स्नातकोत्तर पाठ्यक्रम की परीक्षा योजना

प्रथम सेमेस्टर सत्र 2019–20 के लिए

विषय – भौतिकी प्रथम सेमेस्टर

प्रश्नपत्र	प्रश्नपत्र का शीर्षक	अधिकतम अंक		न्यूनतम उत्तीर्णांक	
		सैध्दांतिक	सी. सी.ई	सैध्दान्तिक	सी.सी.ई
प्रथम	Mathematical Physics	85	15	28	05
द्वितीय	Classical Machanics	85	15	28	05
तृतीय	Quantum Mechanics -I	85	15	28	05
चतुर्थ	Electronics Devices	85	15	28	05
	Lab A	100	–	35	
	Lab B	100	–	35	

द्वितीय सेमेस्टर

प्रथम	Quantum Mechanics -II	85	15	28	05
द्वितीय	Statistical Mechanics	85	15	28	05
तृतीय	Electrodynamics and Plasma	85	15	28	05
चतुर्थ	Atomic and Molecular Physics	85	15	28	05
	Lab A	100	–	35	
	Lab B	100	–	35	

27.6.19

27.6.19

तृतीय तथा चतुर्थ सेमेस्टर सत्र 2020–21 के लिए

विषय – भौतिकी तृतीय सेमेस्टर

प्रश्नपत्र	प्रश्नपत्र का □शीर्षक	अधिकतम अंक		न्यूनतम उत्तीर्णांक	
	□	सैध्दांतिक	सी. सी.ई	सैध्दान्तिक	सी.सी.ई
प्रथम	Condensed matterPhysics-I	85	15	28	05
द्वितीय	Nuclear and Particle Physics	85	15	28	05
तृतीय	Digital electronics	85	15	28	05
चतुर्थ	Atomic and molecular Physics	85	15	28	05
	Lab A	100	–	35	
	Lab B	100	–	35	

चतुर्थ सेमेस्टर

प्रथम	Condensed matterPhysics-II	85	15	28	05
द्वितीय	Laser Physics	85	15	28	05
तृतीय	Numerical Techniques based on C++	85	15	28	05
चतुर्थ	One of the following optional Papers (A) Computer Architecture,Networking & Assembly Language Programming (B) Materials Science (C) Environmental Physics (D) Communication Electronics (E) Analog Electronics and Microprocessors (F) Microprocessor and Microcontroller. Any other optional paper may be added After getting approval of competent authorities of the institution/college/University.	85	15	28	05
	Lab A	100	–	35	
	Lab B	100	–	35	
	Project/Internship	100	–	35	

27.6.19

P. Sen 27.6.19

विषय : स्वाध्यायी छात्रों के परीक्षा के संदर्भ में ।

एम.ए. एम.कॉम. एम.एस.सी. की सेमेस्टर परीक्षा उत्तीर्ण करने के लिए योजना निम्नानुसार रहेगी :–

1. प्रत्येक प्रश्न पत्र 100 अंकों का होगा। 33 प्रतिशत उत्तीर्णांक होगा।
2. कुल अंको (Aggregate marks) में 40 प्रतिशत अंक प्राप्त करने होगें अर्थात 160/400 अंक अर्जित करने होगे।
3. प्रत्येक सेमेस्टर में दो विषयों में ए.टी./के.टी. की पात्रता रहेगी।

सरल कमांक	कक्षा	सैद्धांतिक/प्रायोगिक प्रश्नपत्रों के लिए निर्धारित		न्यूनतम प्राप्तांक	एग्रीगेट प्राप्तांक
		सैद्धांतिक अंक	प्रायोगिक अंक		
1.	M.A., M.Sc., M.Com. M.H.Sc. (सेमेस्टर प्रणाली नियमित)	85	15	28 05	40%
2.	प्रायवेट परीक्षार्थियों के लिए	100	—	33	40%
				Aggregate Marks 160/400	

(Gyan Prakash)

27.6.19

P. 27.6.19

3 (1)

DEVI AHILYA VISHWAVIDYALAYA, INDORE

SYLLABUS

M.Sc (PHYSICS)

SESSION

2019-20
2020-21

P. Sen
27.6.19

(G. RAICHHA)

स्नातकोत्तर पाठ्यक्रम की परीक्षा योजना
प्रथम सेमेस्टर सत्र 2019-20 के लिए
विषय – भौतिकी प्रथम सेमेस्टर

प्रश्नपत्र	प्रश्नपत्र का शीर्षक	अधिकतम अंक		न्यूनतम उत्तीर्णांक	
		सैध्दांतिक	सी. सी.ई	सैध्दान्तिक	सी.सी.ई
प्रथम	Mathematical Physics	85	15	28	05
द्वितीय	Classical Machanics	85	15	28	05
तृतीय	Quantum Mechanics -I	85	15	28	05
चतुर्थ	Electronics Devices	85	15	28	05
	Lab A	100	—	35	
	Lab B	100	—	35	

द्वितीय सेमेस्टर

प्रथम	Quantum Mechanics -II	85	15	28	05
द्वितीय	Statistical Mechanics	85	15	28	05
तृतीय	Electrodynamics and Plasma	85	15	28	05
चतुर्थ	Atomic and Molecular Physics	85	15	28	05
	Lab A	100	—	35	
	Lab B	100	—	35	

5/3/19

5/3/19

विषय – भौतिकी तृतीय सेमेस्टर 2020-21

प्रश्नपत्र	प्रश्नपत्र का शीर्षक	अधिकतम अंक		न्यूनतम उत्तीर्णांक	
		सैध्दांतिक	सी. सी.ई	सैध्दान्तिक	सी.सी.ई
प्रथम	Condensed matterPhysics-I	85	15	28	05
द्वितीय	Nuclear and Particle Physics	85	15	28	05
तृतीय	Digital electronics	85	15	28	05
चतुर्थ	Atomic and molecular Physics	85	15	28	05
	Lab A	100	–	35	
	Lab B	100	–	35	

चतुर्थ सेमेस्टर → Numerical technique based on C++

प्रथम	Condensed matterPhysics-II	85	15	28	05
द्वितीय	Laser Physics	85	15	28	05
तृतीय	Computational Methods and Programming	85	15	28	05
चतुर्थ	One of the following optional Papers (A) Computer Architecture,Networking & Assembly Language Programming (B) Materials Science (C) Environmental Physics (D) Communication Electronics (E) Digital Electronics → Analog electronics and microprocessor (F) Microprocessor and Microcontroller. Any other optional paper may be added After getting approval of competent authorities of the institution/college/University.	85	15	28	05
	Lab A	100	–	35	
	Lab B	100	–	35	

5/7/19

CLASS - M.Sc. SUBJECT - PHYSICS

SEMESTER - I PAPER - I

MATHEMATICAL PHYSICS

Unit -I

Differential equations: Recursion relation, generating functions and orthogonality of Bessel functions of first and second kind, Hermite, Legendre, Associate Legcndre and Laguerre Polynomials.Curvilinear co-ordinate system with specific cases of Cartesian, Cylindrical, and Spherical coordinate systems.

Unit -II

Integral transforms. Fourier integral. Fourier transform and inverse Fourier transforms. Fourier transform of derivatives. Convolution theorem. Elementary Laplace transforms. Laplace transform of derivatives. Application to a damped harmonic oscillator.

Unit -III

Green's functions: Non-homogenous boundary value problems, Green's function for one dimensional problems, eigen function expansion of Green's function, Fourier transform.method of constructing Green's function, Green's function for electrostatic boundary value.problems and quantum-mechanical scattering problem.

Unit -IV

Complex variables: Analyticity of complex functions. Cauchy Riemann equations. Cauchy theorem. Cauchy integral formula. Taylors, Maclaurin, Laurent series & mapping. Theorem of residues. Simple cases of contour integration. Jordan's lemma Integrals involving multiple valued unctions(Branch points).

Unit .V

This unit will have a short *note* question covering all the four units. The students will have to answer any two questions out of the four.

Books Recommended :

1. L. A. Pipes Mathematics of Engineers and Physicists
2. Arfken Mathematical Methods for Physicists
3. P.K. Chattopadhyay Mathematical Physics
4. H.K.Dass Mathematical Physics
5. Ghatak, Goyal & Guha Mathematical Physics
6. M.R Spiegel (Schaum Series) Complex variable & Laplace Transform

513/19

SEMESTER - I PAPER - II

CLASSICAL MECHANICS

Unit - I

Newtonin mechanics of one and many particles systems: Conservation laws, Constrains their classification, Principle of virtual work; D'Almbert's principle in generalized coordinates, The Lagrange's equation from D'Almbert's principle. Configuration space, Hamilton's principle deduction from D'Almberts principle, Generalized momenta and Lagrangian formulation of the conservation theorems, Reduction to the equivalent one body problem; the equation of motion and first integrals, the differential equation for the orbit.

Unit - II

The equat ions of canonical transformation and generating functions; The Hamilton-Jacobi Action and Angel variables. Poisson.s brackets; simple algebraic properties of Poisson.s brackets. The equation of motion in Poisson.s Brackets notation. Poisson theorem; principle of least action. The Kepler problem, Inverse central force field, Rutherford scattering.

Uni t - III

Theory of small oscillations, Equations of motion, Eigen frequencies and general motion, normal modes and coordinates, Applications to coupled pendulum and linear bistable molecule. Rotating coordinate systems. Acceleration in rotating frames. Coriolis force and its terrestrial astronomical applications, Elementary treatment of Eulerian coordinates and transformation matrices. Angular momentum inertia tensor. Eular equations of motion for a rigid body. Torque free motion for a rigid body.

Unit - IV

Symmetries of space and time. Invariance under galilion transformation, Covariant fourdimensional formulation, 4 -Vectors and 4 - scalers. Relativistic generalization of Newton's laws, 4 - momentum and 4 - force, variance under Lornetz transformation relativistic mechanics. Covariant Lagrangian, covariant Hamiltonian, Examples.

Unit -V

This unit will have a short note question covering all the tour units. The students will have to answer any two questions out of the four.

Books Recommended

1. H.Goldstein (Addison Wesley) Classical Mechanics
2. N.C.Rana & P.S.Jog Classical Mechanics
3. Landu & Lifshitz (Pergamann Press) Classical Mechanics
4. A. Sommarfield (Academic Press) Classical Mechanics
5. R.G.Takwale & P.S. Puranik Introduction to Classical Mechanics

5/3/19

QUANTUM MECHANICS- I

Unit . I

Basic Postulates of quantum Mechanics, equation of continuity, Normality, orthogonality and closure properties of eigen functions, expectation values and Ehrenfest theorems, solution of Schrodinger equation for one dimensional (a) potential well (b) potential step and (c) Potential barrier.

Unit . II

Linear vector space, concept of Hibert space, bra and ket notation for state vector, representation of state vectors and dynamical variables by matrices and unitary transformation (Translation and rotation), creation and annihilation operators, matrices for x and p. Heisenberg uncertainty relation through operators (Schwartz inequality). Harmonic oscillator by operator method.

Unit -III

Solution of Schrodinger equation for (a) linear harmonic oscillator (b) hydrogen - like atom (c) square well potential and their respective application to atomic spectra, molecular spectra and low energy nuclear states (deutron).

Unit - IV

Angular momentum in quantum mechanics, Eigen values and Eigen function of L^2 and L_z in term of spherical harmonics, commutation relation. Interpretation of wave function, coordinate and momentum, representation of wave function and operators. Spinangular momentum and Pauli spin matrices, Addition of two angular momenta with some examples. CG-coefficient and their properties, computation of CG-coefficient.

Unit -V

This unit will have a short note question covering all the four units. The students will have to answer any two questions out of the four.

Text Books and reference-book:

1. L I Schiff, Quantum Mechanics
2. S Gasiorovvicz, Quantum Physics
3. B Craseman and J D Powell Quantum Mechanics
4. A P Messiah Quantum Mechanics
5. J. J. Sakurai Modern Quantum Mechanics
6. Mathews and Venkatesan Quantum Mechanics

(7)

SEMESTER - I

ELECTRONIC DEVICES

Unit . I

Transistors: JFET, BJT, MOSFET and MESFET, structure derivations of the equations for I-V characteristics under different condition, microwave devices, tunnel diode, transfer electron devices (Gunn diode), avalanche transits time devices, Impatt diodes and parametric devices.

Unit - II

Photonic devices: radiative and non-radiative transitions, optical absorption, bulk and. Thin film photo conductive devices (LDR), diode Photo detectors, Solar cell (open circuit voltage and short circuit current, fill factor), LED (high frequency limit, effect of surface and indirect recombination current, operation of LED), semi-conductors; diode lasers (conditions for population inversion in active region, light confinement factor, optical gain and threshold current for lasing.

Unit - III

Memory Devices: Read Only Memory (ROM) and Random Access Memory (RAM).Types of ROM: PROM, EPROM, EEPROM and EAPROM, Static and dynamic RAMs (SRAM & DRAM), characteristics of SRAM and DRAM.Hybrid Memories : CMOS and NMOS memories, Nonvolatile RAM, ferro-electric memories, charge coupled devices (CCD), storage devices: Geometry and organization of magnetic (FDD & HDD) and Optical (CD-ROM, CD-R, CD-RW, DVD) Storage devices.

Unit: IV Electro-optic, Magneto-optic and Acousto-optic effects, piezoelectric, electrostrictive and magnetostrictive effects. Sensors and actuator devices, piezoelectric resonators and filters.

Unit - V

This unit will have a short note question covering all the four units. The students will have to answer any two questions out of the four.

Text books and reference books:

1. SM Sze Willey (1985) Semiconductors devices - physics technology
2. MS tyagi Introduction to semiconductors devices
3. M Sayer and A Manisingh Measurement instrumentation and experimental design in physics and engineering
4. Ajoy Ghatak and Thyagrajam Optical Electronics

Subject : Physics

List of Experiments for M.Sc. (Ist Sem) ~~2004-05~~

Lab A : General

1. Forbidden energy gap.
2. Dielectric Constant.
3. e/m by Thomson's / Millikan's oil drop method.
4. Fourier analysis.
5. Study of acoustical and optical modes.

Lab B : Electronics

1. Study of Semiconductors (diode / Zener diode)
2. Transistor as a switch.
3. Study of SC Controlled rectifiers.
4. IC regulated power supply.
5. Study of RC coupled amplifier.

Note :

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

SEMESTER - II

QUANTUM MECHANICS .II

Unit - I

Approxmination method for bound states : Rayleigh- Schrodinger Perturbation theory of non-degenrate and degenrate levels and their application to perturbation of an oscillator, normal helium atom and first order stark effect in hydrogen. Variation method and its application to ground state helium, W K B Approximation method, connection formulae, ideas on potential barrier with applications to theory of alpha decay.

Unit - II

Time dependant perturbation theory: Methods of variation of constants and transition probability, adiabatic and sudden approximation, wave equation for a system of charged particles under the influence of external electromagnetic field, absorption and induced emission, Einstein's A and B coefficients and transition probability.

Unit- III

Theory of Scattering, Physical concepts, scattering amplitude, scattering cross section. Born Approximation and partial waves, scattering by perfectly rigid sphere, complex potential and absorption, scattering by spherically symmetric potential, identical particles with spin, Pauli's spin matrices.

Unit- IV

Schrödinger.s relativistic equation (Klein-Gordon equation), Probability and current density, Klein - Gordon equation in presence of electromagnetic field, hydrogen atom, short comings of Klein-Gordon equation, Dirac.s relativistic equation for free electron, Dirac.s Matrices. Dirac.s relativistic equation in electromagnetic field, negative energy states and their interpretation hydrogen atom, hyperfine splitting.

Unit - V

This unit will have a short note question covering all the four units. The students will have to answer any two questions out of the four.

Text Books and reference book:

1. LI Schiff Quantum Mechanics
2. S Gasiorowicz Quantum Physics
3. B Craseman and J J Powell Quantum Mechanics (Addison Wessley)
4. A .Messiah Quantum Mechanics
5. J.J. Sakurai Modern Quantum Mechanics
6. Mathews and Venkatessan Quantum Mechanics
7. A .K.Ghatak and Loknathan Quantum Mechanics

CLASS - M.Sc. SUBJECT - PHYSICS PAPER - II

(10)

SEMESTER - II

STATISTICAL MECHANICS

Unit - I

Foundation of statistical mechanics, specification of states of a system contact between statistics and thermodynamics, classical ideal gas entropy of mixing and Gibb.s paradox. Microcanonical ensemble, phase space, trajectories and density of states, Liouville theorem, canonical and grand canonical ensembles, partition function, calculation of statistical quantities, energy and density fluctuations.

Unit-II

Statistics of ensembles, statistics of indistinguishable particles, density matrix, Maxwell -- Boltzmann, Fermi Dirac and Bose- Einstein statistics, properties of ideal Bose gases, Bose . Einstein condensation, properties of ideal Fermi gas, electron gas in metals, Boltzman transport equation.

Unit-III

Cluster expansion for a classical gas, virial equation of state, mean field theory of Ising model in 3,2 and 1 dimension. Exact solution in one-dimension.

Unit .V

Thermodynamics fluctuation spatial correlation Brownian motion, Langevin theory, fluctuation dissipation theorem, the Fokker-Planck equation, Onsager reciprocity relations

Unit . V

This unit will have a short note question covering all the four units. The students will have to answer any two questions out of the four.

Text Books and reference book:

1. F Reif Statistical and thermal Physics
2. K Huang Statistical Mechanics
3. R K Pathria Statistical Mechanics
4. R Kubo Statistical Mechanics
5. Tandan Statistical Physics

ELECTRODYNAMICS AND PLASMA PHYSICS

Unit . I

Review of Basics of electrostatics and magnetostatics (electric field, Gauss.s law, Laplaces and Poisson equations, method of images, Biot-Sawart law, Ampere law, Maxwell's equations, scalar and vector potentials, gauge transformation, Lorentz gauge, Coulomb Gauge, Solution of Maxwell equations in conducting media radiations by moving charges, retarded potentials, Lienard Wiechrt potentials, fields of charged particles in uniform motion, fields of arbitrarily moving charge particle.

Unit-II

Fields of accelerated charged particles at low velocity and high velocity, angular distribution of power radiated, Review of four vector and Lorentz transformation in 4-dimensional spaces, Invariance of electric charge, relativistic transformation properties of E and H fields. Electromagnetic fields tensor in 4-dimensional Maxwell equation, Four Vector current and potential and their invariance under Lorentz transformation, covariance of electrodynamics. Langragian and Hamiltonian for a relativistic charged particle in External EM field; motion of charged particles in electromagnetic fields, uniform and nonuniform E and B fields.

Unit -III

Elementary concept of occurrence of plasma. Gaseous and solid state plasma. Production of gaseous and solid state plasma. Plasma parameters. Plasma confinement pinch effect instability in a pinched-plasma column. Electrical neutrality in a plasma. Debye screening distance. Plasma oscillations: Transverse oscillations and longitudinal oscillations.

Unit . IV

Domain of Magnetohydrodynamics and plasma Physics : Magnetohydrodynamic equations, magnetic hydro-static pressure hydrodynamic waves: Magneto-sonic and Alfven waves, particle orbits and drift motion in a plasmas, Experimental study of Plasma, the theory of single and double probes.

Unit - V

This unit will have a short note question covering all the four units. The students will have to answer any two questions out of the four.

Text Books and reference book:

1. Bitteneerort Plasma Physics
2. Chen Plasma Physics
3. Gupta, Kumar, Singh Electrodynamics
4. Sen Plasma state and matter
5. Jackson Classical electrodynamics
6. Pamolsky & Philips Classical electricity and Magnetism

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

(12)

SEMESTER - II

ATOMIC AND MOLECULAR PHYSICS

UNIT -I

Quantum states of one electron atom. Atomic orbitals. Hydrogen spectrum, Paulis principle, Spectra of alkali elements, Spin orbit interaction and line structure of alkali Spectra . Methods of molecular quantum mechanics, Thomas Fermi statistical model, Hartree and Hartree fock method, Two electron system. Interaction energy in L-S and J-J coupling, hyperfine structure (qualitative), line broadening mechanisms(general ideas).

UNIT - II

Types of molecules. Diatomic linear. Symmetric top, asymmetric top and spherical top molecules. Rotational spectra of diatomic molecules as a rigid rotator, Energy level and Spectra of non-rigid rotator, intensity of rotational lines,

UNIT- III

Vibrational energy of diatomic molecule, diatomic molecule as a simple harmonic oscillator, Energy levels and spectrum, Morse potential energy curve, Molecules as vibrating rotator, Vibration spectrum of diatomic molecule PQR branches, IR spectrometer(qualitative)

UNIT-IV

Introduction to ultraviolet, visible and infra-red spectroscopy, Raman spectroscopy: Introduction, pure rotational and vibrational spectra, Techniques and instrumentation, Photo electron spectroscopy, elementary idea about photoacoustic spectroscopy and Mossbauer spectroscopy(principle).

UNIT-V

This unit will have a short note question covering all the four units. The students will have to answer any two questions out of the four.

Text and reference Books:

1. H.E. White Introduction to atomic spectra
2. C.B. Banwell Fundamental of molecular spectroscopy
3. Walker and Strnghem Spectroscopy vol. I, II and 111
4. G.M.Barrow Introduction to molecular spectroscopy
5. Herzberg Spectra of diatomic molecules
6. Jeanne L and McHale Molecular Spectroscopy
7. J.M.Brown Molecular Spectroscopy
8. P.F.Bemath Spectra of atoms and molecules
9. J.M. Halian Modern Spectroscopy

Subject : Physics

List of Experiments for M.Sc. (2nd Sem) 2019-20

Lab A : General

1. Study of calcite prism.
2. Study of Characteristics of Thermistor.
3. Wavelength of light using grating.
4. Four Probe methods.
5. Study of Ionization potential of given gas.

List : Lab B (Electronics)

1. Study of characteristics of FET
2. Study of RPS using Transistor.
3. Study of Filter circuits.
4. Study of Negative resistance diode (Tunnel / LDR)
5. Study of Photocell / solar cell.

Note :

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

SEMESTER - III

CONDENSED MATTER PHYSICS

Unit - I

Crystal structure:

Bravais lattice in two and three dimension. Simple crystal structures: Hexagonal close packed structure, Diamond structure, zinc blende structure, sodium chloride structure, cesium chloride structure.

Unit . II

Crystal diffraction by X-Ray:

Reciprocal lattice, Reciprocal lattice of bcc and fcc lattice. Relation between crystal lattice axes and crystal reciprocal lattice axes. Bragg diffraction. Condition in term of reciprocal lattice vector. Brillouin zones.

Unit-III

Elastic properties of solids:

Stress and strain components, elastic compliance and stiffness constants, elastic energy density, reduction of number of elastic constants, elastic stiffness constants for isotropic body, elastic constant for cubic isotropic bodies, elastic waves, waves in (100) direction, experimental determination of elastic constants.

Unit . IV

Lattice vibration and phonons:

Lattice dynamic of a diatomic linear lattice. Lattice vibrational spectrum. The concept of phonons momentum of phonons. Inelastic scattering of photons by phonons. Inelastic scattering of neutrons by phonons. Inelastic scattering of X-Ray.

Unit - V

Thermal properties and band theory of solids:

Anharmonicity, thermal expansion, thermal conductivity, equation of state of solids, gruneisen constant. Band theory, classification of solids, concepts of effective mass. Fermi surfaces, anomalous skin effect, De Hass van alphen effect, cyclotron resonance, magneto resistance.

Text and reference Books :

1. 1. Verma and Srivastava: Crystallography for solid State physics.
2. Azaroff: Elementary to Solids.
3. Omar: Introduction Solids state physics.
4. Kittle: Solids state physics
5. Huong: theoretical solids state physics
6. Weertman and weertman: Elementary dislocation theory
7. Buerger: Crystal structure physics.
8. Made lung: introduction to solids state physics.

CLASS - M.Sc. SUBJECT - PHYSICS

SEMESTER - III PAPER - II

NUCLEAR AND PARTICLE PHYSICS

Unit-I

Nuclear Interaction and Nuclear reaction:

Nuclear forces, exchange and tensor forces, meson theory of nuclear forces, Low-energy n-p scattering and spin dependence of n-p forces. Direct and compound nuclear reaction mechanism, reciprocity theorem.

Unit - II

Accelerators of charged particles:

Study of cyclotron, phase stability, frequency modulated cyclotron (synchorocyclotron) magnetic induction accelerator (Betatron), Electron synchrotron and linear accelerator (Linac)

Unit . III

Nuclear models:

Liquid drop model, Bohr-wheeler's theory of nuclear fission, shell model, spin orbit interaction, magic number, spin and angular momenta of nuclear ground state, nuclear quadrupole moment.

Unit - IV

Nuclear decay and elementary particles:

β Decay, general features of β ray spectrum, Fermi theory of β decay, selection rules, parity in β decay, muitipole radiation, internal conversion, nuclear isomerism.

Unit - V

Elementary particles:

Classification of elementary particles, fundamental interaction, parameters of elementary particles. Symmetry and conservation laws, symmetry schemes of elementary particles SU(3)

Text and reference Books:

1. Introduction to Nuclear physics : H.A. Enge
2. Nuclear radiation detectors : S.S. Kapoor and V.S.Ramamurthy
3. Atomic and Nuclear physics : S.N. Ghoshal
4. Nuclear and Particle physics : D.C. Tayal
5. Nuclear Physics : R.C. Sharma
6. Introduction to Nuclear physics : KRANE
7. Nuclear physics Principles & Application :Lilley

Digital Electronics

Unit-I

Number system (Binary, Octal, Decimal, hexadecimal) and conversion between them. Boolean arithmetic, signed and unsigned binary numbers, I's complement, 2's complement,

Unit-II

Codes: BCD, Gray, ASCII, EBCDIC, Demorgans theorem, Gates: OR, AND, NOT, NOR, OR, NAND, XOR, XNOR, Boolean algebra, karnaugh map, adder and subtractor circuit design.

Unit-III

Multiplexer, demultiplexer, encoder, decoder, parity checker and generator, Flip-Flops: R-S,D, J-k, J-k Master slave flip flop, race around condition registers, shift registers (left and right shift).

Unit-IV

Counters-asynchronous (ripple) counter, synchronous (parallel) counter, MOD-5 counter and MOD-10 counter, BCD counter, Up-Down counter, Shift Register counter (Ring counter).

Unit-V

Digital to analog conversion (Binary weighted register method, R-2R ladder network method, complete DAC structure. Analog to digital converters (Stair case or counter method, single slope, equal slope, successive approximation ADC).

Text and reference Books:

1. "Digital principles and applications" by A.P.Malvino and Donald P.Leach, Tata Megraw-Hill company, New Delhi, 1993.
2. "Microprocessor Architecutre, Programming and Applications with 8085/8086 by Rames S. Gaonkar, Wiley-eastern Ltd.. 1987 (for unit V)"
3. Digital electronics –S.N. Ali
4. Digital electronics –Morries Mano
5. Microprocessor and Microcomputers-B.Ram-Dhanpat Rai publications V edition.

SEMESTER - III PAPER - IV

Atomic and Molecular Physics

Unit-I

Nuclear Magnetic Resonance Spectroscopy:

Concept of Nuclear Magnetic resonance spectroscopy, Interaction between nuclear spin and magnetic field, population of energy level, relaxation processes, spin-spin interaction and spin-spin coupling between two and more nuclei (Qualitative)

Unit-II

Electronic spectra of Diatomic Molecules:

Franck Condon principles, dissociation and pre-dissociation, dissociation energy. Born-Oppenheimer-approximation, vibrational coarse structure of electronic spectra (bands progression and sequence).

Unit-III

Raman Spectra

Raman effect, quantum theory of Raman effect, Molecular polarisibility in Raman effect, Vibrational Raman spectra, vibration-rotation Raman Spectra of diatomic molecules, application of Raman and infrared spectroscopy in the structure determination.

Unit-IV

Mossbauer Spectroscopy:

Mossbauer Effect, principles of Mossbauer spectroscopy, recoil less emission of gamma emission, line width and resonance absorption, application of mossbauer spectroscopy (Isomer shift, Quadra pole splitting magnetic field effect).

Unit-V

Electron Spin Resonance spectroscopy:

Elementary Idea about ESR, Principle of ESR, ESR spectrometer, splinting of electron energy levels by a magnetic field, G-Values, simple experimental setup of ESR. ESR spectra of free radicals in solution, An Isotropic system.

Text and reference Books:

1. Fundamentals of Molecular Spectroscopy-C.B. Banwell.
2. Spectra of Diatomic Molecules-Herzberg.
3. Mossbauer Spectroscopy-M.R.Bhide
4. NMR and Chemistry-J.W.Akitt
5. Modern Spectroscopy-J.M.Hollons

Subject : Physics

List of Experiments for M.Sc. (3rd Sem) 2020-21

Lab A : General

1. Susceptibility measurements.
2. Study of Hall Effect.
3. Study of Hysteresis curve.
4. Study of Frank and Hertz experiments.
5. e/m using Zeeman effect.

Lab B : Electronics

1. To Study gates and verify truth tables.
2. To verify De-Morgan's theorem.
3. To verify truth table for RS, D, T & JK flip flop.
4. To study synchronous and Asynchronous Counter.
5. Study of Multi vibrator circuits.

Note :

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

(19)

Condensed Matter Physics-II

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 : Pooke and Owens

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

CLASS M.Sc. SUBJECT – PHYSICS

TER – IV PAPER – III

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

(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.

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

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.

(25)

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

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

(27)

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, schematic symbol of op-amp. Idal op-amp parameters: input offset voltage, input offset current, input bias 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, LC 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 Hardware 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 R.S. Gaonkar
6. Microprocessor & Digital Systems : D.V.Hall
7. Fundamentals of Electronics : Broker

5/3/19

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 unt (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.

5/3/19

Subject : Physics

LIst of Experiments for M.Sc. (4th Sem) 2020-21

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.

5/3/19