Unit IV: Electronic properties of solids

Free electron gas model in three dimensions: Density of states- Fermi energy- Effect of temperature- heat capacity of electrons- experimental heat capacity of metals- thermal effective mass- electrical conductivity and ohm's law- Hall effect- failure of the free electron gas

Band theory of solids- periodic potential and Bloch's theorem- Kronig- Penny model-wave equation of electron in a periodic potential- periodic, extended and reduced zone schemes of energy representation- number of orbitals in an energy band- classification of metals, semi conductors and insulators- tight binding method and its applications to FC and BCC structures

Unit V: Super conductivity

Experimental survey: Superconductivity and its occurrence- destruction of superconductivity by magnetic field- Meissner effect- Type I and II super conductors-entropy- free energy- heat capacity- energy gap- isotope effect

Theoretical survey: Thermodynamics of the superconducting transition- London equation- coherence length- salient features of the BCS theory of super conductivity- flux quantization in a superconductivity ring- DC and AC Josephson effects

Books for Study and Reference

1. Introduction to Solid State Physics - 7 th edition - by Charles kittel
2. Solid State Physics by Neil W Ashroff and N.David Mermin
3. Solid State Physics by S.L. Kakani and C. Hemarajani
4. Elementary Solid State Physics by M. Ali Omar

PAPER 6 NUCLEAR PHYSICS

Unit I Properties of nucleus and nuclear forces

Quantum properties of nuclear states: Nuclear energy levels nuclear angular momentum, parity, isospin, Statics , nuclear magnetic dipolement

Nuclear models: Liquid drop model- Bohr-wheeler theory of nuclear fission – Shell model – predictions of shell model – collective nuclear model

Unit II Nuclear reaction and nuclear decay

Types of nuclear reactions, elastic scattering, inelastic scattering, disintegration, radiative capture , direct reaction – conservation laws – law of conservation of energy, momentum, angular momentum, charge, spin , parity. Nuclear reaction kinemetics – Expression for Q-value

Nuclear decay: Gawmow's theory of alpha decay, Fermi's theory of beta decay – Fermi and Gawmow Teller selection rules – internal conversion – nuclear isomerism

Unit III Nuclear forces and Properties of nuclear forces

Deutrons – properties of deuteron- ground state of deuteron – excited state – magnetic quadrupole moment of deuteron- neutron- proton scattering at low energies – proton – proton scattering at low energies – meson theory of nuclear forces- reciprocity theorem – Breit- wigner one level formula

Unit IV Neutrons

Neutron source - properties of neutron - , charge , spin and statistics, decay, magnetic moment – classification of neutrons – neutron diffusion – neutron current density, neutron leakage rate, thermal neutron diffusion, fast neutron diffusion ,Fermi age equation –nuclear reactors, nuclear chain reaction - four factor formula – general aspects of nuclear reactors – classification of nuclear reactors.

Unit V Nuclear particles

Classification of elementary particles – particle interaction – conservation laws- leptons Hardons- pion - muons – mesons – hyperons - strange particle – CPT theorem -- quark model- Elementary particle symmetries SU(2) and SU(3) symmetry

Books for Study and Reference

1.Nuclear Physics-D C Tayal

2. Elements of Nuclear Physics-M C Pandia and R P S Yadav

3.Concept of Nuclear Physics-Bernard L Cohen

4.Nuclear Physics an Introduction-S B Patel

5.Nuclear Physics-R R Roy and B P Nigam

PAPER 7 PRACTICAL – I ELECTRONICS

Any 10 Experiments

1. SCR Characteristics
2. UJT characteristics & Relaxation Oscillator
3. Construction of Dual regulated power supply using IC 78XX
4. Two stage RC coupled Transistor Amplifier- with and without feedback
5. Half adder and Full adder
6. Half Subtractor and Full Subtractor
7. Voltage to current and current to voltage converter - OP AMP
8. Study of Flip-Flops and verification of Truth Tables [RS,JK and D]
9. Square wave generator using IC741 and IC555
10. Wien's bridge Oscillator -using OPAMP
11. Differentiator and Integrator -using OPAMP
12. Solution of simultaneous equations using IC 741C
13. Schmitt Trigger
14. Phase Shift Oscillator
15. Mod 'n' Counters
16. Sine Wave, Square wave & Triangular wave generator using IC 741C
17. D/A Converter- R-2R method
18. D/A Converter- Weighted Resistor method
19. Active filters[Low, high, Band- Pass] using OPAMP
20. Triangular and Saw tooth waveform generators using OPAMP
21. Monostable and Astable Multivibrator using IC741C

PAPER 8 PRACTICAL II C++ PROGRAMMING

Any 10 Experiments

1.Solution of simultaneous equation-Gauss elimination method- currents in a network

2.Using Runge- Kutta method to find a solution for any physical problem (Radio active Decay)

3.Using Euler's method, to find a solution for any physical problem

4.Evaluate $\int_0^1 xe^x dx$ using Simpson's 1/3 and 3/8 rule

5.Using Mante-Carlo method,evaluate area under a bell shaped curve $y = e^{-x^2/2}$

6.Program to get Eigen values and eigen vectors of symmetry matrices

7.Newton’s law of cooling(or any physical problem) using numerical differentiation method

8.Newton’s Raphson method used to find a solution of Polynomial equations

9.Program to perform Matrix multiplication

10.Curve fitting to straight line and data interpolation-(Cauchy’s constants)

11.Program to implement Gauss-Jordan elimination method to find inverse of a matrix

12.Program to solve any linear equation in one variable

13. Program to find basis and dimension of a matrix

14. Program to check if a matrix is invertible

15. Program to represent a set of linear equations in matrix form

16. Program to evaluate the determinant of a given matrix

17. Program to find the band width and resonance frequency of LCR circuit

18. Program to get Fourier transform of a square wave or a rectangular wave

19. Program to rotate a given point (x, y) by an angle 45^0, 60^0 using the rotation matrix

20. Program to simulate low pass, high pass and band pass filters

II YEAR

PAPER 9 QUANTUM MECHANICS

Unit I: The Schrodinger Equation and Stationary States

Physical basis of quantum mechanics – wave particle duality- The Schrödinger equation (time dependent and time independent) – Physical interpretation and conditions on the wave function – Expectation values and Ehrenfest's theorem – Stationary states and energy spectra – Particle in a square well potential.

General Formulation: The fundamental postulates of wave mechanics – Dirac notation: Bra and Ket – Hilbert space – Hermitian operators and their properties – Commutator relation and Heisenberg's uncertainty principle.

Unit II: Exactly Solvable Systems

Linear harmonic oscillator – Solving the one dimensional Schrodinger equation – Abstract operator method – Particle in a box- Square well potential–Rectangular barrier potential – Rigid rotator – Hydrogen atom.

Unit III: Approximation Methods

Time independent problems: Non-degenerate case: First and second order perturbations – Degenerate case: Zeeman Effect – Stark effect – variational method – WKB Quantization rule.
Methods for Time Dependent problems: Time dependent perturbation theory – First order perturbation – Harmonic perturbation – Transition probability – Fermi's Golden rule – Adiabatic approximation – Sudden approximation.

Unit IV: Angular, Spin angular Momentum and Scattering theory

Matrix representation of angular momentum and spin angular momentum – Commutation relations – Eigen values – Addition of angular momenta – Clebsch-Gordan coefficients (basic ideas only) – Identical particle with spin- Pauli's exclusion principle- Spin statistics- Stern Gerlach experiment and electron spin.

Scattering theory: The scattering cross section-Born approximation-Partial wave analysis – Differential and total cross sections – Phase shift.

Unit V: Relativistic Quantum Mechanics

Klein-Gordon equation for a free particle and in an electromagnetic field – Dirac equation for a free particle – Charge and current densities.

Dirac matrices – Plane wave solution – Negative energy states – Zitterbewegung – Spin angular momentum – Spin-orbit coupling- Fine structure

Books for Study and reference:

1. L. Schiff, *Quantum Mechanics* (Tata McGraw Hill, New Delhi, 1968).
2. P. M. Mathews and K. Venkatesan, *A Text Book of Quantum Mechanics* (Tata McGraw Hill, New Delhi, 1987).
3. V.K. Thankappan, *Quantum Mechanics* (Wiley-Eastern, New Delhi, 1985)
4. J. Singh, *Quantum Mechanics: Fundamentals and Applications to Technology* (John Wiley, New York, 1997).
5. Goswami, *Quantum Mechanics* (W.C. Brown, Dubuque, 1992).
6. Y.R. Waghmare, *Foundations of Quantum Mechanics* (Wheeler, New Delhi, 1996).
7. S. Devanarayanan, *Quantum Mechanics* (SciTech Publications Pvt Ltd, Chennai, 2005

PAPER 10 MOLECULAR SPECTROSCOPY

Unit I: Microwave spectroscopy

Classification of molecules – Rotational spectra of rigid diatomic molecules- Isotope effect-Non rigid rotator- linear polyatomic molecules- symmetric top molecules – asymmetric top molecules –Microwave spectrometer- information derived from rotational spectra.

Unit II: Infrared spectroscopy

Vibrational energy of a diatomic molecule – Selection rules – vibrating diatomic molecule – diatomic vibrating rotator –asymmetry of rotation – vibration band –vibrations of polyatomic molecules – Rotation-vibration spectra of poly atomic molecules –interpretation of vibrational spectra – IR spectrophotometer- sample handling techniques - fourier transform IR spectroscope –applications.

Unit III: Raman spectroscopy

Theory of Raman scattering- rotational Raman spectra – vibrational Raman spectra – Raman spectrometer- structure determination using IR and Raman spectroscopy

Hyper Raman effect – classical treatment of Raman effect- Experimental techniques for Hyper – Raman effect – stimulated Raman scattering – Inverse Raman scattering – CARS – PARS –SERS (basic ideas only).

Unit IV: Electronic spectroscopy

Vibrational coarse structure –Vibrational analysis of band systems - Deslanders table – progressions and sequences –Franck condonprinciple –Rotational fine structure of electronic vibration spectra- the fortrat parabola – Dissociation – Pre dissociation-photoelectron spectroscopy – Instrumentation – information from photoelectron spectra.

Unit V: NMR, ESR, NQR, Mossbauer spectroscopy

NMR: Magnetic properties of nuclei –resonance condition –NMR instrumentation- relaxation process –Bloch equations – chemical shift.

ESR: principle –ESR spectrometer- Hyper fine structure –ESR spectra of Hydrogen atom.

NQR: The quadrupole molecules –principle – transitions for axially and nonaxially symmetric systems –NQR instrumentation.

Mossbauer: Recoilless emission and absorption – Mossbauer spectrometer – Isomer shift – application.

Book for study and reference :

1. G.Aruldhas, "Molecular structure and spectroscopy", second edition, practice – Hall of India, Pvt Ltd, New Delhi – 110001, 2007
2. Fundamentals of Molecular Spectroscopy-Colin N Banwell and Elaine M Mccash
3. Spectroscopy-G R Cghatwal and S K Anand

PAPER 11 LASERS AND OPTO ELECTRONICS

UNIT I LASERS

Lasers: Stimulated and spontaneous emission- Einstein's A & B coefficients- relation between them- condition for light amplification- Population inversion- Pumping methods and schemes- optical resonator-theory and condition for oscillation- modes-Laser Rate equations- solid state lasers: Ruby & Nd:YAG- Gas lasers: He-Ne and Co_2 lasers- Dye laser- semiconductor diode laser

Applications: Lasers in mechanical industry, Electronics industry, nuclear energy, medicine, Defence, communication- measurement of distance and velocity

UNIT II BASICS OF SEMICONDUCTORS

Nature of light - light sources- black body - colour temperature - units of light - radiometric and photometric units - basic semiconductors - PN junction-carrier recombination and diffusion - injection efficiency - hetero junction - internal quantum efficiency - External quantum efficiency - double hetero junction - fabrication of hetero junction - quantum wells and super lattices .

UNIT III OPTOELECTRONIC DEVICES

Optoelectronic devices - Optical modulators - modulation methods and modulators – transmitters - optical transmitter circuits - LED and laser drive circuits- LED – power and efficiency - double hetero LED - LED structure - LED characteristics - Junction laser operating principles - Condition for laser action - Threshold current – Homo junction – Hetero junction - Double hetero junction lasers - Quantum well laser - Distributed feedback laser - laser modes, strip geometry- gain guided lasers- index guided lasers.

UNIT IV OPTICAL MODULATORS AND DETECTORS

Modulation of light – birefringence - electro optic effect - EO materials - Kerr modulators - scanning and switching - self electro optic devices - MO devices, AO devices - AO modulators.

Photo detectors - thermal detectors – photoconductors – detectors - photon devices - PMT- photodiodes - photo transistors - noise characteristics - PIN diode - APD characteristics - APD design of detector arrays – CCD - Solar cells

UNIT V DISPLAY DEVICES

Display devices – photoluminescence - EL display - LED display - drive circuitry - plasma panel display - liquid crystals – properties - LCD display - numeric displays.

Book for study and reference

1. M.N.Avadhanulu, An Introduction to Lasers: Theory and Applications, S.Chand and Company Ltd, New Delhi, I st Edition, 2001[For unit I]
2. J. Wilson & J.F.B. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, India, 1996.
3. P. Bhattacharya, "Semiconductor optoelectronic devices", Second Edn Pearson Education, Singapore, 2002.
4. J. M. Senior, "Optical fiber communication", Prentice-Hall India, 1985.
5. J. Gowar, "Optical fiber communication systems", Prentice–Hall, 1995.
6. J .Palais, "Introduction to optical electronics", Prentice– Hall, 1988.
7. Jasprit Singh, "Semiconductor optoelectronics", McGraw–Hill, Inc, 1995.
8. R. P. Khare, "Fiber optics and Optoelectronics", Oxford University Press, 2004.

PAPER 12 SOLID STATE PHYSICS II

Unit I : Semi conductor crystals and Fermi surfaces

Semi conductor crystals: Band gap- Direct and indirect absorption processes- motion of electrons in an energy band- holes- effective mass- physical interpretations of effective mass- effective masses in semiconductors

Fermi surfaces and metals: Fermi surface and its construction for square lattice- (free electrons and nearly free electrons)- electron orbits- hole orbits- open circuits- Wigner-Seitz method for energy band-experimental determination of Fermi surface-De Hass-Van Allhen effect

Unit II : Imperfections in crystals

Introduction- classifications of imperfections- Schottky defects- Frenkel defects- extrinsic vacancies-colour centres- excitons- dislocations- dislocation energies- dislocation and shear strength of single crystals-plane defects- the Sonder-Sibley notation rules for point defects in insulator

Unit III : Dielectrics and Ferro electrics

Polarization- Macroscopic electric field- Dielectric susceptibility- local electric field at an atom - dielctric constant and polarizability- Clausius-Mossotti relation- electronoic polarizability- classical theory of electronic polarizability

Structural phase transitions: Ferro electric crystals and their classification- Landau theory of phase transition- anti ferro electricity- ferro electric domain- piezoelectricity- ferro elasticity

Unit IV : Magnetism 1

Magnetic susceptibility- magnetic permeability- magnetization- electron spin and magnetic moment-diamagnetism- theory of diamagnetism- paramagnetism- Langevin's theory of paramagnetism- Weiss theory- Hund's rule- paramagetic susceptinbility of a solid- quantum theory of paramagnetism- cooling by adiabatic demagnetization- determination of susceptibility of para and dia magnetic materials-theory-Guoy method- Quincke's method

Unit V : Magnetism 2

Ferromagnetism -spontaneous magnetization in ferro magnetic materials- quantum theory of ferro magnetism- Weiss molecular field- Curie Weiss law- temperature dependence of spontaneous magnetization- internal field and exchange interaction- ferromagnetic domains- domain theory- spin waves- magnons

Anti ferromagnetism- two sublattice model-anti ferro magnetic order and magnons- ferrimagnetism (ferrites)- structure of ferrites- magnetic materials-soft and hard magnetic materials

Book for study and Reference:

1. Introduction to Solid State Physics (7 th edition) by Charles Kittel
2. Solid State Physics by S.O. Pillai
3. Solid State Physics by A.B. Gupta and Nurul Islam
4. Solid State Physics by A.J. Dekker
5. Fundamentals of Solid State Physics by B.S.Saxena, R.C. Gupta and P.N. Saxena
6. Elementary Solid State Physics by Ali Omar

PAPER 13 MICROPROCESSOR

UNIT I Evolution and Architecture of Microprocessors 8085 & 8086

Evolution of Microprocessors – Computers and its Classifications– INTEL 8085 microprocessor Pin out configuration – Pins and their functions - Bus system–control and status signals – externally initiated signals including interrupts- architecture – ALU – Flags – registers (general purpose & special purpose registers). INTEL 8086 microprocessor – Pins description, Operating modes, Pin description for Minimum mode and Maximum mode – Operation of 8086 – registers, flags, and interrupts of 8086.

UNIT II Instruction Set of 8085 and Assembly Language Programming

Software – Assembly Language – Assembler, Assembler directives– Instruction set of 8085 : Data transfer instructions, Arithmetic instructions, Logical instructions, Branching instructions, Machine control instructions Processor cycles – Instruction & machine cycle, Timing diagram & instruction format–Timing diagram for memory read machine cycle & executing an instruction– addressing modes of 8085A – Assembly language programming using 8085A– Sequence, branching and loop programming – Subroutines and ISR.

UNIT III Peripheral Interfacing Devices and Techniques

Address space – partitioning, interfacing – memory and I/O interfacing – I/O ports: non programmable I/O port INTEL 8212,Programmable Peripheral Interface (PPI) INTEL 8255, Programmable Interval (Counter) Timer (PIT) INTEL 8253. – Data transfers: types of parallel and serial data transfer schemes – Direct Memory Access (DMA) controller INTEL 8257– 8085A interrupt system: software & hardware interrupts – interfacing, working and programming of PIC 8259 with 8085.

UNIT IV Programming of 8086

Pin out diagram – architecture – maximum and minimum mode configuration – Registers description – Assembly language programming – Instruction set - 8086 Instructions – Data transfer and arithmetic instructions, addressing modes of Intel 8086.

UNIT V Microprocessor System Design and Applications

Delays – Generation of square waves of pulses – Interfacing of 7- Segment LED display – Formation of codes for alphanumeric characters – Sensors and transducers in physical

instruments – Temperature measurements and control – Frequency and resistance measurements – Digital clock – DC motor speed control – Traffic control system

Books for study and reference:

1. Microprocessor Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar, III Edition, Penram International Publishing,1997
2. Fundamentals of Microprocessor and Microcomputers, B. Ram,V Edition, Dhanpat Rai publications (P) Ltd. New Delhi, 2003.
3. The 8051 Microcontroller – Architecture, Programming & Applications, Kenneth J. Ayala,

PAPER 14 NUMERICAL METHODS

Unit I Solution of algebraic and transcendental equations

Iteration method, bisection method, Newton – Raphson method,- rate of convergence- solution of polynomial equations – Brige vieta method-Bairstow method.

Unit II Solution of simultaneous equations -

Direct method – Gauss elimination method- Gauss Jordon method- iterative methods – Gauss seidal iterative method – Eigen values and Eigen vectors of matrices- Jacobi method for symmetric matrices.

Unit III Interpolation

Interpolation formula for unequal intervals = Lagrange's method - Interpolation formula for equal intervals –Newton's forward interpolation formula –Newton's backward interpolation formula- least squares approximation method.

Unit IV Numerical differentiation and integration

Methods based on interpolation –Newton's forward difference formula- Newton's backward formula- numerical integration – Quadrature formula(Newton- cote's formula) – Trapezoidal rule, Simpson's $1/3^{rd}$ rule, $3/8^{th}$ rule – Gauss quadrature formula –Gauss two point formula and three point formula.

Unit V Initial value problems

Solution of first order differential equations –Taylor series method, Euler's method, Ru nge -Kutta methods (forth order) –Milne's predictor – corrector method- Adam-Moulton method.

Books for study and Reference:

1. Numerical methods for scientific and engineering computations – Jain and Iyengar.
2. Numerical methods – Venkatraman.
3. Numerical methods –Sastry.
4. Numerical methods - A. Singaravelu.

PAPER 15 PRACTICAL III NON ELECTRONICS

Any 10 Experiments

1. Cauchy's constant.
2. Hyperbolic fringes – Elastic constants.
3. Elliptical fringes – Elastic constants
4. Michelson's interferometer.
5. Ultrasonic interferometer – velocity of ultrasonic waves in liquid.
6. Ultrasonic diffraction- compressibility of a liquid.
7. Solar spectrum.
8. Determination of radius of a thin wire by forming air wedge and using laser light.
9. Characteristics of optical fibre.
10. Susceptibility -Guoy's method.
11. Biprism – Determination of wavelength.
12. Hall effect – Determination of Hall coefficients.
13. Resistivity – Four probe method.
14. Equipotential surface – For various pairs of electrodes.
15. Dielecteric constant –LCR circuit.
16. B-H curve –Hysteresis loss.
17. Characteristics of photo transistor and photo diode.
18. Band gap determination.

PAPER 16 PRACTICAL IV MICROPROCESSOR – (8085/ 8086)

Any 10 Experiments

1. Assembly language for arithmetic operations- addition and subtraction- Direct and indirect methods
2. Assembly language program for multiplication of 16 bit number by 8 bit number
3. Assembly language program for division of 16 bit number by 8 bit number
4. Arranging the numbers in ascending and descending order
5. Find the largest number in a block of data
6. Search a character from an array
7. Program to stimulate a decimal Up counter to display 00 to 99
8. Program to stimulate a decimal Down counter to display 99 to 00
9. Generate the first “n” Fibonacci numbers
10. Generate the first “n” Tribonacci numbers
11. Program to display any character
12. Program to display seven segment display scrolling
13. Analog to Digital and Digital to Analog convertors
14. Program to implement square wave generation using DAC
15. Program to implement triangular wave generation using DAC
16. Program to calculate the sum of series of odd and even numbers from the list of numbers
17. Program to find the square of the number from zero to nine using table of square
18. Program to shift a 16 bit data one bit left . assume that the data is in the HL register
19. Write a program to shift an 8 bit data four bits right assume that the data is in register C
20. Program to compute the factorial of a positive number “n”
21. Program to find the 1’s complement and 2’s complement of the number stored at memory location
22. Program to convert given hexadecimal number into its equivalent BCD number