SEMESTER - IV CLASS - M.Sc. SUBJECT - PHYSICS

Condensed Matter Physics-II PAPER - I

Unit-I

Super Conductivity:

Concept of super conducting state, persistent current, critical temperature, Meissner effect, thermodynamics of the super conducting transitions, London equation and penetration depth, coherence length, Type I and Type II superconductors, B.C.S. theory of superconductivity. AC and DC Josephson effects, Josephson Tunneling

Unit-II

Magnetism:

Weiss theory of ferromagnetic Heisenberg model and molecular field theory, Domain and Bloch wall energy, Spin waves and mangnons, curie weiss law for susceptibility, Ferri and anti ferrimagnetic.

Unit-III

Imperfection in crystals:

Imperfection in atomic packing, point defects, interstitial Schottky and frenkel defects, lattice vacancies colour centres, F centres, F' centres, coagulation of F centres, production of colour centres and V centres, explanation of experimental facts, line defects, edge and screw dislocation, mechanism of plastic deformation in solids, stress and strain fields of screw and edge dislocation, elastic energy of dislocation, slip and plastic deformation, shear strength of single crystal, burgers vector stress fields around dislocation.

Unit-IV

Thin film: Study of surface topography by multiple beam interferometer, conditions for accurate determination of step height and film thickness (Fizeau frings) Electrical conductivity of thin films, expression for electrical conductivity of thin films, Hall-coefficient quantum size effect in thin film. Preperation of thin film by different physical vapour deposition system.

Unit-V

Nano structure: Definition and properties of nano structured material, different method of preparation and characterisation of nano materials, piasma enchanted chemical vapour deposition, electro deposition. Structure of single wall carbon nano tubes (classification, chiral vector Cn, Translational vector T, Symmetry vector R, Unit Cell, Brillouin Zone) Electronic, mechanical, thermal and phonon properties.

Text and reference Books:

1. Kittel: Solid State Physics 2. Tolansky: Multiple Beam interferometer.
3. Huang: Theoretical Solid State Physics 4.Heavens: Thin films
5. Thomes: Multiple-Electron microscopy 6. Chopra: Physics of thin films.
7. Weertmon and Weertman: Elementary Dislocation theory

6. Thin Film : Goswami
9. Nanomaterials : Pook and Owens

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Laser Physics

Unit-I

Basic principles of laser:

Introduction to laser, spontaneous and stimulated emission. Einstein coefficients. Idea of light amplification. Population invertion, laser pumping schemes for two and three level system with threshold condition for laser oscillation.

Unit-II

Properties of Laser Beams and Resonators:

Properties of Laser-Temporal coherence, spatial coherence, directionality and monochromatic of laser beam, resonators, vibrational mode of resonators, laser amplification, open resonator.

Unit-III

Types of lasers:

Solid state lasers i.e. Ruby Laser, Nd-Yag Laser, Semiconductor laser, Gas laser i.e. Carbon dioxide Laser, He-Ne Laser, Basic idea about liquid laser, Dye laser and chemical laser i.e. HCl and HF lasers.

Unit-IV

Application of Lasers

Holography and its principle, theory of holograms, reconstruction of image, characteristics of Holographs, Application of lasers in chemistry and optics laser in Industry i.e. laser belding, Hole drilling, laser cutting, application of lasers in medicine.

Unit-V

Basic idea about non-linear optics

Harmonic generation, second and third harmonic generation, phase matching, optical mixing, parametric generation of light, self-focusing of light.

Text and reference Books:

1. Laser-syelto
2. Optical electronics-Yarive
3. Laser spectra scopy-demtroder
4. laser spectroscopy and instrumentation demotroder
5. Molecular spectra scopy-King
6. Non linear optics by B.B. Loud

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CLASS M.Sc. **SUBJECT – PHYSICS**

PAPER – III

SEMESTER – IV

Numerical Techniques based on C++

Unit I

Programming in the C++ language: Numeric types, expressions, input and output, conditions, logical expressions, and selection control structures.

Unit II

Loops: For loop, while loop, and do-while loop,

Functions: User defined and library functions.

Arrays: Numeric and character arrays.

Unit III

Elements of error analysis.

Root finding: Bisection Method, False Position or Regula Falsi Method, and Newton-Raphson Method.

Unit IV

The Solution of Linear Systems AX = B: Gauss Elimination , Jacobi iteration and Gauss Siedel method.

Unit V

Curve Fitting: Least Squares Line fitting.

Interpolation and polynomial approximation: Lagrange Interpolation and Newton Interpolation.

Numerical integration: Newton-Cotes Integration, Trapezoidal Rule, Simpson's Rule.

Books Recommended:

1. Programming with C++, Schaum's Outline Series: J. Hubbard.
2. Object-oriented programming in Turbo C++: Robert Lafore.
3. Teach yourself C++ in 21days : Jesse Liberty.
4. Numerical Methods for Mathematics, Science and Engineering by J.H. Mathews.
5. Computer Oriented Numerical Methods by V. Rajaraman.
6. First course in numerical analysis : A.Ralston

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CLASS - M.Sc. SUBJECT - PHYSICS PAPER – IV (A)

SEMESTER - IV

(A) Computer Architecture, Networking & Assembly Language Programming

Unit-I

Graphical User Interface: Common Graphical User Interfaces & its Functionality, GUI Design Consideration: Psychological factors & Standards; GUI Examples: Microsoft Windows, Macintosh Toolbox, X-windows, NeXt, etc.

Unit-II

Operating System: Evolution of Operating System – Serial Processing, Batch Processing, Multiprogramming; Operating System Structure – Layered Structure Approach, Virtual Machine, Client-Server Model & Kernel Approach.

Unit-III

Logic Circuits - Logic Gates, Logic Circuits, Combinational Circuits – Canonical and Standard Forms, Minimization of Gates; Design of Combinational Circuits; Examples of Logic Combinational Circuits – Adders, Decoders, Multiplexer, Encoder, Programmable Logic Array, Read Only Memory (ROM).

Sequential Circuit's Definition, Flip Flops – Basic Flip-Flops, Excitation Tables, Master Slave Flip Flops, Edge Triggered Flip-flops; Sequential Circuit Design & its examples – Registers, Counters (Asynchronous & Synchronous), RAM; Design of a Simple Counter.

Unit-IV

Assembly Language Programming (ALP)-I:

Microprocessor Architecture: Microcomputer Architecture; Structure of 8086 CPU [The Bus Interface Unit, Execution Unit (EU)]; Register Set of 8086; Instruction Set of 8086 – Data Transfer Instructions, Arithmetic Instructions, Bit Manipulation Instructions, Program Execution Transfer Instructions, String Instructions, Processor Control Instructions; Addressing Modes – Register, Immediate, Direct & Indirect Addressing Modes.

Introduction to ALP: Need and use of ALP; Assembly Program Execution; An Assembly Program and its components - The Program Annotation & Directives; Input Output in ALP - Interrupts, DOS Function Calls (Using INT 21H); The Types of Assembly Programs – COM Programs, Exe Programs & Bin Programs.

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Unit-V

Assembly Language Programming (ALP)-II:

Simple Assembly Programs – Data Transfer, Simple Arithmetic Application, Application Using Shift Operations, Larger of the Two Numbers; Programming With Loops and Comparisons – Simple Program Loops, Find the Largest and the Smallest Array Values, Character Coded Data, Code Conversion;

Programming for Arithmetic and String Operations – String Processing, & Arithmetic Problems. Use of Arrays in Assembly; Modular Programming – The stack, FAR and NEAR Procedures, Parameter Passing in Procedures, External Procedures.

Interfacing Assembly Language Routines to High Level Language i.e. C.

Text and reference Books:

1. Computer Architecture :Morris Mano
2. Operating System Concepts :Silberchatz Galwin Gagne
3. Web Technology :A.S. Godbole & Atul Kahate
4. Digital Electronics :Malvino & Leech
5. Advance Microprocessor & Peripherals : A.K. Ray & Bhurchandi
6. Introduction to Microprocessor :Mathur

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CLASS - M.Sc. SUBJECT - PHYSICS

SEMESTER - IV PAPER – IV (B)

Materials Science

Unit-I

Classification of Materials: Types of materials: Crystalline, Polycrystalline, Amorphous (Introduction and their structure), Elementary idea of polymers (structure and properties methods of polymerization, Glasses: Structure and properties, Type of Glasses, Fracture in glasses, Composite Materials: Introduction, their types and properties, Different types of bonding, Medalung energy for ionic crystal.

Unit-II

Phase Transitions:- Thermodynamics of phase transformation, Free-energy calculation, I and II order transformation, Hume-Rother rule, solid solid solution and types of solid solutions, phase rule, One, Two component systems, Eutectic and peritectic phase diagrams, Lever rule, phase diagrams of Mg-Al, Fe-C Kinetics of transformations, Homogeneous and heterogeneous nucleation, Growth kinetics.

Unit-III

Diffusion in Materials:- Mechanism of diffusion, Energy of formation and motion, long distance motion, Rate theory of diffusion, Einstein relation (relation between diffusivity and mobility), Fick's laws of diffusion and solution of Fick's second law, Kirkendal effect, Diffusion of vacancies in ionic crystals, Experimental determination of Diffusion coefficient.

Unit-IV

Elastic and Anelastic Behaviour:- Atomic models for elastic behaviour, Elastic deformation in single crystals, Elastic anisotropy, Elastic constant and elastic module (Cubic system, isotropic body), Rubber like elasticity, anelastic behaviour, Thermo-elastic effect and relaxation process, Idea of visco elastic behaviour (Spring-Dashpot model), Determination of elastic constant of cubic crystaly by ultrasonic wave propagation

Unit-V

Transport Properties of Solids:- Electrical conductivity of metals and alloys, Extrinsic, intrinsic semiconductors and amorphous semiconductors, Scattering of electrons by phonons, impurity, etc, Relaxation time, Carrier mobility and its temperature dependence, Mathiessio's rule for resistivity, temperature dependence of metallic resistivity.

Text and reference Books:

1. Introduction to Solids : L. V. Azaroff
2. Introduction to Solid State Physics : C. Kittle
3. Materials and engineering : Raghawan
4. Diffusion Kinetics for Atoms in Crystals : Manning
5. Theoretical solid State Physics : Huang
6. Materials Science and engineering :Callister VI Ed.

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SEMESTER - IV

Environmental Physics

Unit-I

Essentials of Environmental Physics:- Structure and thermodynamics of the atmosphere. Composition of air. Greenhouse effect. Transport of matter, energy and momentum in nature. Stratification and stability of atmosphere. Laws of motion, hydrostatic equilibrium.

Unit-II

Solar and Terrestrial:- Physics of radiation. Interaction of light with matter. Rayleigh and Mie scattering. Laws of radiation (Kirchoffs law, Planck's law, Wien's displacement law, etc.). Solar and terrestrial spectra. UV radiation. Ozone depletion problem. IR absorption

Unit-III

Environmental Pollution and Degradation:- Elementry fluid dynamics. Diffusion. Turbulence and turbulent diffusion. Factors governing air, water and noise pollution. Air and water quality standards. Waste disposal. Gaseous and particulate matters. Wet and dry deposition

Unit-IV

Environmental Changes and Remote Sensing:- Energy sources and combustion processes. Renewable sources of energy: Solar energy, wind energy, bioenergy, hydropower, fuel cells, nuclear energy.

Unit-V

Global and Regional Climate:- Elements of weather and climate. Stability and vertical motion of air. Horizontal motion of air and water. Pressure gradient. forces. Viscous forces. Inertia forces. Reynolds number. Enhanced Greenhouse Effect. Global climate models.

Text and reference Books

1.Solar Energy , Narosa Publication: G.N.Tiwari

2. The Physics of Atmosphere (Cambridge University Press, 1977) J.T. Hougtion

3. Renewable Energy Resources (Eibs, 1988) J.Twidell and J. Weir

4. An Introduction to Solar Energy for Scientists and Engineers John Wiley, Sol Wieder 1982

5. The Physics of Monsoons (Allied Publishers 1992). R.N. keshavamurthy and M. Shanker Rao

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CLASS - M.Sc. SUBJECT - PHYSICS

SEMESTER - IV PAPER – IV (D)

Communication Electronics

Unit-I

Communication Electronics: Amplitude modulation – generation of AM waves demodulation of AM waves, DSBSC modulation, Generation of DSBSC waves, coherent detection of DSBSC waves, SSB modulation, generation and detection of SSB waves, vestigial sideband modulation.

Unit-II

Propagation of Waves: Ground Waves, sky wave, space wave, propagation, maximum usable frequency, skip distance, virtual height, fading of signals, Satellite communication: orbital satellite, geostationary satellites, orbital pattern, look angles, orbital spacing, satellite system, link modules.

Unit-III

Microwave: Advantages and disadvantages of microwave transmission loss in free-space, propagation of microwaves, atmospheric effects on propagation, Fresnel Zone problem used in microwave communication systems.

Unit-IV

Digital Communications: Pulse-Modulation system, sampling theorem, Low pass and Band pass signals, PAM, channel BW for a PAM signal, Natural Sampling, Flat top sampling, signals Recovery through Holding, Quantization of signals, Quantization, Differential PCM Delta Modulation, Adaptive Delta Modulation, CVSD.

Unit-V

Data Transmission: Base-band signal receiver, probability of error, optimum filter, white noise, matched filter and probability of error, coherent reception correlation, PSK, FSK, non coherent detection of FSK, differential PSK, QPSK, calculation of error probability for BPSK, BFSK, and QPSK.

Text and reference Books

1. Digital Communications : W. Tomasi
2. Microwave : K. C. Gupta
3. Microwave Devices & Circuits : S.Y. Lio

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CLASS - M.Sc. SUBJECT - PHYSICS

SEMESTER - IV PAPER – IV (E)

Analog Electronics and Microprocessors

Unit .I

OP-AMP :- Differential amplifier circuit configurations: dual input balanced output dual input. single input unbalanced output (ac analysis) Only, block digram of a typical op amp analysis, schmatic symbol of op-amp. Idal op-amp parameters: input offset voltage, input offset current, input blas current CMRR, Slew rate, Gain band width product, output resistance, inverting and non-inverting inputs.

Unit-II

Application of OP-AMP : Inverting and non-inverting amplifier, Summing, Scaling and averaging amplifier, integrator and differentiator. Oscillator Principles : oscillator types, frequency, stability response, the phase shift oscillator, Wein-bridge oscillator, tunable oscillator, square wave generator.

Unit-III

Basic architecture of intel 8085 microprocessor, Microprocessor and its architecture-data. Address and control buses. ALU registers, program counters. Flow chart and assembly language.

Unit . IV

Microprocessors and Micro Computers: Microprocessor and Architecture : Intel 8086. Microprocessor archiecture : modes of memory addressing 8086/8088 Hardv are specification : Pin-outs and pin functions, clock generator (8284 A) Bus Buffering and lactching, Bus timing, Ready and wait state, Minimum mode versus maximum mode.

Unit . V

Programming the Microprocessors : Addressing modes : data addressing modes, program memory addressing modes, stack memory-addressing modes. Instruction set : data movement Instructions, Arithmetic and login instruction, Program control instructions. Programming example : Simple assembly language programs table handling direct table addressing, searching a table sorting a table using pseudo ops.

TextBooks and reference book:

1. Digital Principles and Application : A.P.Malvino & D.P. Leech
2. OP-Amps & Liner Integrated circuits : R.A.Gayakwad
3. Electronics : D.S.Mathur
4. Digital Principles & Applications : Malvino & Leech
5. Microprocessor Architecture & Applications with 8085/8086 : Programming
6. Microprocessor & Digital Systems : D.V.Hall
7. Fundamentals of Electronics : Broker

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CLASS - M.Sc. SUBJECT - PHYSICS PAPER – IV (F)

SEMESTER - IV

Microprocessor and Microcontroller

Unit-I

Microprocessor(μp) as CPU and its three components.Internal Architecture of 8085 microprocessor, its block diagram and functions of various blocks.Pin diagram of 8085 and functions of various pins.

Microcomputer or microprocessor unit (MPU) Its block diagram. System Bus. Control and Status signals.

Timing Diagram. Interfacing of memory and input/output devices

Unit-II

Microcontroller(μc). Difference between Microprocessor and Microcontroller. Internal Architecture of 8051 microcontroller, its block diagram and functions of various blocks.Pin diagram of 8051 and functions of various pins.Internal RAM @ROM Memory and their use.External Memory.

Unit-III

Assembly language 8051 instruction set.Addressing modes., external addressing, interrupts.Data movement instructions.Arithmetic instructionsBit operators.Execution change operatoes.Simple programs

Unit-IV

8051 Timer /Counter and their registers.Timer contral and modes and their programming.8051 Ports and their programming.

Unit-V

Interfacing of simple devices as : LCD, hex keyboard, ADC, DAC, relay and optoisolators

Text and reference Books

1 Microprocessor Architecture, programming and application with the 8085-Ramesh Gaonkar-PRI India Pvt. Ltd.

Fundamentals of Microprocessor and Microcomputer –B.Ram, Dhanpat Rai publication (p) Ltd.

The 8051Microcontroller and Embedded Systems using assembly and C- M.A.Mazidi. J.G Mazidi R.D.McKinlay-Pearson Education(Prentice Hall)

Programming and customizing the 8051microcontroller-Myke Predcko.-Tata McGraw-Hill.

Academic Session 2017-19

Subject : Physics

LIst of Experiments for M.Sc. (4th Sem) 2014-15

Lab A : General

1. Newton's Ring experiment / Polari meter.
2. Characteristics of laser.
3. Wavelength of light using laser.
4. Study of Elastic constants.
5. Oscillators- Wein bridge / Hartley.

Lab B : Electronics

(Select as per optional paper)

1. Communication Electronics :
   a. Pulse amplitude modulation / demodulation.
   b. Pulse position modulation / demodulation.
   c. Pulse width modulation / demodulation.
   d. FSK modulation / demodulation using timer.
2. Digital Electronics :
   a. Op-Amp - Integrator, Differentiator.
   b. Differential amplifier.
3. Microporcessor - 8085/8086.

Note :

Other experiments depending upon availability in institution, related to theory paper in corresponding semester.

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