III-Semester (w.e.f. 2022-2023 academic year)

Paper code	Comp. code	Title of the paper	Internal Exam Marks	End Exam		Total Max. Marks	Total Min. Marks	No. of credits
				Max. Marks	Min. Marks			
		Theory						
3.1	301	Quantum Mechanics -II	20	80	32	100	40	04
3.2	302	Nuclear Physics	20	80	32	100	40	04
3.3A	303A	Solid state Physics: (Special - I) **(OR)**						
3.3B	303B	Electronics: (Special -) Microprocessor-8086	20	80	32	100	40	04
3.3C	303C	**(OR)** Nanoscience:(SPL) Materials Science - I						
3.4A	304A	Solid state Physics: (Special - II) **(OR)**						
3.4B	304B	Electronics:(Special - II) Electronic Communication Systems	20	80	32	100	40	04
3.4C	304C	**(OR)** Nanoscience - SPL- II						
		Practical						
3.6	306	General Physics – II	--	100	40	100	40	04
3.7A	307A	Solid State Physics (Special-I) **(OR)**	--					
3.7B	307B	Electronics (Special-I)	--	100	40	100		04
3.7C	307C	**(OR)** Nanoscience –I Practicals	--					
Seminar			--	25	10	25	10	01
Total						**625**		**25**

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3.1 QUANTUM MECHANICS –II

Unit-I: **12Hrs**

Symmetry in Quantum Mechanics: Space and time displacements. Unitary displacement operator. Equation of motion. Symmetry and degeneracy. Matrix elements for displaced states. The group concept. Time displacement. Rotational symmetry. Infinitesimal rotation generators. **General Angular momentum**: Angular momentum operators. Eigen values of J^2 and J_z. Pauli spin operators. Matrix representation of J in |jm> basis. Addition of angular momenta and Clebsh- Gordon coefficients.

Unit-II : **12Hrs**

Scattering theory: The scattering cross-section. Wave mechanical picture of scattering – the scattering amplitude, Green's functions. Formal expression for scattering amplitude. The Born and Eikonal approximations. Partial wave analysis. Scattering amplitude in terms of phase shifts. Optical theorem. Exactly solvable problems – scattering by a square well potential, hard sphere and Coulomb potential.

Unit-III : **10Hrs**

Relativistic Quantum Mechanics: Klein- Gordon equation – plane wave solution – charge and current densities. Interaction with electromagnetic field for hydrogen like atom. Non-relativistic limit. Dirac equation. Dirac matrices. Plane wave solution and energy spectrum. Properties of Dirac spinors. Positive and negative energy states. Free Dirac particle in an external electromagnetic field. Spin-orbit interaction.

Unit-IV : **14Hrs**

Many Particle system: Identical particles, permutation operator, symmetrization, Slater determinant. Pauli exclusion principle. Central field approximation. Thomas Fermi statistical model. Evaluation of the potential. Hartree self consistent field – connection with variation method.

Molecular bonding: Bonding, anti-bonding and non-bonding orbitals. Fundamental principles of molecular orbital theory. LCAO approximation. Molecular orbital theory of hydrogen molecular ion and hydrogen molecule. Discussion of improved wave functions for H_2^+ ion; Valence bond theory of hydrogen molecule. Comparison of molecular orbital and valence bond theories.

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Recommended Books:

1. Quantum Mechanics - ***L.I. Schiff***., McGraw Hill, New York.
2. A Text Book of Quantum Mechanics - ***P.M. Mathews and K. Venkatesan***, TMH.
3. Quantum Mechanics - ***A.K. Ghatak and S. Lokanathan****, MacMillan*
4. Introduction to Molecular Orbital Theory – ***Turner,*** PHI**..**
5. Molecular structure and Spectroscopy-***G. Aruldas***, PHI.
6. A text book of Quantum Mechanics-***G.Aruldas***, PHI.
7. Quantum Mechanics – ***Max Born***
8. Quantum Mechanics Concepts and Applications by ***Nouredine Zetili,*** Wiley,Ed.,2021
9. An Introduction to Quantum Mechanics, ***P.T.Mathews*** Mc Graw Hill Publishing Company,1974

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3.2 NUCLEAR PHYSICS

Unit-I : **12Hrs**

Properties of Atomic Nucleus: Theories of Nuclear Composition- Proton-Electron, Proton-Neutron, Neutron-Positron and Antiproton-Neutron. Binding Energy, Semi-empirical Mass Formula (nuclear stability), Quantum Numbers for individual nucleons, Quantum Properties of nuclear states, Nuclear Angular Momentum. Nuclear Magnetic Dipole moment with determination methods, Classical Multipole Moments for point charges, Electric Quadrupole Moment, Potential well, Quantum Statistics.

Radioactivity and Isotopes: Fundamental laws of Radioactivity, Dosimetry, measurements ofdecay constants, Radioactive dating, natural radioactive series, Isotopes, their separation and uses.

Unit-II : **14Hrs**

Nuclear Forces: Deuteron-properties nuclear force, Number of excited S-states, Range and depth of potential, excited states of the deuteron. Neutron-Proton scattering at low Energies - scattering length, phase shift, spin dependence, coherent scattering, shape independent effective range theory, Proton-Proton scattering at low energies. Similarity between (*nn*) and (*pp*) forces, non-central forces - experimental evidence for the existence of non-central forces, general form of this force, its properties, ground state of the deuteron, *n-p* scattering below 10 Mev, High energy n-p and p-p scattering, Meson theory of nuclear forces.

Unit-III: **12Hrs**

Nuclear Fission and Fusion: Nuclear fission-Types of fission, distribution of fission products, Neutron emission in Fission. Fissile and Fertile materials, spontaneous fission, Deformation of liquid drop; Bohr and Wheeler's theory, Quantum effects, Nuclear Fusion and thermo nuclear reactions, controlled thermonuclear reactions - Hydrogen bomb, different methods for the production of fusion reactions.

Unit-IV: **10Hrs**

Introduction to Elementary Particles: Introduction, Classification of Elementary Particles, Particle Interactions - Gravitational, Electromagnetic, strong and weak, Conservation laws, Invariance under charge, parity, C.P., time and C.P.T.; Lepton and Baryon number. Elementary particle symmetries – SU(2) and SU(3) symmetries. Quarks.

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Recommended Books:

1. Nuclear Physics - ***D.C.Tayal***, Himalaya Publishing House.
2. Introductory Nuclear Physics - ***Kenneth S Krane***, John Wiley.
3. Elements of Nuclear Physics - ***M.L.Pandya and R.P.S.Yadav***, Sarika Offset Press, Meerut.
4. Atomic and Nuclear Physics - ***Shatendra Sharma***, Pearson Education.
5. Nuclear Physics - ***R.P.Roy and B.P.Nigam***, New Age International Ltd**.**

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3.3A. SOLID STATE PHYSICS - SPECIAL - I

Unit-I : **10Hrs**

X-ray Crystallography-Experiments: Small Angle X-ray Scattering (SAXS), Debye –Waller factor, Rotating crystal method, Weissenbery method, accurate determination of lattice parameters, systematic errors, graphical extrapolation method, Ball-milling method.

Unit II : **12Hrs**

Crystal structure determination: Factors affecting intensities, Calculation of structure factors of some simple structures, obtaining structure factors from measured intensities. Fourier analysis of electron density – electron density sections and projections. The phase problem, Patterson synthesis, isomorphic replacement and heavy atom methods, structure refinement by least squares method. Limitations of X-ray diffraction – advantages of neutron diffraction. Applications of neutron diffraction to hydrogen containing structures and magnetic structures.

Unit-III : **13Hrs**

Dielectrics: Static dielectric constant of solids, dielectric polarization, polarizability and dielectric constant, various contributions to the Polarizability. The local electric field – Clausius Mossotti relation. Dielectric response of an ionic crystal – difference between static and high frequency dielectric constants. Dielectric in an alternating field, the complex dielectric function, dielectric constantand dielectric loss, Debye's equations, dielectric dispersion, electronic polarisability and optical absorption, Ionic polarization and infrared absorption.

Unit-IV : **13Hrs**

Ferroelectricity: Characteristic properties and classification of ferroelectrics, spontaneous polarization, phase transition and temperature variation of dielectric constant. Behaviour of some representative ferroelectrics like KH_2PO_4, Rochelae salt and $BaTiO_3$. Theoretical aspects: Dipole theory of ferroelectrics, Thermodynamic theory of ferroelectrics, and Ionic displacement of ferroelectrics. Ferroelectric catastrophe. Domain structure of ferroelectrics: Description of domain structure, Domains and hysteresis, display of hysteresis loop and methods for observation of domain structure. Applications of ferroelectrics, Anti-ferro electricity.

Recommended Books:

1. Introduction to X-ray Crystallography **– *Woolfson***, Vikas, New Delhi.
2. Crystal structure analysis **– *M J Burger,*** John Wiley & Sons.
3. Solid State Physics **– *A J Dekker***, MacMillan.

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4. Basics of X-ray diffraction and its applications - ***K. Ramakanth Hebbar,*** I.K.International Pub. House.
5. X-ray diffraction procedures - ***Klug and Alexander,*** Wiley Easter Ltd.
6. Atomic properties of Solids –***D.B.Sirdeshmukh,L.Sirdeshmukh, K.G.Subhadra*** Springer
7. Nanoscience and Nanotechnology –***B.S.Murthy and P. Shanker*** etal.
8. Solid State Electronic Devices, ***B.G.Streetman***,Edition7th,2018,Pearson Education India
9. Elementary Solid State Physics,***M.Ali Omar***,1993,Addison-Wesley
10. Solid State Physics, ***M.A.Wahab***,Edition:3rd ,2020,Narosa Publishing House.
11. Electrons in Solids,***Richard H.Bude***,Edition 3rd ,1992 Elsevier,
12. Solid State Physics by ***R.K,Puri V.K Babbar*** Edition:1st 2017,S.Chand

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3.3B. Electronics Special –I (Microprocessor- 8086)

UNIT- I : **10Hrs**

INTEL 8086 Architecture - Bus Interface Unit (BIU), Execution Unit, Pin Description, External Memory Addressing, Bus cycles, Important companion chips: Intel 8284A, Intel 8286/8287.Intel 8282/8283, Maximum mode Bus cycles, 8086 System configuration, Memory interfacing, Minimum Mode System Configurations - Interrupt Processing, Direct Memory Access, Compatibility between the 8088, 80186 and 80286.

UNIT-II: **12Hrs**

Programming of 8086 - Addressing modes of 8086, Instruction Set of 8086 – Data transfer Instructions - Arithmetic instructions – Logical instructions – Shift and Rotate Instructions, Adjustment Instructions, Flag related instruction control Transfer Instructions, Process control Instructions, Level of programming, ,Flowchart Assembly language program development tools, Variables and constants used in assemblers, Assembler directives, Procedures and macro, Interrupts of personal computers, Hand coding of assembly language programs , Examples of 8086 assembly language programs.

UNIT-III **12Hrs**

Data Transfer Schemes and Peripheral interfaces –Parallel transmission – Programmed IO – Interrupt driven IO – Direct memory access (DMA) – Serial Transmission – Universal Synchronous Asynchronous Receiver Transmitter (USART) -8251. – pin diagram – Block diagrams of 8251. 8251– control word – 8251 interfacing in I/O mapped I/O.
Parallel I/O methods, Programmable Peripheral Interface (8255A), key board / displaying Interface (8579), Priority interrupts Controller (8259A), DMA Controller (8237) Programmable interval Timer (8254), Interface of DAC 0800.

UNIT-IV **14Hrs**

Intel 80x86 family of processors -INTEL 80186, Pins and signals of 80186, Architecture of 80186, INTEL 80286, Pins and signals of 80286, Architecture of 80286, Real address mode of 80286, Protected virtual address mode of 80286, INTEL 80386, Pins and signals of 80386, Architecture of 80386 microprocessor. Registers of 80386 microprocessor, Operating modes of 80386 microprocessor, INTEL 80486 microprocessor, Pins and signals of 80486, Architecture of 80486, Pentium microprocessor, Pins and signals of Pentium microprocessor, Architecture of Pentium processor, Advanced Pentium processors.

Recommended books:

1. The 8086 Microprocessor: Programming & Interfacing the PC - By Kenneth J. Ayala a. Penram International Publishing, 1995.

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2. Microprocessor 8086, Architecture, programming and Interfacing- Sunil Mathur, PHI Learning PVT. LTD, NEWDELHI
3. The Intel Microprocessors 8086/8088, 80186/80188, 80286,80386,80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming, and Interfacing - By Barry B. Brey, 6th Ed., PHI / PEA, 17th Reprint, 2003.
4. Advanced Microprocessors and Interfacing - By Badri Ram, TMH, 2nd Reprint 2002
5. The 8088 and 8086 Microprocessors - Programming, Interfacing, Software, Hardware and Applications - By Walter A Triebel and Avtar Singh, PHI, 4th Ed., 2002.
6. Yu Cheng Lin and Glenn A. Gibson, "Microcomputer systems: The 8086/8088 Family Architecture, Programming and Design", PHI,1992.
7. A NagoorKani ,8086 Microprocessor and its applications, McGraw-Hill, Second edition.
8. RS Goankar, Microprocessor Architecture, Programming and Applications with 8086, Wiley Eastern Edition.

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3.3C. Nanoscience -SPL (Materials Science –I)

Unit-I: **12Hrs**

Imperfections and Dislocations in solids: Classification of Materials, Point defects, line defects, plane defects and volume defects. Surface imperfections**.** . Geometry of dislocations- Edge and Screw dislocations ,Mixed dislocations, Burgers vector and Burgers circuit, stress field of dislocation, force on dislocation, Forces between dislocations, Interaction of dislocations, Elastic energy of dislocations, Movement of dislocations, slip vector and slip plane. Tilt and twist dislocation.

Unit-II : **10Hrs**

Diffusion in solids and Phase transformations: Diffusion: Diffusion Phenomena**,** Laws of diffusion, effect of temperature and concentration on diffusion, Kirckendall effect and mechanism of diffusion, Atomic model of diffusion.

Phase transformations: Obstacles to phase transformations, Nucleation and growth, Nucleation kinetics, Growth and the overall transformation kinetics.

Unit-III : **12Hrs**

Elastic Behaviour of Materials- Atomic model of elastic behaviour, anelastic behaviour and relaxation process, viscoelastic behaviour, plastic deformation, stress-strain curves, plastic deformation by slip, shear strength of perfect and real crystals,effect on the stress to move a dislocation, Multiplication of dislocations, effect of grain size, solute atoms and precipitate particles on dislocation motion., Creep,Mechanisms of creep, Creep resistant materials.

Unit-IV: **14Hrs**

Dielectric and Magnetic materials: Dielectrics: polarization and dielectric constant, dielectric loss, mechanism of polarization, frequency dependence, polarizability in condensed state, dielectric strength, eletrostriction, piezoelectricity, pyroelectric materials, applications of dielectric materials.

Magnetic materials: Classification of magnetic materials, soft and hard magnetic materials, materials for magnetic recording, properties of magnetic materials, domain and magnetization process, magneto striction (cubic and poly crystals), magneto resistance, magneto static energy, hysteresis and its significance, soft and hard ferrites, applications of ferrites.

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Recommended Books:

1. Materials Science –**Raghavan,PHI**.
2. Material Science and Engineering by **RALLS COURTNEY WULFF**
3.Materials Science and Engineering –**C.M.Srivastava**
4.Materials Science and Engineering –**W.D.Calister,** JohnWiley and sons Inc.
5.Materials Science-**I.P.Singh**, Jain Brothers, New Delhi.

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3.4A SOLID STATE PHYSICS – SPECIAL -II

Unit-I: **14Hrs**

X-ray studies of Defects: Point defect estimation from densities obtained by X-ray methods, Activation energies of defect formation in metals and ionic crystals by X-ray method. Defect parameters from line profile analysis, stacking fault energies, dislocation densities, X-ray topography –various geometries and contrast mechanisms, Berg-Barrett method, Long method. Applications in study of dislocations and crystal growth phenomena.

Diffraction from periodic structures: General theory of Diffraction, periodic structures and the Reciprocal Lattice, The Scattering conditions for periodic structures, Structure Factor, methods of structure analysis, Diffraction experiments with various particles, X-ray interferometry and X-ray topography.

Unit-II: **12Hrs**

Ferromagnetism: Quantum theory of para magnetism, Weiss molecular field, exchange interaction Heissenberg model, Spin waves, Dispersion relation, Bloch T 3/2 law, Band model theory of ferromagnetism, crystal anisotropy (incubic crystals) and magnetic striction, Ferromagnetic domains, Thickness and energy of the Block walls, Observation of domain patterns.

Antiferromagnetism: Molecular field theory of the two sub lattice model, Neel temperature. Antiferromagnetic spin waves, Dispersion in relation. Qualitative treatment of super exchange interaction in MnO.

Ferrimagnetism: Molecular field theory of ferrimagnetisms.

Unit-III **12Hrs**

Electrical Transport Properties of Insulators : Hopping conduction; Temperature variation of electrical conductivity; Seebeck coefficient; Polarons- small polaron band conduction; large polaron band conduction; small polaron hopping conduction; Mott transitions; Ionic Conductivity; Supersonic Conductivity- structure, defects and conductivity.

Unit-IV : **10Hrs**

Plasmons, Polaritons, Polarons and Excitons : Dielectric function of the electron gas, plasmons, electrostatic screening, poloritons – LST relation. Electron –Electron interaction, Electron-Phonon interaction, polarons, Optical reflectance, Kramers-Kronig relation, Excitons-Frenkel excitons, weakly bound (Mott-Wannier) excitons. Raman effect in crystals.

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Recommended Books:

1. Physical properties of crystals J.F.Nye.
2. Physics of crystals S.Bhagavantam and S.Radhakrishna,
3. X-ray Studies of defects in single crystals by Auleytner.
4. Applied X-rays by Clarke.
5. X-ray Diffraction by polycrystalline materials by Peiser,Rooksby and Wilson.
6. Solid State Physics by Kittle.
7. Solid State Physics by Dekker.
8. SolidState Physics -M.A. Waheb
9. SolidState Physics- Kachava,
10. Principles of the Solid State-H.V. Keer
11. Intermediate theory of crystalline solids -Animalu
12.SSP-An Introduction to Principles of Materials Science-Harald Ibach l Hans Luth/
I3.G. F. Bacon: Neutron Diffraction, 2nd edn. (Oxford Univ. Press, Oxford 1962)
14.Solid State Physics - Ashcroft and Mermin.
15.The Oxford Solid state Basics- Steven H. Simon.

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M.Sc. Physics III-Semester Theory

3.4B: Electronics – Special – II (Electronic Communication Systems)

Unit-I: **12Hrs**

Pulse Modulation Systems: Introduction - Pulse amplitude modulation (PAM), Natural sampling, Flat-top sampling, PAM Modulator circuit, Demodulation of PAM Signals, PAM Demodulator circuit.

Pulse Code Modulation (PCM), Quantization of signals, Quantization error, Electrical representation of binary signals, PCM system, Equalization, Companding, Time division Multiplexing (TDM) of PCM signals - Synchronous & Asynchronous TDM, Bandwidth of PCM system; Delta Modulation (DM) system, Limitations of DM, Differential PCM.

Unit-II: **11Hrs**

Data Transmission Techniques: Introduction, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK) system, Phase Shift Keying (PSK) system, Quadrature Phase Shift Keying (QPSK), QPSK Transmitter and Receiver, Differential Phase Shift Keying (DPSK), DPSK Transmitter and Receiver, Baseband signal receiver, Probability of error, Optimum filter, Matched filter, Correlator.

Unit-III: **14Hrs**

Optical Fiber Communication: Introduction, Total internal reflection, Acceptance angle, Numerical aperture, Optical Fiber construction, Optical Fiber Configurations, Optical Fiber Classifications – Single-mode step-index, multi-mode step-index, single-mode graded-index and multi-mode graded-index fibers; Losses in Optical fibers – Absorption, Scattering, dispersion and radiation losses; Modal dispersion-Types, Coupling or Splice losses, Optical sources – Homojunction and Heterojunction LEDs, Lasers – Types, Characteristics and Basic laser construction; Light Detectors – PIN diodes, Avalanche Photodiode (APD); Optical Fiber Communication system (Block diagram).

Unit-IV: **11Hrs**

Transmission Lines: Introduction, Primary line constants, Phase velocity and line wavelength, Characteristic impedance, Propagation coefficient, Phase and group velocities, Standing waves, Lossless line at radio frequencies, Voltage Standing Wave Ratio(VSWR), Slotted-line measurements at radio frequencies, Transmission lines as circuit elements, Smith chart.

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M.Sc. Physics III-Semester Theory

Recommended Books:

1. Communication Systems – ***R.P. Singh and S.D. Sapre,*** TMH
2. Principles of Communication Systems – ***H. Taub, D. L. Schilling, Goutam Saha*** (3rd edition), TMH
3. Optical Fiber Communication – **Gerd Keiser,** 4th edition, TMH
4. Electronic Communication Systems **–** ***Wayne Tomasi***, 5th edition, Pearson Education
5. Electronic Communications **–** ***Dennis Roddy and John Coolen***, 4th edition, Pearson Education.
6. Electronic Communication System **–** ***G. Kennedy.***

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3.4C. Nanoscience –SPL -I

Unit-I: **12Hrs**

Introduction and Electrical Transport in Nanomaterials: Introduction to nanomaterials, Band structure. Density of states of nanostructures. Electron transport in nanostructures. Various conduction mechanisms in 3D (bulk), 2D (thin film) and low dimensional systems-Thermionic emission, Field enhanced thermionic emission (Schottky effect), Field assisted thermionic emission from traps (Poole-Frenkel effect), Arrhenius type thermally activated conduction, Variable range hopping conduction, Polaron conduction.

Unit-II: **12Hrs**

Quantum mechanical concepts at Nanoscale: Introduction, Size effects in smaller systems: Pre-quantum, Quantum behaviour of nanometric world. Applications of Schroedinger equation: Iinfinite potential well a confined particle in 1D, Potential step: Reflection and Tunneling: Quantum leak, Penetration of barrier, Potential box: Trapped particle in 3D: Nanodot, Electron trapped in 2D plane: Nano sheet, Electron moving in 1D: Nanowire/rod/belt. Quantun confinement in nanomaterials.

Unit-III: **12Hrs**

Synthesis of Nanomaterials - Physical methods: Factors Affecting Synthesis of Nanomaterials, Top-down and Bottom-up approaches, Mechanical methods: Ball Milling, Melt Mixing, Methods based on Evaporation: Physical Vapour Deposition with Consolidation, Ionized cluster Beam Deposition, Laser Vapourization (Ablation), Laser Pyrolysis, Sputter Deposition, Chemical Vapour Deposition (CVD), Electric Arc Deposition. Molecular Beam Epitaxy (MBE). Nanolithographic Techniques: Introduction, Lithography using Photons (UV-VIS, Laser or X-rays), Lithography using Particle Beams.

Unit-IV: **12Hrs**

Synthesis of Nanomaterials - Chemical methods: Colloids and colloids in solutions. Growh of Nanoparticles – Synthesis of metal nanoparticles by colloidal routes, Synthesis of semiconductor nanoparticles by colloidal routes, Langmuir Blodgett (L-B) method, Sol-Gel method - Advantages, Disadvantages and Applications, Microemulsion method, **Biological methods**: Introduction to biomaterials. Synthesis using micro-organisms, synthesis using plant extracts.

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M.Sc. Physics III-Semester Theory

Recommended Books:

1. Introduction to Nanoscience and Nanotechnology – K.K. *Chatopadhyay and A.N. Benerjee*, PHI
2. Nanotechnology: Principles and Practices – *Sulabha K Kulkarni*. Capital Publishing Company, New Delhi.
3. Nanostructured Materials and Nanotechnology – *Hari Singh Nalwa*. AP.
4. Nanostructures and Nanomaterials-Synthesis, Properties and Applications – *Cao, Guozhong*.
5. Nano structures an Nanomaterials: Synthesis,properties and Application by Guozliong Cao,Imperial College Press(2004).
6. Introdction to Nanotechnology, By Charles P.Poole,Jr and Frank J.Owens,Willey India (2006).
7. An Introduction to Microeletromechanical Systems Engineering by Nadim Maluf,Artech House Publishers,2004
8. Nanomaterials Synthesis Properties and Applications, by Alen.S.Edelstein and Robert C.Cammarata,1998.

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M.Sc. Physics III Semester Practicals

3.6. General Physics-II Laboratory

1. Determination of 'g' factor using ESR spectrometer.
2. Analysis of square wave, clipped sine wave, saw tooth wave using Fourier analysis.
3. To study the characteristics of a given photo conductive cell and the spectral response.
4. To study the characteristics of G M counter and to find out its operating voltage.
5. Verify the inverse square law for γ-rays using G M counter.
6. Using G.M counter find the operational voltage by Least square fitting method.
7. Determination of energy gap of an intrinsic semiconductor by Four Probe Method.
8. Determination of e/m of an electron using helical method.

3.7A Solid State Physics Special – I Laboratory

1. Determination of co-efficient of thermal conductivity of a single crystal.
2. Determination of the ferromagnetic Curie temperature of monel metal.
3. Determination of paramagnetic susceptibility using Guoy balance.
4. Indexing of Laue pattern.
5. Indexing of a Debye-Scherrer film – Accurate determination of lattice constant using least squares method.
6. Determination of lattice constant using symmetric focusing camera.
7. Determination of lattice constant using X Ray Diffractometer.

3.7B Electronics Special - I Labaratory

Part-I: Communication Systems

1. Study of sampling techniques- a) Natural, b) Sample and Hold, c) Flat top sampling.
2. To study Pulse amplitude modulation and Demodulation – IC 555 timer.
3. To study Pulse width Modulation and demodulation – IC555 timer.
4. To study Pulse Position Modulation and demodulation – IC555 timer.
5. To study Pulse Code Modulation and demodulation – IC555 timer.
6. To study Amplitude shift keying (ASK) Technique.
7. To study Phase shift keying (PSK) Technique.
8. To study Frequency shift keying (FSK) Technique.

Part-II: Experiments with MATLAB

1. To verify Nyquist sampling theorem for over sampling and under sampling.
2. To study the Pulse Width Modulation (PWM) and demodulation.
3. To study the Pulse Position Modulation (PPM) and demodulation.

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4. To find scatterplot of M symbols in PSK.
5. To study the FSK modulation and demodulation.
6. To determine the signal-to-noise ratio (SNR) for PCM coded PSK and FSK.

Part-III: Microprocessor 8086 Experiments: (Assembly Language Programming and Interfacing with 8086 -)

1. Programs for data transfer, arithmetic and logical operations.
2. Programs for array operations – finding out the largest and smallest in a data array.
3. Programs for arranging hex. numbers in ascending and descending order.
4. Programs to find the square root, finding the sum of 'n' natural numbers and finding the sum of squares of the 'n' natural numbers.
5. Program to convert digital signals to analog signals (DAC) – conversion of digital to DC voltages (-5 V to +5V) using DAC-0800.
6. Programs to generate waveforms viz., square, saw tooth and triangular using DAC.
7. Program to generate tones of different frequencies.
8. Program to demonstrate stepper motor control.

3.7C. Nanoscience -I Practicals

1. To determine the resistivity of a graphite sample using four probe method
2. To study the Curie temperature of a ferromagnetic material.
3. To study the magneto resistance behavior of Ge crystal at room temperature.
4. Determination of lattice constant using XRD.
5. Sol-Gel synthesis of nanoparticles
6. Synthesis of Silver metal nanoparticles by chemical route.
7. Synthesis of Copper oxide nanoparticles.
8. Grain size estimation using XRD and AFM.

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