Course Learning Outcomes

Non-Conventional Energy Sources
गैर परम्परागत ऊर्जा स्रोत

At the end of the course student will be able to achieve.

- A good understanding of various non-conventional energy sources.
- Knowledge about non-conventional energy harvesting Technology.
- The knowledge about the availability of non-conventional energy resources in India.
- A good understanding of the solar energy and the appliances based on solar energy.
- A non-conventional energy harvesting technical skill that will be helpful for employment.

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इस पाठ्यक्रम के अंत में विद्यार्थी प्राप्त करेगा:

- विभिन्न गैर परम्परागत ऊर्जा संसाधनों के बारे में अच्छी समझ|
- गैरपरम्परागत ऊर्जा के संचयन प्रौद्यो गिकी का ज्ञान।
- भारत में गैर परम्परागत ऊर्जा संसाधनों की उपलब्धता का ज्ञान|
- सौर ऊर्जा एवं सौर ऊर्जा पर आधारित उपयोग की अच्छी समझ।
- गैरपरम्परागत ऊर्जा संचयन की तकनीकि कुशलता प्राप्त करेगा जो उसे रोजगार में सहायक होगी।

SAROJINI NAIDU GOVT. GIRL'S P. G. (AUTONOMOUS) COLLEGE,
SHIVAJI NAGAR,BHOPAL
AS RECOMMENDED BY THE BOARD OF STUDIES
SESSION: 2021-22
THEORY

- **PROGRAM /कार्यक्रम : CERTIFICATE /प्रमाणपत्र**
- **CLASS/ d{kk : BSC-I YEAR /ch- ,llh-&izFke o"kZ**
- **SUBJECT/ fo"k;%** PHYSICS**@HkkSfrd foKku**
- **COURSE CODE/ ikB~;Øe dk dksM**
- **COURSE TITLE/ ikB~;Øe dk 'kh"kZd%**

  NON CONVENTIONAL ENERGY SOURCES
  गैर परम्परागत ऊर्जा स्रोत
- **COURSE TYPE /ikB~;Øe dk izdkj ELECTIVE/,sfPNd**
- **CRADIT VALUE /ØsfMV eku% 4**
- **MAXIMUM MARKS/vf/kdre~ vad % 25 + 75**
- **MINIMUM PASSING MARKS/U;wure~ mRrh.kkZad % 33**
- **PRE REQUISITE/iwokZis{kk% Open for All/lHkh ds fy, miyC/k**

Unit		Syllabus	Hours
Unit-I	**English**	Introduction to non-conventional energy sources: 1. Classification of energy resources, Consumption trend of primary energy resources Importance of non-conventional energy resources. 2. Energy chain, Common form of energy, Limitations of non-conventional energy resources. 3. Salient features of non-conventional energy resources, Environmental aspects of energy. 4. World energy status, Energy scenario in India **Keywords/Tags:** Energy resources Energy chain, Non-conventional energy.	

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Unit-II	**English**	Solar energy: 1. The sun as a source of energy, Solar radiation at the Earth's surface. 2. Photo thermal applications: Solar collectors, Solar drying Solar cooker (box type), Solar distillation, Solar water heating system Solar thermo-mechanical System. 3. Photovoltaic system: Photovoltaic principle, Basic photovoltaic system for power generation, Solar cells, types of solar cells, Concentrator cells, Sun-tracking systems, Limitations and environmental aspect of solar cells. 4. Photovoltaic applications: Solar Cell Panels, Solar light, Solar pump, solar power plants, Solar cell in transportation, solar refrigeration and air conditioning. **Keywords Tags:** Solar radiation, Photo thermal, Photovoltaic, Solar cells.	

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<tr><td rowspan="2">Unit-III</td><td>English</td><td>Biomas Energy
1. Biomass resource, biomass conversion technology, Biogas generation.
2. Let of factors affecting bio-digestion, Working of biogas plant (with block diagram), biogas from plant waste.
3. Methods of obtaining energy from Biomass, Thermal gasification of biomass.
4. Biomass energy programme in India, Biodiesel production from non-edible all seeds.
Keywords Tags: Biomass, Thermal Gasification, Bio digestion.</td><td></td></tr>
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Unit-IV	**English**	Wind energy: 1. Concept of Wind, Origin of winds, Wind climate, Wind profile. Limitation of extracted power from a wind turbine. 2. Wind resource map and site identification, Land requirement. 3. Wind turbine setting, Wind turbine aerodynamics wind turbine type: Upwind and downwind turbines, Blade count, Constant and variable speed wind turbine onshore and offshore wind turbines. 4. Wind turbine rotor, working of wind turbine, Drag principle, Lift principle. 5. Effect of wind turbine on environment. Wind energy storage, Wind energy program in India. **Keyword/Tag:** Wind climate, Wind energy, Wind turbine	
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Unit-V	**English**	Geothermal and Oran energy 1. Geothermal energy origin and distribution of geothermal energy types of geothermal resources, Analysis of geothermal resources. 2. Exploration and development of geothermal energy. 3. Advantages and disadvantages of geothermal energy, Possibilities and limitations 4. Ocean energy Tidal energy Origin and nature of tidal energy, Environmental impact, Energy and power in waves, advantages and disadvantages of wave energy. 5. Ocean Thermal Energy, Ocean Thermal conservation Technology (OTEC). Environmental impact. **Keyword / Tags:** Geothermal energy ,Ocean energy, Tidal energy, OTEC	
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Learning Resources: (Text Books, Reference Books, Other Resources)

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1. Rai G. D. "Non-conventional energy sources, Khanna Publishers, 4th edition.
2. Sukhatme S. P. and Nayak J. K., "Solar Energy: Principles of thermal collection and storage", Tata McGraw Hill Ltd, Second Edition.
3. Rai G. D., "Solar energy utilization", Khanna Publishers, 5th edition.
4. Khan B. H., "Non-conventional energy resources", McGraw Hill Publications.

Suggestive digital platforms web links /vuq’kaflr fMftVy lysVQkWeZ csc fyad

1. https:/mnre.gov.in Ministry of New and Renewable Energy.

Suggested equivalent online course/ vuq’kaflr led{k vkWuykbu ikB~;Øe

1. https://nptel.ac.in/course/121/106/121106014/ By Prof. Prathap Haridoss, IIT Madras.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

COURSE LEARNING OUTCOMES

B.Sc. II Year

Paper I : OPTICS

On successful completion of this course students will gain knowledge on various theories of light.

- Acquire skills to identify and apply formulas of optics and wave physics.
- understand phenomenon of Optics like- Interference in working of Interference, Diffraction, Polarisation and their application.
- Application of interference in Working of Interferometer.
- Application of diffraction will give concept of Resolving Power of optical instruments.
- learn basic mechanism of Laser action and understand how real world. LASER operates and their types and properties.
- Gain knowledge in Holography optical fiber and application in communication.
- Geometrical option provides basic tool in understanding optical system in image information, lens combination and aberration in optical instruments.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)
Session : 2021-22

Class: B.Sc. Second Year
Max. Marks: 50

Subject : Physics
Paper : First
Title of Paper : Optics

Unit-I Geometrical Optics & Waves
Lectures

Fermat's Principle, Refraction at a spherical surface, Aplanatic points and its applications, Lens formula, Combination of thin lenses and equivalent focal length. Dispersion and dispersive power, chromatic aberration and achromatic combination, different types of aberration (qualitative) and their remedy. Need for multiple lenses in eyepieces, Ramsden and Huygens eye-piece, Simple Harmonic Motion, Dempend oscillations, forced oscillations and resonance, Beats, Stationary wave in a string; pulse and wave packets: Phase and group velocities, Refilaction and Refraction from Huygen's principle.

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Unit-II Interference of light

The principle of superposition, two slit interference, coherence requirement for the sources, optical path retardations, Lateral shift of fringes, Localised, fringes, thin films, interference by a film with two non-parallel reflecting surfaces, Newton's rings. Haidinger fringes (Fringes of equal inclination), Michelson interferometer, its appllication for precision determination of wavelength, wavelength difference and the width of spetral lines. intensity distribution in multiple beam interference, Fabry-Perot intrerferometer and Elalon.

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Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)

Session : 2021-22

Class: B.Sc. Second Year

Unit-III Diffraction

Fresnel's and Fraunhofer diffraction: Half period zone, Zone plate. Diffraction at straight edge, rectilinear propagation. Diffraction at a slit, phasor diagram and integral calculus methods. Diffraction at a circular aperture. Rayleigh criterion of resolution of images. Resolving power of telescope and microscope, Diffraction at N-parallel slits, Intensity distribution, Plane diffraction grating, Resolving power of a grating.

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Unit-IV Polarsation

Transverse nature of light waves, Polarization of electromagnetic waves, Plane polarised light - production and analysis, Description of Linear, circular and elliptical polarisation. Propagation of electro magnetic waves in anisotropic media, uniaxial and biaxial crystals, symmetric nature of dielectric tensor, Double refraction, Hygen's principle, Ordinary and extraordinary refractive indices, Fresnel's formula, light propagation in uniaxial crystal, Nicol prism, Production of circularly and elliptically polarized light, Babinet compensator and applications, Optical rotation, Optical rotation in liquids and its measurement through polarimeter.

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Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)
Session : 2021-22

Class: B.Sc. Second Year

Unit-V Fibre Optics and Laser

Principle of fiber optics, attenuation: pulse dispersion and step index and paradolic index fibres. A brief history of lasers, characteristics of laser light, Einstein prediction, Relationship between Einstein's coefficients (qualitative discussion), Pumping schemes, Resonators, Ruby laser, He-Ne laser, Applications of lasers, Principle of Holography. Photodiodes, Phototransistors, and Photomultipliers.

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References Books:

1. Fundamentals of Optics : F.A. Jenkins and H.E. White, 1976 Mc Graw-Hill.
2. Principles of Optics : B.K. Mathur, 1995, Gopal Printing.
3. University Physics: F.W. Sears, M.W. Zemansky and H.D. Yong, 13/c, 1986 Addison-Wesley.
4. Optics: A.K. Ghatak, McGraw Hill Publications.
5. Principles of Optics : Max Born and Wolf, Pregmon Press.

6. Optics and Atomis Physics, D.P. Khandelwal, Himalaya Publication.
7. Lasers : Theory and Application : K. Thyagrajen and A.K. Ghatak.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

COURSE LEARNING OUTCOMES

B.Sc. II Year

Paper II-: Electrostatistics, Magnetostatics and Electrodynamics

This course develops concepts of electric field and scalar potential, magnetic field and vector potential. It provides Knowledge based on fundamental concepts of charge, field and their interaction with matter. Course leaming'outcome is to

- Define various electric feild in electrstatistics, magnetostatics, and electrodynamics .
- Explain propagation of electromagnetic wave and apply Maxwells equation to solution of problems related to wave propagation which forms base to modern PLASMA physics.
- To learn the Principle, construction and operation of important and basic electronic device CRO to measure frequency and voltage.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)
Session : 2021-22

Class: B.Sc. Second Year
Max. Marks: 50

Subject	:	Physics
Paper	:	Second
Title of Paper	:	Electrostatics, Magneto statics and Electrodynamics

Unit- 1 Electrostatics

Fundamental's of Electrostatics, Gauss's law and its application for finding E for symetric charge distributions, Capacitors, conducting sphere in a uniform electric field, point charge in front of a grounded infinite conductor. Dielectrics. Parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector P, relation between displacement vector D, E and P. Molecular interpretation of Claussius-Mossotti equation.

Laplace and poissson equations in electrostatics and their applications; Energy of system of charges, multiple expression of scalar potential; method of images and its application. potential and field due to a dipole, force and torque on a dipole in an external electric field.

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Unit-2 Magnetostatics

Force on a moving charge, Lorentz force equation and definition of B, force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment, angular momentum and gyromagnetic ration, Bior and Savart's law, calculation of H for simple geometrical situations such as solenoid, Anchor ring. Ampere's law, $VxB = M_0 J$, $V.B= 0$. Field due to a magnetic dipole, free and bound currents, magnetization vector (M), relationship between B,H and M. Derivation of the relation $Vx M = J$ for non-uniform magnetization.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

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Unit-3 Current Electricity and Bio Electricity

Steady current, current density J, non-steady currents and continuity equation, Kirchoff's laws and analysis of multiloop circuits, growth and decay of current in LR and CR circuits, decay constants, LCR circuits. Mean and RMS values of A.C., AC circuits, complex numbers and their application in solving AC circuits problems, complex impedance and reactance, series and parallel resonance. Q-factor, power consumed by an A.C. circuit, power factor, Y and V networks and transmission of electric power, Electricity observed in living systems, Origin of bioelectricity.

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Unit-4 Motion of Charged Particles in Electric and Magnetic Fields

(Note: The emphasis here should be on the mechanical aspects and not on the details of the apparatus mentioned which are indicated as applications of principles involved.)

E as an accelerating field, electron gun, discharge tube, linear accelerator. E as deflecting field - CRO, Sensitivity of CRO. Transverse B Field; 180^0 deflection, Mass spectrograph and velocity selector, Curvatures of tracks for energy determination for nuclear particles; principle and working of Cyclotron. Mutually perpendicular and parallel E & B fields; Positive ray parabolas, Discovery of isotopes, Elements of Mass Spectrographs, Principle of magnetic focusing (lenses).

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)

Session : 2021-22

Class: B.Sc. Second Year

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Unit-5 Electrodynamics

Electromagnetic induction, Faraday's Laws, Electromotive force, Integral and differential forms of Faraday's laws, Self and mutual inductance, Transformers, Energy in a static magnetic field, Maxwell's displacement current, Derivations of Maxwell's equations, Electromagnetic field energy density. Poynting vector, vector and scalar protentionals; Electromagnetics field Tensors, Fresnel's relations, Rayleigh scattering. Electromagnetic wave equation, Plane electromagnetic waves in vacuum and dielectric media, Reflection at a plane boundary of dieletrics, Fresnel's Laws, Polarization by reflection and total internal reflection, Waves in a conducting medium, Reflection and refraction by the ionosphere.

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References:

1. Berkley Physics Course, Electricity and Magnetism Ed. E. M. Purcell Mcgraw Hill
2. Physics Volume 2, D. Halliday and R. Resnick
3. Introduction to Electrodynamics: D.J. Griffiths, 4 Edition, Printice Hall.
4. Electricity and Magnetism: S.S. Atwood Dover.
5. Electrodynamics: Emi Cossor and Bassin Lorraine, Ashahi Shimbunsha Publishing Ltd.
6. From Neuron to Brain : Kuffler and Nicholas, Sinauer Associates, Inc Pub. Sunderland Masschuetts.
7. Schaums Oulline of Begining Physics II: Electricity and Magnetism

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)

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Class: B.Sc. Second Year

Max Marks : 50

List of Practicals

1. Study of interference using biprism.
2. Study of diffraction at straight edge.
3. Use of plane diffraction grating to determine D1, D2 lines of sodium lamp.
4. Resolving power of telescope
5. Potarization by reflection and verification of Brewster's Law.

6. Study of optical rotation in sugar solution.]
7. Refractive index and dispersive power of prism using spectrometer.
8. Absorption spectrum of material using constant deviation spectrograph.
9. Beam divergence of He-Ne Laser.
10. Determination of wavelength of Laser by diffraction.
11. Determination of radius of curvature of plano-convex lense by Newton's rings.
12. Characteristics of a ballistic galvanometer.
13. Setting up and using an electroscope or electrometer.
14. Measurement of Low resistance by Carey-Foster bridge or otherwise.
15. Measurement of inductance using impedance at different frequencies.
16. Measurement of capacitance using, impedance at different frequencies.
17. Response curve for LCR circuits and response frequencies.
18. Sensitivity of a cathode-ray oscilloscope.
19. Use of a vibration magnetometer to study a field.
20. Study of Magnetic field due to current using Tangent Galvanometer.
21. Study of decay of currents in LR and RC circuits.
22. Study of Lissajous figures using CRO
23. Verification of Network theorems.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

PROGRAM OUTCOME

B.Sc.

The department of Physics is having three programs namely B.Sc. (PCM), B.Sc. (POM) and B.Sc. (PUM) in our department
the curricula are framed in such a manner that the basic connection between theory and experiment and its importance in understanding Physics is apparent to the

student. We also aim to expose the student to the vast scope of Physics as a theoretical and experimental science that is turn furnishes the job opportunities in existing multidisciplinary areas.

- B.Sc (PCM) -- B.Sc. (Physics, Chemistry, Maths)
- B.Sc (POM) -- B.Sc. (Physics, Computer Application, Maths
- B.Sc (PUM) -- B.Sc (Physics, Computer Science, Maths)

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

COURSE LEARNING OUTCOME

B.Sc. III Year

Paper I : Quantm Mechanics and Spectroscopy.

Understand the central concept of Quantum Mechanics with the historical development, operators and Schroldinger Equation helping to decipher the inadequacies of Classical Mechanics, Spectroscopy is an integral part of the curriculum that benefits students in elucidation of structure of certain complex molecules. Understanding the properties of Nuclei, Nuclear Forces and different nuclear models would help students to interpret basic problems in Nuclear Physics.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)
Session : 2021-22

Class: B.Sc. Third Year
Max Marks : 50
Subject : Physics
Paper : Second
Title of Paper : Quantum Mechanics and Spectroscopy
Unit-I: Quantum Mechanics-1

Particles and Waves: Photoelectric effect. Black body radiation. Planck's radiation law, Stefan Boltzmann law, Wien's displacement law and Rayleigh-Jean's law. Compton effect. De Broglie hypothesis. Wave particle duality. Davisson-Germer experiment. Wave packets. Concept of phase and group velocity. Two slit experiment with electrons. Probability. Wave amplitude and wave functions. Heisenbcrg's uncertainty principle with illustrations. Basic postulates and formalism of Schrodinger's equation. Eigenvalues. Probabilistic interpretation of wave function. Equation of continuity. Probability current density. Boundary conditions on the wave function. Normalization of wave function.

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Unit-II: Quantum Mechanics-2

Time independent Schrodingcr equation: One dimensional potential well and barrier. Boundary conditions. Bound and unbound states. Reflection and transmission coefficients for a rectangular barrier in one dimension. Explanation of alpha decay. Quantum phenomenon of tunneling. Free particle in one-dimensional box, eigen functions and eigen values of a free particle. One-dimensional simple harmonic oscillator, energy eigenvalues from Hermite differential equation, wave function for ground state. Particle in a spherically symmetric potential. Rigid rotator. Particle in a three dimensional box, Angular Momentum, properties of Pauli spin matrices.

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Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)

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Class: B.Sc. Third Year

Unit-III: Atomic Spectroscopy

Atoms in **electric and magnetic fields:** Quantum numbers, Bohr model and selection rules. Stern-Gerlach experiment. Spin as an intrinsic quantum number. Incompatibility of spin with classical ideas. Orbital angular momentum. Fine structure. Total angular momentum. Pauli exclusion principle. Many particles in one dimensional box. Symmetric and anti-symmetric wave functions. Atomic shell model. Spectral notations for atomic states. Spin-orbit coupling, L-S and **J-J** coupling. Zeeman effect. Continuous and characteristic X-rays. Mossley's law.

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Unit-IV: Molecular Spectroscopy

Various types of spectra. Rotational spectra. Intensity of spectral lines and determination of bond distance of diatomic molecules. Isotope effect. Vibrational energies of diatomic molecules. Zero point energy. Anharmonicity. Morse potential. Raman effect, Stokes and anti-Stokes lines and their intensity difference. Electronic spectra. Born-Oppenheimer approximation. Frank-Condon principle, singlet and triplet states. Fluorescence and phosphorescence. Introduction to Laser Raman spectroscopy. Elementary concept and applications of NMR and EPR.

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Syllabus for Physics

(As Recommended by the Board of Studies)

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Class: B.Sc. Third Year

Unit - V : Nuclear Physics and Elementary Particles

Basic properties of nucleus: Shape, Size, Mass and Charge of the nucleus. Stability of the nucleus and Binding energy. Alpha particle spectra - velocity and energy of alpha particles. Geiger-Nuttal law. Nature of beta ray spectra. The neutrino and its physics. Energy levels and decay schemes. Positron emission and electron capture. Selection rules. Beta absorption and range of beta particles. Kurie plot. Nuclear reactions, pair production. Q-values and threshold of nuclear reactions. Nuclear reaction cross-sections. Examples of different types of reactions and their characteristics. Compound nucleus, Bohr's postulate of compound nuclear reaction, Semi empirical mass formula, Shell model, Liquid drop model, Nuclear fission and fusion (concepts). Classification of elementary particles and their interactions; Conservation laws; Quark Structure of hadrons; Elementary ideas about unification of forces.

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References:

1. **Quantum Mechanics: V. Devanathan, Narosa Publishing House, New Delhi, 2005**
2. **Quantum Mechanics: B. H. Bransden, Pearson Education, Singapore, 2005**
3. **Quantum Mechanics: Concepts and Applications, Nouredine Zcttili, Jacksonville tate University, Jacksonville, USA, John Wiley and Sons, Ltd, 2009**
4. **Physics of Atoms and molecules: B.H. Bransden and C.J. Joachaim, Pearson Education, Singapore, 2003**
5. **Fundamentals of Molecular Spectroscopy: C.M. Banwell and M. McCash, McGraw Hill (U.K. edition).**
6. **Introduction to Atomic Physics, H. E. White**
7. **Quantum Mechanics: Schaums Outlines, Y. Peleg, R. Pnini, E. Zaarur, E. Hecht.**

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College,

Shivaji Nagar, Bhopal

COURSE LEARNING OUTCOME

B.Sc. III Year

Paper I : Solid state physics and Devices

A brief idea about crystalline and amorphous substances and knowledge of lattice vibrations is a part of the curriculum. The understanding of insulators, conductors and semi-conductors also helps the student to comprehend the elementary band theory. Nano materials have significant commercial impact today and their study in this paper would enrich the student in the area of nano technology.

Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)
Session : 2021-22

Class: B.Sc. Third Year
Max. Marks : 50
Subject : Physics
Paper : Second
Title of Paper : Solid State Physics & Electronic Devices

Unit-I: Solid state Physics-1

Crystal Structure and bonding: Crystalline and amorphous solids. Translational symmetry. Lattice and basis. Unit cell. Reciprocal lattice. Fundamental types of lattices (Bravias Lattice). Miller indices Lattice planes. Simple cubic. Face centered cubic. Body centered cubic lattices. Laue and Bragg's equations. Determination of crystal structure with X-rays, X-ray spectrometer. Ionic, covalent, metallic, van der Waals and hydrogen bonding. Band theory of solids. Periodic potential and Bloch theorem. Kronig-Penny model (Qualitative).

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Unit-LI: Solid state Physics-2

Lattice structure and properties: Dulong Petit, Einstein and Debye theories of specific heats of solids. Elastic and atomic force constants. Dynamics of a chain of similar atoms and chain of two types of atoms. Optical' and acoustic modes. Electrical resistivity. Specific heat of electron. Wiedemann-Franz law. Hall effect. Response of substances in magnetic field, dia-, para- and ferromagnetic materials. Classical Langevin theory of dia and paramagnetic domains. Curie's law. Weiss' theory of ferromagnetism and ferromagnetic domains. Discussion of BH hysteresis. Super conductivity, Meissner's effect, Josephson junction effect and high temperature superconductivity.

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Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)
Session : 2021-22

Class: B.Sc. Third Year

Unit-III: Semiconductor devices-1

Electronic devices: Types of Semiconductors (p and n). Formation of Energy Bands, Energy level diagram. Conductivity and mobility. Junction formation, Barripr formation in p-n junction diode. Current flow mechanism in forward and reverse biased diode (recombination), drift and saturation of drift velocity. Derivation of mathematical equations for barrier potential, barrier width. Single p-n junction device (physical explanation, current voltage characteristics and one or two applications). Two terminal devices. Rectification. Zener diode. Photo diode. Light emitting diode. Solar cell. Three terminal devices. Junction field effect transistor (JFET). Two junction devices. Transistors as p-n-p and n-p-n. Physical mechanism of current flow. Characteristics of transistor.

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Unit-IV: Semiconductor devices-2

Amplifiers (only bipolar junction transistor). CB, CE and CC configur'ations. Single stage CE amplifier (biasing and stabilization circuits), Q-point, equivalent circuit, input impedance, output impedance, voltage and current gain. Class A, B, C amplifiers (definitions). RC coupled amplifiers (frequency response). Class B push-pull amplifier. Feedback amplifiers. Voltage feedback and current feedback. Effect of negative voltage series feedback on input impedance. Output impedance and gain. Stability, distortion and noise. Principle of an Oscillator, Barkhausen criterion, Colpitts, RC phase shift oscillators. Basic concepts of amplitude, frequency and phase modulations and demodulation.

Digital Electronics : Boolean Identities, De-Morgan's law, Logic gate and truth tables; simple logics Circuits; Thermistors , solar cells. Concepts of Microprocessors and digital computer.

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Syllabus for Physics

(As Recommended by the Board of Studies)
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Class: B.Sc. Third Year

Unit-V: Nano materials

Nanostructures: Introduction to nanotechnology, structure and size dependent properties. 3D, 2D, 1D, OD nanostructure materials and their density of states, Surface and Interface effects. Modelling of quantum size effect. Synthesis of nanoparticles - Bottom Up and Top Down approach, Wet Chemical Method. Nanolithography. Metal and Semiconducting nanomaterials. Essential differences in structural and properties of bulk and nano materials (qualitative description). Naturally occurring nano crystals. Applications of nanomaterials.

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References:

1. Introduction to Solid State Physics, C. Kittel, V11Ith Edition, John Wiley and Sons, New York, 2005.
2. Intermediate Quantum theory of Crystalline Solids, A. 0. E. Animalu, Prentice—Hall of India private Limited, New Delhi 1977
3. Solid State Electronic devices, B. G. Streetman, II Edition Prentice Hall, India.
4. Microelectronics, J. Millman and A. Grabel McGraw Hill New York
5. The Physics and Chemistry of Nanosolids: Frank J. Owens, and Charles P. Poole Jr., Wiley Inter Science, 2008
6. Physics of Low Dimensional Semiconductors: An introduction; J.H. Davies, Cambridge University Press, U.K., 1998
7. Electronic fundamentals and applications, J. D. Ryder, Prentice Hall, India.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)
Session : 2021-22

Class: B.Sc. Third Year

Subject : Physics
For Regular Students

Practical	Sessional	Viva	Total
25	10	15	50

List.Of Practicals

1. Specific resistance and energy gap of a semiconductor.
2. Study of half wave and full wave rectification.
3 Characteristics of Zener diode.
4. Characteristic of a tunhel diode.
5. Characteristics of JFET.
6. Characteristic of a transistor.
7. Study of regulated power supply.
8. Study of RC coupled amplifiers
9. Determination of Planck's constant.
10. Determination of e/m using Thomson's method.
11. Determination of e by Millikan's method.
12. Study of spectra of hydrogen and deuterium (Rydberg constant and ratio of masses of electron to proton).

13, Absorption spectrum of iodine vapour.
14. Study of Zeeman effect for determination of Lande g-factor.
15. Study of Raman spectrum using laser as an excitation source
16. To draw B-H curve of ferro-magnetic material with the help of CRO
17. Hysteresis curve a transformer core.
18. Hall probe method for measurement of resistivity.

Course Learning Outcomes

Non-Conventional Energy Sources
गैर परम्परागत ऊर्जा स्रोत

At the end of the course student will be able to achieve.

- A good understanding of various non-conventional energy sources.
- Knowledge about non-conventional energy harvesting Technology.
- The knowledge about the availability of non-conventional energy resources in India.
- A good understanding of the solar energy and the appliances based on solar energy.
- A non-conventional energy harvesting technical skill that will be helpful for employment.

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इस पाठ्यक्रम के अंत में विद्यार्थी प्राप्त करेगा:

- विभिन्न गैर परम्परागत ऊर्जा संसाधनों के बारे में अच्छी समझ|
- गैरपरम्परागत ऊर्जा के संचयन प्रौद्यो गिकी का ज्ञान।
- भारत में गैर परम्परागत ऊर्जा संसाधनों की उपलब्धता का ज्ञान|
- सौर ऊर्जा एवं सौर ऊर्जा पर आधारित उपयोग की अच्छी समझ।
- गैरपरम्परागत ऊर्जा संचयन की तकनीकि कुशलता प्राप्त करेगा जो उसे रोजगार में सहायक होगी।

SAROJINI NAIDU GOVT. GIRL'S P. G. (AUTONOMOUS) COLLEGE, SHIVAJI NAGAR,BHOPAL

AS RECOMMENDED BY THE BOARD OF STUDIES

SESSION: 2021-22

THEORY

- **PROGRAM /कार्यक्रम : CERTIFICATE /प्रमाणपत्र**
- **CLASS/ d{kk : BSC-I YEAR /ch- ,llh-&izFke o"kZ**
- **SUBJECT/ fo"k;%** PHYSICS**@HkkSfrd foKku**
- **COURSE CODE/ ikB~;Øe dk dksM**
- **COURSE TITLE/ ikB~;Øe dk 'kh"kZd%**

  NON CONVENTIONAL ENERGY SOURCES
  गैर परम्परागत ऊर्जा स्रोत
- **COURSE TYPE /ikB~;Øe dk izdkj ELECTIVE/,sfPNd**
- **CRADIT VALUE /ØsfMV eku% 4**
- **MAXIMUM MARKS/vf/kdre~ vad % 25 + 75**
- **MINIMUM PASSING MARKS/U;wure~ mRrh.kkZad % 33**
- **PRE REQUISITE/iwokZis{kk% Open for All/lHkh ds fy, miyC/k**

Unit		Syllabus	Hours
Unit-I	**English**	Introduction to non-conventional energy sources: 1. Classification of energy resources, Consumption trend of primary energy resources Importance of non-conventional energy resources. 2. Energy chain, Common form of energy, Limitations of non-conventional energy resources. 3. Salient features of non-conventional energy resources, Environmental aspects of energy. 4. World energy status, Energy scenario in India **Keywords/Tags:** Energy resources Energy chain, Non-conventional energy.	

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Unit-II	**English**	Solar energy: 1. The sun as a source of energy, Solar radiation at the Earth's surface. 2. Photo thermal applications: Solar collectors, Solar drying Solar cooker (box type), Solar distillation, Solar water heating system Solar thermo-mechanical System. 3. Photovoltaic system: Photovoltaic principle, Basic photovoltaic system for power generation, Solar cells, types of solar cells, Concentrator cells, Sun-tracking systems, Limitations and environmental aspect of solar cells. 4. Photovoltaic applications: Solar Cell Panels, Solar light, Solar pump, solar power plants, Solar cell in transportation, solar refrigeration and air conditioning. **Keywords Tags:** Solar radiation, Photo thermal, Photovoltaic, Solar cells.	

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Unit-III	**English**	Biomas Energy 1. Biomass resource, biomass conversion technology, Biogas generation. 2. Let of factors affecting bio-digestion, Working of biogas plant (with block diagram), biogas from plant waste. 3. Methods of obtaining energy from Biomass, Thermal gasification of biomass. 4. Biomass energy programme in India, Biodiesel production from non-edible all seeds. **Keywords Tags:** Biomass, Thermal Gasification, Bio digestion.	
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Unit-IV	English	Wind energy: 1. Concept of Wind, Origin of winds, Wind climate, Wind profile. Limitation of extracted power from a wind turbine. 2. Wind resource map and site identification, Land requirement. 3. Wind turbine setting, Wind turbine aerodynamics wind turbine type: Upwind and downwind turbines, Blade count, Constant and variable speed wind turbine onshore and offshore wind turbines. 4. Wind turbine rotor, working of wind turbine, Drag principle, Lift principle. 5. Effect of wind turbine on environment. Wind energy storage, Wind energy program in India. **Keyword/Tag:** Wind climate, Wind energy, Wind turbine	
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Unit-V	**English**	Geothermal and Oran energy 1. Geothermal energy origin and distribution of geothermal energy types of geothermal resources, Analysis of geothermal resources. 2. Exploration and development of geothermal energy. 3. Advantages and disadvantages of geothermal energy, Possibilities and limitations 4. Ocean energy Tidal energy Origin and nature of tidal energy, Environmental impact, Energy and power in waves, advantages and disadvantages of wave energy. 5. Ocean Thermal Energy, Ocean Thermal conservation Technology (OTEC). Environmental impact. **Keyword / Tags:** Geothermal energy ,Ocean energy, Tidal energy, OTEC	
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Learning Resources: (Text Books, Reference Books, Other Resources)

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1. Rai G. D. "Non-conventional energy sources, Khanna Publishers, 4th edition.
2. Sukhatme S. P. and Nayak J. K., "Solar Energy: Principles of thermal collection and storage", Tata McGraw Hill Ltd, Second Edition.
3. Rai G. D., "Solar energy utilization", Khanna Publishers, 5th edition.
4. Khan B. H., "Non-conventional energy resources", McGraw Hill Publications.

Suggestive digital platforms web links /vuq’kaflr fMftVy lysVQkWeZ csc fyad

1. https:/mnre.gov.in Ministry of New and Renewable Energy.

Suggested equivalent online course/ vuq’kaflr led{k vkWuykbu ikB~;Øe

1. https://nptel.ac.in/course/121/106/121106014/ By Prof. Prathap Haridoss, IIT Madras.

Course Learning Outcomes

Mechanics and General Properties of Matter (Paper 2)

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- The course would empower the students to develop the idea about the behavior of physical systems (bodies).
- It will provide the basic concepts related to the motion of all the objectives around us in daily life.
- The students would be able to build foundation to various applied field in science and technology (specially in the field of mechanical engineering).
- The students will acquire the knowledge of basic mathematical methods to solve the various problems in physics.
- The students will be able to understand the relativistic effect and the relation between energy and mass.

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SAROJINI NAIDU GOVT. GIRL'S P. G. (AUTONOMOUS) COLLEGE, SHIVAJI NAGAR, BHOPAL

AS RECOMMENDED BY THE BOARD OF STUDIES

SESSION: 2021-22

THEORY

- **PROGRAM / कार्यक्रम : CERTIFICATE / प्रमाण पत्र**
- **CLASS/ d{kk : BSC-I YEAR / ch- ,llh-&izFke o"kZ**
- **SUBJECT/ fo"k;%** PHYSICS **@HkkSfrd foKku**
- **COURSE CODE/ ikB~;Øe dk dksM**
- **COURSE TITLE/ ikB~;Øe dk 'kh"kZd%**

  Mechanics and General Properties of Matter (Paper 2)

  ;kaf=dh vkSj inkFkZ ds lkekU; xq.k ¼iz'ui= 2½
- **COURSE TYPE / ikB~;Øe dk izdkj CORE COURSE / dksj dkslZ**
- **CRADIT VALUE / ØsfMV eku% 4**
- **MAXIMUM MARKS/ vf/kdre~ vad % 25 + 75**
- **MINIMUM PASSING MARKS/ U;wure~ mRrh.kkZad % 33**
- **PRE REQUISITE/iwokZis{kk% To Study this course a student must have had the subject Physics in 12th Class/bl dksLkZ dk v/;;u djus ds fy, Nk= ds ikl 12 oha d{kk esa HkkSfrdh fo"k; gksuk pkfg,A**

Unit	Syllabus	Hours

Unit-I	**English**	Historical background and Mathematical Physics 1. Historical background: 1.1. A brief historical background of mathematics and mechanics in the context of India and Indian culture. 1.2. A brief biography of Varahamihira and Vikram Sarabhal with their major contribution to science and society. 2. Mathematical Physics: 2.1. Scalar and vector fields, Gradient of a scalar field and Its physical significance. 2.2. Vector Integral: line integral, surface Integral and volume integral, Divergence of a vector field and its physical significance, Gauss divergence theorem. 2.3. Curl of a vector field and its physical significance, Stokes and Green's theorem, Numerical problems based on the above topics. Keywords/Tags: Scalar field, Vector field, Vector integral, Gradient, Divergence, Curl.	
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		lekdyu] ,d lfn'k {ks= dk Mkbojtsal vkSj bldk HkkSfrd egRo] xk¡l Mkbojtsal çes;A 2-3- lfn'k {ks= dk dyZ vkSj HkkSfrd egRo] LVksDl ,oa xzhu dk çes;] mijksä fo"k;ksa ij vk/kkfjr la[;kRed ç'uA **lkj fcanq ¼dh oMZ½ VSx%** vfn'k {ks=] lfn'k {ks=] lfn'k lekdyu] xzsfM,V Mkbotsal] dtZA	
Unit-II	**English**	Mechanics of Rigid and deformable bodies 1. Rigid body mechanics: 1.1. System of particles and concept of Rigid body. Torque, centre of mass: position of the centre of mass, Motion of the centre of mass, Conservation of linear & angular momentum with examples, Single stage and multistage rocket. 1.2. Rotatory motion and concept of moment of inertia, Theorems on moment of inertia: theorem of addition, theorem of perpendicular axis, theorem of parallel axis, Calculation of moment of inertia of rectangular lamina, disc, solid cylinder, solid sphere 2. Mechanics of deformable bodies: 2.1 Hook's law, Young's modulus, Bulk modulus, Modulus of rigidity and Poisson's ratio, Relationship between various elastic module. 2.2 Possible values of Polsson's ratio Finding Poisson's ratio of rubber in the laboratory, Torsion of a cylinder, Strain energy of twisted cylinder. 2.3 Finding the modulus of rigidity of the material of a wire by Barton's method, Torsional pendulum and Maxwell's needle, Searl's method to find Y, n and o of the material of a wire, Bending of beam, Cantilever, Bean supported at its ends and loaded in the middle.	

		Keywords/Tags: Rigid body, Centre of mass, Moment of Inertia, Poisson's ratio.	
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Unit-III	**English**	Fluid mechanics 1. Surface Tension:	

		1.1. Inter molecular forces and potential energy curve, force of cohesion and adhesion. 1.2. Surface tension, Explanation of surface tension on the basis of intermolecular forces, Surface energy, Effect of temperature and Impurities on surface tension, Daily life. application of surface tension. 1.3. Angle of contact, The pressure difference between the two sides of a curved liquid surface, Excess pressure inside a soap bubble, Capillarity, determination of surface tension of a liquid capillary rise method, Jaeger's method. 2. Viscosity: 2.1 Ideal and viscous fluld, Streamline and turbulent flow, Equation of continuity, Rotational and Irrotational flow, Energy of a flowing fluid, Euler's equation of motion of a non-viscous fluid and Its physical significance. 2.2 Bernoulli's theorem and its applications (Velocity of efflux, shapes of wings of airplane, magnus effect, Filter purp Burnsen's burner), 2.3 Viscous flow of a fluid Flow of liquid through a capillary tube, Derivation of Poiseulille's formula and limitations, Stocks formula, Motion of a spherical body falling in a viscous fluid. **Keyword/Tags:** Inter molecular force, Surface tension, Angle of contact Capillarity, vscosity, Euler's equation, Polseuille's formula.	
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		v’kqf);ksa dk izHkko] i`"B ruko ds dqN vU; mnkgj.kA 1-3 Li'kZ dks.k] nzo ds nksuksa oØh; lrgksa ds chp nkckUrj lkcqu ds cqycqys ds vanj vfrfjä nckc]dsf’kdkRo] æo ds i`"B ruko dk ekiu% dsf'kdk mUu;u fof/k] tSxj dh fof/kA 2- ';kurk% 2-1- vkn'kZ vkSj ';ku rjy /kkjkjs[kh; rFkk fo'kq) çokg lkrR; lehdj.k] ?kw.khZ vkSj vk/kw.khZ çokg çokfgr rjy dh ÅtkZ] v';ku rjy dh xfr dk ;wyj dk lehdj.k ,oe~ bldk HkkSfrd egRoA 2-2- ojukSyh çes; vkSj mlds vuqç;ksx ¼cgh lkzo osx] gokbZ tgkt ds ia[kksa dh vk—fr] eSxul çHkko] fQYVj iEi] cUlu cuZj½A 2-3- rjy dk ';ku çokg] dsf’kdkuyh ds ek/;e ls rjy dk izokg] Iokbtqys lw= dk fuxeu ,oa lhek,a] LVksd lw=] ';ku nzo esa fxjus okys xksykdkj fiaM dh xfrA lkj fcanq ¼dh cbZ½ VSx varj&vk.kfod cy] i`"B ruko] Li'kZ dks.k] dsf'kdkRo] ';kurk] ;wtj dk lehdj.k] Iokbtqys lw=A	
Unit-IV	**English**	Gravitational potential and Central forces 1. Gravitational potential: 1.1. Conservative and non-conservative force field, Conservative of energy in motion under the conservative and non-conservative forces, Potential energy. 1.2 Conservative force, Conservation of energy, Gravitational potential and gravitational	

		potential energy, Gravitational potential and intensity of gravitational field due to a uniform spherical shell and a uniform solid sphere. 1.3. Gravitational self-energy, Gravitational self-energy of a uniform spherical shell and a uniform solid sphere. 2 Central forces: 2.1 Motion under Central forces, Conservative characteristics of central forces 2.2 The motion of a two particles system in Central force, Concept of reduced mass, Reduced mass of positronlum and hydrogen. 2.3 Motion of particles in an inverse-square central force, Motion of celestial bodies and derivation of Kepler's laws, 2.4 Elastic and inelastic scattering (elementary idea). **Keyword:/Tag:** Conservative force field, Gravitational potential, Gravitational self-energy, Central force, reduced mass, Scattering	
	¼fgUnh½	xq#Roh; foHko vkSj dsaæh; cy foHko% 1- xq#Roh; foHko 1-1 laj{kh vkSj vlaj{kh cy {ks=] laj{kh vkSj vlaj{kh cyksa ds varxZr xfr esa ÅtkZ dk laj{k.k] fLFkfrt ÅtkZA 1-2 laj{kh cy vkSj vkarfjd ÅtkZ dk laj{k.k] xq#Roh; foHko vkSj xq#Roh; fLFkfrt ÅtkZ] ,d leku xksyh; [kksy vkSj ,d leku Bksl xksys ds dkj.k xq#Roh; foHko vkSj xq#Roh; {ks= dh rhozrkA 1-3 xq#Roh; Lo ÅtkZ] ,d leku xksyh; [kksy vkSj ,d leku Bksl xksys dh xq:Roh; Lo ÅtkZA	

		2- dsUæh; cy 2-1 dsUæh; cy ds varxZr xfr] dsUæh; cy dh laj{kh fo'ks"krk,¡A 2-2 dsaæh; ds varxZr nksuksa ds fudk; dh xfr] lekuhr æO;eku dh vo/kkj.kk] i,ftVªksfu;e ,oa gkbMªkstu dk lekuhr æO;ekuA 2-3 O;qRØe & oxZ dsUæh; cy esa d.kksa dh xfr] [kxksyh; fiaMksa dh xfr vkSj dsIyj ds fu;eksa dh O;qRifÙkA 2-4 çR;kLFk rFkk vçR;kLFk çdh.kZu ¼çkjafHkd tkudkjh½A **lkj fcanq ¼dh oMZ½ VSx%** laj{kh cy {ks=] xq#Roh; foHko] Lo ÅtkZ dsUæh; cy] lekuhr nzO;eku] izdh.kZuA	
Unit-V	**English**	Relativistic Mechanics and Astrophysics 1. Relativistic Mechanics: 1.1. Frame of references, Galilean transformation, Michelson - Morley experiment, 1.2. Portulates of special theory of relativity, Lorentz Transformation, Simultaneity and order of events, Length contraction, Time dilation, Relativistic transformation of velocities, Variation of mass with velocity. 1.3. Mass energy equtvalence and its experimental verification. 2. Astrophysics: 2.1 Introduction to the Universe, Properties of the Sun, Concept of Astronomical Distance 2.2 Life cycle of a stars, Chandrasekhar Limit, H-R diagram, Red giant star, White dwarf star,	

		Neutron star, Black hole, 23. Big Bang Theory (elementary Idea). **Keyword Tags:** Transformation, Mass-energy equivalence, Astronomical distance, Chandrasekher limit, Black hole.	
	¼fgUnh½	lkis{kdh; ;kaf=dh vkSj [kxksy HkkSfrdh 1- lkis'kh; ;kaf=dh 1-1 funsZ'k ra= xSyhfy;u :ikUrj.k] ekbdylu&ekWysZ ç;ksx] lkis{krk ds fof'k"V fl)kar dh vfHk/kkj.kk,aA 1-2- ykjast :ikUrj.k ?kVukvksa dh le{kf.kdrk vkSj ?kVukvksa dk Øe] yackbZ ladqpu] le; foLrkj.k] osxksa dk lkis{kdh; ifjorZu] nzO;eku dk osx ds lkFk ifjorZuA 1-3 nzO;eku&ÅtkZ rqY;rk vkSj bldk çk;ksfxd lR;kiuA 2- [kxksy HkkSfrdh 2-1- czg~ekaM dk ifjp;] lw;Z ds xq.k] [kxksyh; nwjh dh vo/kkj.kkA 2-2- rkjksa dk thou pØ paæ'ks[kj lhek] ,p vkj vkjs[k yky nkuo rkjk] lQsn ckSuk rkjk] U;wVªku rkjk CySd gksyA 2-3- fcx cSx fl)kar ¼izkjfEHkd /kkj.kk½ **lkj fcanq ¼dh oMZ½ VSx**% :ikUrj.k] nzO;eku & ÅtkZ rqY;rk] [kxksyh; nwjh] paæ'ks[kj lhek] CySd gksyA	

Learning Resources: (Text Books, Reference Books, Other Resources)

vuq'kaflr v/;;u lalk/ku% ¼ikB~; iqLrdsa] lanHkZZ iqLrdsa] vU; lalk/ku½

1. Splegel M. R., "Vector Analysis: Schaum Outline Series", MCGraw Hill Education, 2017.
2. Mathur D. S., Mechanics", S. Chand, 2012.

3. Ghatak A. K., Gayal I. C abd Cgya S. J. Mathematical Physics", Laxmi Publications Private Limited, 2017.
4. MAthur D. S., "Properties of matter", Shyamlal Charitable Trust, New Delhi.
5. Sears and Zeemansky, " University Physics", Pearson Education.

Suggested Equivalent online Courses: ¼vuq'kaflr vkWuykbZu ikB~;Øe½

1- https://nptel.ac.in/courses/115/106/115106090/ Mechanics, Heat, Oscillations and Waves by Prof. V. Balakrishnan, Department of Physics, Indian Institute of Technology, Madras.
2- https://nptel.ac.in/courses/115/106/115106090/ Mathematical Physics by Dr. Saurabh Basu, Department of Physics, Indian Institute of Technology, Guwahati.

Course Learning Outcomes

Mechanics and General Properties of Matter Lab (Paper 2)

;kaf=dh vkSj inkFkZ ds lkekU; xq.k iz;ksx'kkyk ¼iz'ui= 2½

- The Students would acquire basic practical knowledge related to mechnics through the experiments.
- Students will be familiar with various measurement devices by which they can measure various physical quantities with accuracy.
- The student will dovelope the cncept related to the mechanics and properties of matter.

ikB~;Øe ds v/;;u dh ifjyfC/k;k¡

- Nk= fofHkUu iz;ksxksa ds ek/;e ls ;kaf=dh ls lacaf/kr cqfu;knh O;ogkfjd Kku izkIr gksxkA
- Nk= fofHkUu ekiu midj.kksa ls ifjfpr gksaxs ftuds }kjk os fofHkUu HkkSfrd jkf'k;ksa dk lVhdrk ds lkFk ekiu dj ldrs gSA

- Nk=ksa esa ;kaf=dh vkSj inkFkZ ds xq.kksa ls lacaf/kr vo/kkj.kk fodflr gksxhA

SAROJINI NAIDU GOVT. GIRL'S P. G. (AUTONOMOUS) COLLEGE, SHIVAJI NAGAR, BHOPAL

AS RECOMMENDED BY THE BOARD OF STUDIES

SESSION: 2021-22

THEORY

- **PROGRAM / कार्यक्रम : CERTIFICATE / प्रमाण पत्र**
- **CLASS/ d{kk : BSC-I YEAR / ch- ,llh-&izFke o"kZ**
- **SUBJECT/ fo"k;%** PHYSICS **@HkkSfrdh foKku**
- **COURSE CODE/ ikB~;Øe dk dksM**
- **COURSE TITAL/ ikB~;Øe dk 'kh"kZd%**

  Mechanics and General Properties of Matter Lab (Paper 2)

  ;kaf=dh vkSj inkFkZ ds lkekU; xq.k iz;ksx'kkyk ¼iz'ui= 2½

- **COURSE TYPE / ikB~;Øe dk izdkj CORE COURSE / dksj dkslZ**

- **CRADIT VALUE / ØsfMV eku% 2**
- **MAXIMUM MARKS/ vf/kdre~ vad % 25 + 75**
- **MINIMUM PASSING MARKS/ U;wure~ mRrh.kkZad % 33**

Mechanics and General Properties of Matter Lab (Paper 2)

Sr. No	List of Experiments
1.	Determination of Young's modulus, modulus of rigidity and Poisson's ratio of material of a wire using Scarle's method.
2.	Determination of Young's modulus of material of a metallic bar by bending of beam method.
3.	Determination of acceleration due to gravity (g) using Bar pendulum.
4.	Determination of acceleration due to gravity (g) using Kater's reversible pendulum
5.	Determination of modulus of rigidity of a rod with the help of Barton's apparatus
6.	Determination of coefficient of viscosity of liquid using Poiseuille's method.
7.	Determination of the moment of inertia of a flywheel about its axis of rotation

8.	Determination of the moment of inertia of a given body (irregular body) with the help of inertia table.
9.	Verification of laws of the parallel/perpendicular axes of moment of Inertia
10.	Determination of modulus of rigidity of material of a wire with the help of Maxwell's needle
11.	Determination of Young's Modulus of a material of a rod using Cantilever method.
12.	Determination of modulus of rigidity of material of a wire with the help of torsional pendulum
13.	Determination of force constant of a spring.
14.	Determination of Poisson's ratio of rubber
15.	Determination of surface tension of a liquid by Jaeger's method.

Text Rooks, Reference Books, Other resources

ikB~; iqLrdsa] lanHkZ iqLrds] vU; lalk/ku

Suggested Readings./ vuq'kaflr lgk;d iqLrds

1. Prakash I & Ramakrishna, A Text Book of Practical Physics Kitab Mahal 2011,11/e
2. Squires G. L." Practical Physics, Cambridge University Wes 2015, 4/e
3. Flint BE and Worsnop H.T. "Advanced Practical Physics for students", Asia Publishing House, 197.
4. Chattopadhyay D. & Rakshit P. C. "An Advanced Course in Practical Physics, New Central Book Agency.

Suggestive digital Platforms web links/ vuq'kaflr fMftVy lysVQkeZ csc fyad

1. http/www.vlab.co.in/broad-area-physical-scirnces
2. http/storage.qooqleapis.com/uniquecourses/online.html

;kaf=dh vkSj inkFkZ ds lkekU; xq.k iz;ksx'kkyk ¼iz'ui= 2½

l- Ø-	iz;ksxksa dh lwph
1.	lyZ dh fof/k ls fdlh rkj ls inkFkZ dk iax çR;kLFkrk xq.kkad] n`<+rk xq.kkad rFkk ik;lu fu"ifÙk Kkr djukA
2.	cadu fof/k ls /kkfRod NM+ ds inkFkZ dk ;ax izR;kLFkk xq.kkad Kkr djukA
3.	naM yksyd dh lgk;rk ls xq#Roh; Roj.k ^g^ dk eku Kkr djukA
4.	dSVj ds mRØe.kh; yksyd dh lgk;rk ls xq:Roh; Roj.k *g* dk eku Kkr djukA
5.	ckVZu midj.k dh lgk;rk ls NM ds inkFkZ dk –<rk xq.kkad Kkr djukA
6.	ikbtqyh dh fof/k ls æc dk ';kurk xq.kkd Kkr djukA
7.	xfrikyd pØ dk mlds ?kw.kZu v{k ds ifjr% tgÙo vkiw.kZ Kkr djukA

8.	**tM+Ro eap dh lgk;rk ls fdlh fn, gq, vfu;fer fi.M dk tM+Ro vk?kw.kZ Kkr djukA**
9.	**tM+Ro vk?kw.kZ ds lkekukarj@yacor~ v{k çes; dk lR;kiu djukA**
10.	**eSDlesy lqbZ dh lgk;rk ls rkj ds inkFkZ dk –<+rk xq.kkad Kkr djukA**
11.	**dSUVhyhoj dh lgk;rk ls fdlh NM ds inkFkZ dk ;ax çR;kLFkrk xq.kkad Kkr djukA**
12.	**ejksM+h yksyd }kjk fdlh rkj ds inkFkZ dk –<rk xq.kkad Kkr djukA**
13.	**fLçax dk cy fu;rkad Kkr djuk A**
14.	**jcj dk ik;lu vuqikr Kkr djukA**
15.	**tSxj dh fof/k }kjk nzo dk i`"B ruko Kkr djukA**

Text Rooks, Reference Books, Other resources

ikB~; iqLrdsa] lanHkZ iqLrds] vU; lalk/ku

Suggested Readings./ vuq'kaflr lgk;d iqLrds

1. Prakash I & Ramakrishna, A Text Book of Practical Physics Kitab Mahal 2011,11/e
2. Squires G. L." Practical Physics, Cambridge University Wes 2015, 4/e
3. Flint BE and Worsnop H.T. "Advanced Practical Physics for students", Asia Publishing House, 197.
4. Chattopadhyay D. & Rakshit P. C. "An Advanced Course in Practical Physics, New Central Book Agency.

Suggestive digital Platforms web links/ vuq'kaflr fMftVy lysVQkeZ csc fyad

1. http/www.vlab.co.in/broad-area-physical-scirnces
2. http/storage.qooqleapis.com/uniquecourses/online.html

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE,

BHOPAL

SYLLABUS FOR

M.Sc (Physics)

SEM ; I, II, III & IV

SESSION : 2021-22

PROGRAM SPECIFIC OUTCOME
M.Sc. (Physics)
Objectives

- Students will be able to conduct experiments, analyze and interpret data for investigating problems in the field of Physics.
- Student of Physics can pursue higher studies (M. Phil, Ph. D) to attain research positions Students can get jobs in various fields of Physics both in the private and public sector. Some of the common job positions or profiles for a physics graduates are in College lecturer and Teaching Fields, Scientific Positions as Research Associates in various Research institutes. Assistant Professor. They can apply for jobs in Aerospace and Defense, Automobile. IT and Software, Railways, Nuclear and Renewable energy. Oil and Gas Electronics and Telecommunications and the Manufacturing sector.
- Besides Industrial sector these are ample opportunities in Academics, like in School Education Department and Higher Education Department.
- Students will be able to understand the wide potential of the subject Physics and its implementation in sustainable development.

COURSE LEARNING OUTCOMES
M.Sc. (Physics)
SEMESTER-1

Paper I (Mathematical Physics)	The objective is to provide students the ability to develop the mathematical skills necessary to approach problems in advanced physics courses. ➢ The students will be able to understand and apply the mathematical skills to solve quantitative problems in the study of physics. ➢ The students will be able to apply integral transform to solve Mathematical problems of interest in physics. ➢ The students will be able to use Fourier transforms as an aid for analyzing Experimental data. ➢ The students should be able to solve differential equation of various types. ➢ Describe basics of group theory, Special functions, and Recurrence relations.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College,

Shivaji Nagar, Bhopal

As Recommended by the Board of Studies

Session 2021-22

Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : I**
Title of the Paper	**MATHEMATICAL PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**Differential equations: Recursion relation, generating functions and orthogonality of Bessel functions of first and second kind, Hermite, Legendre, Associate Legendre and Laguerre Polynomials, Curvilinear coordinate system with specific cases of Cartesian, Cylindrical and Spherical coordinate systems.**	1. L.A. Pipes Mathematics of Engineers and Physicists. 2. Arfken Mathematical Methods for Physicists. 3. P.K. Chattopadhyay Machematical Physics. 4. H.K.Dass Mathematical Physics
Unit - II (English)	**Integral transforms. Fourier integral. Fourier transforms and inverse Fourier transforms.** **Fourier transform of derivatives. Convolution theorem. Elementary Laplace transforms.** **Laplace transform to derivatives. Application to a damped harmonic oscillator.**	

Unit - III (English)	**<u>Green's functions</u>: Non-homogenous boundary value problems, Green's function for one dimensional problems, eigen function expansion of Green's function, Fourier transforms.** **Method of constructing.** **Green's functions, Green's function for electrostatic boundary value. Problems and quantum-mechanical scattering problem.**	5. Ghatak, Goyal & Guha Mathematical Physics 6. M.R. Spiegal (Schaum Series) Complex variable & Laplace Transform.
Unit - IV (English)	**<u>Complex variables</u>: analyticity of complex functions. Cauchy Riemann equations. Cauchy theorem. Cauchy integral formula.** **Taylors, Maclaurin Laurent series and mapping.** **Theorem of residues. Simple cases of contour integration. Jordan's lemma Integrals involving multiple valued function (Branch points)**	
Unit - V (English)	**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.**	

COURSE LEARNING OUTCOMES
M.Sc. (Physics)
SEMESTER-1

Paper II
(Classical Mechanics)

The objective aims to develop an understanding of Lagrangian and Hamiltoman formulation which allow for simplified treatments of many complex problems in classical mechanics and provide the foundation for the modern understanding of dynamics.

- The students will be able to apply the Variational principles to real physical problems.
- The students will be able to model mechanical systems, both in inertial and rotating frames, using Lagrange's and Hamilton's equations.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College,

Shivaji Nagar, Bhopal

As Recommended by the Board of Studies

Session 2021-22

Theory

Class	**M.Sc.**	**Semester: I**	
Subject	**Physics**	**Paper No : II**	
Title of the Paper	**CLASSICAL MECHANICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**<u>Newtonin mechanics of one and many particles systems</u>: Conservation laws, Constraints their classification, Principle of virtual work; D'Almbert's principle in generalized coordinates, The Lagrange's equitation from D'Almbert's principle. Configuration space, Hamilton's principle deduction from D'Almberts principle, Generalized momenta and Lagragian 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.**	1. H. Goldsetin (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)
Unit - II (English)	**<u>The equitation of canonical transformation and generating functions</u>: The Hamilton-Jacobi Action and Angle 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.**	

Unit - III (English)	**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.**	R.G. Takwale & P.s. Puranik Introduction to Classical Mechanics.
Unit - IV (English)	**Symmetries of space and time.** **Invariance under galilion transformation, Covariant four-dimensional 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 Hamiltonioan, Examples.**	
Unit - V (English)	**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.**	

COURSE LEARNING OUTCOMES
M.Sc. (Physics)
SEMESTER-1

Paper III (Quantum Mechanics)	The objective is to provide an understanding of the formalism and language of non-relativistic quantum mechanics and understand the concepts of time-independent. perturbation theory and their applications to physical situations. ➢ The students will be able to formulate and solve problems in quantum mechanics using Dirac representation. ➢ The students will be able to grasp the concepts of spin and angular momentum, as well as their quantization and addition rules. ➢ The students will be familiar with various approximation methods applied to atomic nuclear and solid-state physics.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College,

Shivaji Nagar, Bhopal

As Recommended by the Board of Studies

Session 2021-22

Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : III**
Title of the Paper	**QUANTIUM MECAHNICS – I**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

<table>
<tr><th>Unit</th><th>Syllabus</th><th>Recommended Books</th></tr>
<tr><td>Unit - 1 (English)</td><td>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.</td><td rowspan="2">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</td></tr>
<tr><td>Unit - II (English)</td><td>Linear vector space, concept of Hilbert 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).</td></tr>
</table>

		5. J.J. Sakurai Modern Quantum Mechanics Mathews and Venkatesan Quantum Mechanics.
Unit - III (English)	**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 (deuteron).**	
Unit - IV (English)	**Angular momentum in quantum mechanics, Eigen values and Eigen function of L_2 and L_z in term of spherical harmonics, commutation relation. Time independent perturbation theory. Non-degenerate and degenerate cases.**	
Unit - V (English)	**This unit will have a short note question covering all the four units.** **The students will have to answer any two questions of the four.**	

COURSE LEARNING OUTCOMES
M.Sc. (Physics)
SEMESTER-1

Paper IV (Electronic device)	The objective is to develop an understanding of fundamentals of electronics in order to deepen the understanding of electronic devices that are part of the technologies that surround us ➢ The Students will be able to use techniques for electronic circuits, and formulate the concepts of Field Effect Transistors (FET), identity its major properties and main types of FET circuits ➢ The Students will develop ability to describe the behavior of special Purpose Diode LDR, LED, and Solar Cells. ➢ The Students will be able to recognize various storage devices like RAM, ROM, Hybrid memories. ➢ The Students will be able to understand electro-optics magneto-optics and acousto-optics effects material and properties.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College,

Shivaji Nagar, Bhopal

As Recommended by the Board of Studies

Session 2021-22

Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : IV**
Title of the Paper	**ELETRONIC DEVICES**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - 1 (English)	**<u>Transistors</u> : JFET, BJT, MOSFET and MOSFET, structure derivations of the equations for I-V characteristics under different conditions, microwave devices, tunnel diode, transfer electron devices (Gunn diode) avalanche transits time devices, Impatt diodes and parametric devices.**	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.
Unit - II (English)	**<u>Photonic devices</u>: 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 (English)	**<u>Memory Devices</u>: Read Only Memory (ROM) and Random Access Memory (RAM). Types of ROM: PROM, EPRON, EEPROM AND EAPROM, Static and dynamic RAMs (SRAM & DRAM), characteristics of SRAM and DRAM.** **<u>Hydbrid Memories</u> : CMOS and NMOS memories, Nonvolatile RAM, ferro-electric memories, charge coupled devices (CCD), storage devices : Geometry and organization of magnetic (FDD and HDD) and Optical (CD-ROM, CD-R, CD-R/W, DVD) Storage Devices.**	Ajoy Ghatak and Thyagrajam Optical Electrics.
Unit - IV (English)	**Eletro-optics, Magneto-optic and Acousto-optic effects, materials properties related to get these effect, important ferro electric, Liquid crystal and polymeric materials for these devices, piezoelectric, electrostrictive and magnetostrictive effects. Important materials for these properties and their applications in sensors and actuator devices, acoustic delay lines, peizoelectric resonators and filters, high frequency piezoelectric devices-surface, acoustic wave devices.**	
Unit - V (English)	**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.**	

As Recommended by the Board of Studies

Session – 2021-22

Practical

Class	M. Sc	Semester - I
Subject	Physics	
Title of Practical	LAB – A (Electronics)	
Medium of Instruction/Teaching	English	
Maximum Marks	100	

List of Experiments

1. To study characteristics of Zener Diode.
2. To study characteristics of Silicon Controlled Rectifier (SCR).
3. To study characteristics of Light Emitting Diode (LED).
4. To study characteristics of Tunnel Diode.
5. To study characteristics of Junction Field Effect Transistor (JFET)n
6. To study characteristics of Metal Oxide Semiconductor Field Effect Transistor (MOSFET).
7. To study characteristics of PN Diode.
8. To study characteristics of Thermistor.
9. To study characteristics of Triac.
10. To study characteristics of Uni junction Transistor (UJT)
11. To study characteristics Diac.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

As Recommended by the Board of Studies

Session – 2021-22

Practical

Class	M. Sc	Semester - I
Subject	Physics	
Title of Practical	LAB – B (General)	
Medium of Instruction/Teaching	English	
Maximum Marks	100	

List of Experiments

1. To find Characteristics of Photo cell.
2. To find energy band gap of semiconductor.
3. To find electronic charge by rectifier.
4. To study characteristics of solar cell.
5. To find e/m by Thomson method.
6. To find resolving power of grating.
7. To verify Cauchy's formula.
8. To study hysteresis loss of transformer using CRO.
9. To study wave form and frequency by CRO.
10. To study characteristics of VR Tube.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER II

Paper I (Quantum Mechanics - II)	The objective is to understand the concepts of the time-dependent perturbation theory and their applications to physical situations and the basics of scattering theory. ➢ The students will be able to grasp the concepts of Dirac equation and Klein Gordon equation. ➢ The students will be familiar with various approximation methods applied to atomic nuclear and solid-state physics.

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : I**
Title of the Paper	**QUANTUM MECHANICS -II**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - I (English)	**<u>Approximation method for bound states</u>: Rayleigh - Schrodinger Perturbation theory of non-degenerate and degenerate 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.**	1. LI Schiff Quantum Mechanics 2. S Gasirowicaz Quantum Physics
Unit - II (English)	**<u>Time dependant perturbation theory</u> : 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.**	3. B.Craseman and J J Powell Quantum Mechanics (Addison Wessley) 4. A. Messiah Quantum

Unit - III (English)	**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 practices with spin, Pauli's spin matrices.**	Mechanics 5. J.J. Sakurai Modern Quantum Mechanics 6. Mathews and Venkatessan Quantum Mechanics A.K.Ghatak and Loknathan Quantum Mechanics.
Unit - IV (English)	**Schrodinger.s relativistic equation (Klein-Gordon equation), Probability and current denisity, 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 (English)	**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.**	

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER II

Paper II (Statistical Mechanics)	The objective is to have an appreciation for the modern aspects of equilibrium and non-equilibrium statistical physics ➢ The students will be able to describe the features and examples of Maxwell Boltzmann Bose Einstein and Fermi-Dirac statistics. ➢ The students will be able to work out equations of state and thermodynamic potentials for elementary systems of particles, and use and develop mean field theory for first and second order phase transitions.

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : II**
Title of the Paper	**STATISTICAL MECHANICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**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. Micro canonical ensemble, phase space, trajectories and density of states, Liouvelle theorem, canonical and grand canonical ensembles, partition function, calculation of statistical quantities, energy sand density fluctuations.**	1. F Reif Statistical and thermal Physics 2. K Huang Statistical Mechanics 3. R K Pathria Statistical Mechanics 4. R Kubo Statistical
Unit - II (English)	**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.**	

		Mechanics 5. Tandan Statistical Physics.
Unit - III (English)	**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 - IV (English)	**Thermodynamics fluctuation spatial correlation Brownian motion, Langevin theory, fluctuation dissipation theorem, the Fokker-Planck equation, Onsager reciprocity relations.**	
Unit - V (English)	**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.**	

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER II

Paper III (Electrodynamics and Plasma Physics)	The objective is to evaluate fields and forces in Electrodynamics and Magneto dynamics using basic scientific method To provide concepts of relativistic electrodynamics and applications in branches of Physical Sciences. ➢ The students will be able to explain and solve advanced problems based on classical electrodynamics using Maxwell's equation. ➢ The students will be able to analyze radiation systems in which the electric dipole magnetic dipole or electric quadruple dominate. ➢ The students will have an understanding of the covariant formulation of electrodynamics and the concept of retarded time for charges undergoing acceleration.

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : III**
Title of the Paper	**ELECTRODYNAMICS AND PLASMA PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - I (English)	**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.**	1. Bitteneerort Plasma Physics 2. Chen Plasma Physics 3. Gupta, Kumar, Singh Electro

Unit - II (English)	**Fields of an 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-demension Maxwell equation, Four Vector current and potential and their invariance under Lortentz transformation, covariance of electro-dynamics.** **Langragian and Hamiltonian for a relativistic charged particle in External EM field; motion of charged particles in electromagnetic fields, uniform and non-uniform E and B fields.**	dynamics 4. Sen Plasma state and matter 5. Jackson Classical electrodynamics 6. Pamolsky & Philips Classical electricity and Magnetism.
Unit - III (English)	**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 plasma. Debye screening distance. Plasma oscillations: Transverse oscillations and longitudinal oscillations.**	
Unit - IV (English)	**<u>Domain of Magneto hydrodynamics and plasma Physics</u> :** **Magneto hydrodynamic equations, magnetic hydro-static pressure hydrodynamic waves: Magneto-sonic and Alfven waves, particle orbits and drift motion in plasmas. Experimental study of Plasma the theory of single and double probes.**	
Unit - V (English)	**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.**	

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER II

Paper IV (Atomic and molecular Physics)	The objective is to get the better understanding of the fundamental aspects of atomic and molecular physics and to study spectroscopy of it multi-electron atoms and diatomic molecules. ➢ The students will have an understanding of quantum behavior of atoms in external electric and magnetic fields. ➢ The students will understand important concepts of Atomic and molecular physics IR Raman and Electronic Band Spectra of Di- Atomic molecule will be studied. ➢ Also NMR and ESR technique will be introduced.

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : IV**
Title of the Paper	**ATOMIC AND MOLECULAR PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**Quantum states of one electron atom. Atomic orbitals. Hydrogen spectrum, Pauli's 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).**	1. H.E. White Introduction to atomic spectra 2. C.B. Banwell Fundamental of molecular spectroscopy 3. Walker and Strengthen Spectroscopy Vol. I , II and III 4. G.N. Barrow Introduction of molecular spectroscopy
Unit - II (English)	**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.**	

		5. Herzberg Spectra of diatomic molecules
Unit - III (English)	**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)**	6. Jeanne L and McHale Molecular spectroscopy 7. J.M. Brown Molecular spectroscopy
Unit - IV (English)	**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 photo acoustic spectroscopy and Moss Bauer spectroscopy (principle).**	8. P.F. Benmath Spectra of atoms and molecules J.M. Halian Modern Spectroscopy
Unit - V (English)	**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.**	

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Practical

Class	M. Sc	Semester - II
Subject	Physics	
Title of Practical	LAB – A (Electronics)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. To Study frequency response of RC Coupled Amplifier.
2. To study Characteristics of Photo Transistor
3. To find 'h' Parameters of Transistor.
4. To compare Characteristics of Ge and Si Transistor.
5. To study Transistor as a switch.
6. To Study regulated and unregulated power supply.
7. To verify De morgan's law.
8. To study Basic logic Gates
9. To sutudy 'NAND' Gate.
10. To study Passive Filters.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

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Practical

Class	M. Sc	Semester - II
Subject	Physics	
Title of Practical	LAB – B (General)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. To study 'Hall Effect'
2. To determine resistivity of given material by 'Four Probe Method'.
3. To determine band gap in semiconductor by 'Four Probe Method'.
4. To find Stefan's Constant.
5. To find thickness of mica sheet by biprism.
6. To find capacitance by 'Shearing Bridge'
7. To study Lissanjou's figure.
8. To study 'Push Pull Amplifier'
9. To study 'Wein Bridge Oscillator'
10. To study diffraction at single slit.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER-III

Paper I (Condensed matter physics)	The objective is to provide extended knowledge of solid state physics by understanding structure, thermal and elastic properties of matter. ➢ Student will have achieved the ability to differentiate between different lattice types and explain the concept of reciprocal lattice and crystal diffraction. ➢ The students will be able to formulate basic models for electrons and lattice vibrations for describing the physics of crystalline materials; and predict electrical and thermal properties of solids and explain their origin. ➢ The students will be able to explain concept of energy bands and their effect on electrical properties.

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Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : I**
Title of paper	**Condensed Matter Physics-I**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional %	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit-1	**Crystal structure:** Bravis lattice in two and three dimension. Simple crystal structures, Hexagonal close packed structure, Diamond structure, zinc blende structure, sodium chloride structure, cesium chloride structure.	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
Unit-2	**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-3	**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.	5. Huong: Theoretical solids state physics
Unit-4	**Lattice vibration and phonons:** Lattice dynamics 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.	6. Weertman and Weertman: Elementary dislocation theory
Unit-5	**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.	7. Buerger: Crystal structure physics. 8. Made Lung: Introduction to solids state physics.

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER-III

Paper II (Nuclear and Particle Physics)	The objective is to provide an understanding of static properties of nuclei nuclear decay modes, nuclear force and nuclear models and to provide bread understanding of basic experimental nuclear-detection techniques. ➢ The students will have an understanding of the structure of the nucleus, radioactive decay, nuclear reactions and the interaction of nuclear radiation with matter; and develop an insight into the building block of matter along with the fundamental interactions of nature. ➢ This course gives knowledge on fundamental principles of various particle accelerators and the motion of charged particles in electromagnetic field. ➢ The students will able to understand the classification and fundamental properties elementary particles.

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Theory

Class	**M.Sc.**		**Semester: III**
Subject (English)	**Physics**		**Paper No : II**
Title of Paper	**Nuclear and Particle Physics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional %	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit-1	**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.	1. Introduction of Nuclear physics : H.A. Enge 2. Nuclear radiation detectors : S.S. Kapoor and V.S. Ramamurthy
Unit-2	**Acclerators of charged particles:** Study of cyclotron, phase stability, frequency modulated cyclotron (synchorocyclotron) magnetic induction accelerator (Betatron) Electron synchrotron and linear accelerator (Linac)	

Unit-3	**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.	3. Atomic and Nuclear physic : S.N. Ghoshal 4. Nuclear and Particle physics : D.C. Tayal
Unit-4	**Nuclear decay and elementary particles:** ß Decay, general features of ß ray spectrum, Fermi theory of ß decay, selection rules, parity in ß decay, multipole radiation, internal conversion, nuclear isomerism.	5. Nuclear physics : R.C. Sharma
Unit-5	**Elementary particles:** Classification of elementary particles, fundamental interaction, parameters of elementary particles. Symmetry and conservation laws, symmetry schemes of elementary particles SU(3).	6. Introduction of Nuclear physics: KRANE 7. Nuclear physics Principles & Application : Lilley

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER-III

Paper III (Digital Electronics)	At the end of this course, the student will be able to understand the basic of digital circuit. ➢ Students will be capable to design different type of digital logic circuit ➢ Student will learn about basic knowledge of Digital Electronics. ➢ Student will develop ability to understand, analyze and design various combinational and Sequential Circuit

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Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : III**
Title of Paper	**Digital Electronics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional %	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit-1	Number system (Binary, Octal, Decimal, hexadecimal) and conversion between them. Boolean arithmetic, signed and unsigned binary numbers, I's complement, 2's complement.	1. "Digital principles and applications" by A.P. Malvino and Donald P. Leach, Tata Megraw-Hill Company, New Delhi, 1993. 2. "Microprocessor Architecture, Programming and Applications with 8085/8086 by Rames S.Gaonkar, Wiley-eastern Ltd., 1987 (for unit V)"
Unit-2	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-3	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)	

		3. Digital electronics : S.N. Ali 4. Digital electronics: Morries Mano 5. Microprocessor and Microcomputers : B. Ram- Dhanpat Rai publications V edition.
Unit-4	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-5	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)	

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER-III

Paper IV (Atomic and molecular Physics)	The objective to provide an understanding of the fundamental aspects of atomic and molecular structure. ➢ Students will have the understanding of the interaction of atomic and molecular systems with external homogenous static electric, magnetic fields and electromagnet radiations. ➢ Student will be familiar with different type of atomic and diatomic models and their spectra. ➢ Student will also be familiar NMR ESR techniques and Raman and Mossbauer Spectroscopy.

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Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : IV**
Title of Paper	**Atomic and Molecular Physics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional %	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit-1	**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 interation and spin-spin coupling between two and more nuclei (Qualitative)	1. Fundamentals of Molecular Spectroscopy : C.B. Banwell. 2. Spectra of Diatomic Molecules : Herzberg. 3. Mossbauer Spectroscopy : M.R. Bhide
Unit-2	**Electronic spectra of Diatomic Molecules and fourier transform infrared spectroscopy** Frank Condon principles, dissociation and pre-dissociation, dissociation energy. Born-Oppenheimer-approximation, vibrational coarse structure of electronic spectra (bands progression and sequence). fourier transform infrared spectroscopy :Theory and application FTIR peaks of common	

	bands and functional groups	4. NMR and Chemistry : J.W. Akitt 5. Modern Spectroscopy : J.M. Hollons
Unit-3	**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-4	**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, Quadrapole splitting magnetic field effect).	
Unit-5	**Electron Spin Resonance Spectroscopy:** Elementary Idea about ESR, Principle of ESR, ESR spectrometer, spliting of electron energy levels by a magnetic field, G-Values, simple experimental set-up of ESR. ESR spectra of free radicals in solution, Anisotropic system.	

As Recommended by the Board of Studies
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Practical

Class	M. Sc	Semester - III
Subject	Physics	
Title of Practical	LAB – A (Electronics)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. Seven Segment Display.
2. BCD to Hexadecimal Converter.
3. UP Down Counter.
4. RS,JK,T,D, flip flop
5. Master Slave fillip flop.
6. Hexadecimal to binary encoder.
7. Encoder Decoder(decimal to binary)
8. Half adder and full adder (IC7483)
9. A to D converter.
10. Study of binary to decimal decoder.
11. Design and study 4 bit binary ripple counter.
12. Study of decimal to octal converter.
13. 4 bit binary full adder.
14. Decimal to octal and decimal to binary converter using Digital Lab Trainer Kit.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

As Recommended by the Board of Studies

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Practical

Class	M. Sc	Semester - III
Subject	Physics	
Title of Practical	LAB – B (General)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. To study divergence of LASER beam.
2. To find refractive index of a liquid using LASER source.
3. To find wavelength of LASER.
4. To study frequency response of negative feedback amplifier.
5. To study effect of feedback network on gain of feedback amplifier.
6. To find Rydberg Constant by Hydrogen Discharge Tube.
7. To Study differential comparator.
8. To study 'Push Pull Amplifier'.
9. To analyse elliptically polarized light by Babinet's compensator.
10. Use of Michelson Interferometer.
11. To study emitter follower.
12. To study Colpitt's Oscillator.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER IV

Paper I (Condensed matter physics -II)	The objective of this paper will give students fare idea of concept of super conductivity, types of super conductor's theory, and AC and DC effects. ➢ The student will have the understanding of Weiss theory of Ferromagnetisms, Domain and Bloch wall energy. ➢ The student will able to understand Curie Weiss Law Ferri and Anti Ferrimagnetism. ➢ The student will able to learn about Basic physics behind Nano material and used. ➢ Different technique for synthesis and characterization of Nano Material and tube. ➢ The student will able to gain the knowledge of basic principles of material science in thin film technology and used various techniques to synthesis thin films of desired characteristics and various properties like electrical conductivity and hall coefficient quantum size effect in thin films.

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Session –2021-22

Class / d{kk	% M.Sc.
Semester / lsesLVj	% IV
Subject / fo"k;	% Physics
Title of Subject Group	% Condensed Matter Physics-II
fo"k; lewg dk 'kh"kZd	%
Paper No. / iz'ui= dzekad	% I
Compulsory / vfuok;Z ;k Optional / oSdfYid vfuok;Z	% Compulsory
Max. Marks vf/kdre vad 100	% CCE : 30, Main Exam : 70 Total - 100

Particulars / fooj.k

Unit-1	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-2	Magnetism: Weiss theory of ferromagnetic, Heisenberg model and molecular field theory, Domain and Bloch wall energy, Spin waves and magnons, Curie Weiss law for susceptibility, Ferri and anti ferrimagnetism.
Unit-3	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-4	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.
Unit-5	Nano structure: Definition and properties of nano structured material, different method of preparation of nano materials, plasma enchanted chemical vapour deposition, electro deposition. structure of single wall carbon nono tubes (classification, chiral vector Cn, Translational vector T, Symmetry vector R, Unit Cell, Brillouin Zone) Electronic, mechanical, thermal and phonon properties.

Suggested Readings:

1. Kittel: Solid State Physics
2. Huang: Theoretical Solid State Physics
3. Weertmon and Weertman: Elementary Dislocation theory
4. Thomes: Multiple Electron microscopy
5. Tolansky: Multiple Beam Interferometer

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER IV

Paper II (Laser Physics)	The objective is to provide an understanding of various concepts of Laser Physics. ➢ Student will be able to analyze the intensity variation of light using laser. ➢ Student will be able to explain working principles knowledge and conceptual understanding in Laser Physics. ➢ Students approach an ability to analyze quantitatively and to design such Lasers. ➢ Student comes to know basic idea about non liner optics.

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Session –2021-22

Class / d{kk	% M.Sc.
Semester / lsesLVj	% IV
Subject / fo"k;	% Physics
Title of Subject Group	% Laser Physics
fo"k; lewg dk 'kh"kZd	%
Paper No. / iz'ui= dzekad	% II
Compulsory / vfuok;Z ;k Optional / oSdfYid vfuok;Z	% Compulsory
Max. Marks vf/kdre vad 100	% CCE : 30, Main Exam : 70 Total - 100

Particulars / fooj.k

Unit-1	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-2	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-3	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 HCI and HF lasers.
Unit-4	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 welding, Hole drilling, laser cutting, application of lasers in medicine.
Unit-5	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.

Suggested Readings:

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

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER IV

Paper III (Computer Programming and Informatics)	The objective is to demonstrate an understanding of computer programming language concepts. ➢ Students will able to develop basic understanding of computers the concept of algorithm and logical thinking. ➢ Students will develop ability to design Computer programs, analyze and interpret the concept of variable declarations, Initialization, operations and their usage and able to use the concept of array of structures. ➢ Students will be able to build an understanding of the fundamental concepts of computer networking and familiarize with the basic taxonomy and terminology of the computer networking area. ➢ Students will be able to use knowledge of HTML and HTML editor to create websites for current professional and industry standards and use critical thinking skills to design and create websites.

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Session –2021-22

Class / d{kk **% M.Sc.**

Semester / lsesLVj **% IV**

Subject / fo"k; **% Physics**

Title of Subject Group **% Computer Programming and Informatics**

fo"k; lewg dk 'kh"kZd **%**

Paper No. / iz'ui= dzekad **% III**

Compulsory / vfuok;Z ;k Optional / oSdfYid vfuok;Z **% Compulsory**

Max. Marks vf/kdre vad 100 **% CCE : 30, Main Exam : 70 Total - 100**

Particulars / fooj.k

Unit-1	Conceptual framework of computer languages (Algorithm, Flowcharts) Need of structured programming, Top-down, bottom-up and modular programming design. Introduction to C languages-basic structure of C programme. Character set, keyword and identifiers, C data types, variable and data type declaration. Various operators like arithmetic, relational, logical assignment, conditional, increment and decrement operators. Evaluation of expression and operator precedence.
Unit-2	Input and output statement, control statement (If, If-else, If nested If-else statements switch, while, Do... while and for statements) Simple C programmes like search of prime number between given range of numbers, finding the smallest and largest of three numbers, sume of algebraic series, factorial of given number, roots of a quadratic equation, binary of decimal and decimal to binary conversion etc.
Unit-3	Functions: need of functions, calling the function by value and by reference, category of functions: no argument no return, argument but not return, argument with return. Recursion. One and two dimensional arrays. String and string handling functions like sprinf (), strepy (), sscanf (), strlen(), sizeorf () strcmp ()etc. Simple programs using user define functions, arrays and string functions.
Unit-4	Network: Terminals-Dumb terminals, smart terminals, intelligent tgerminals. Types of network: • According to range: LAN,MAN,WAN, Client server • According to topologies: BUS, RING, STAR, Mesh Network.

	Internet: History of Internet Service Provider (ISP), introduction to type of internet account-shell/Ac, TCP/IP A/c. types of connectivity-Dialup, Leased lines, Satellite. IP Address-Class A, Class B, Class C Domain Name address. URL-absolute and relative
Unit-5	Web enabled technology (Email and HTML): Web Browser: Internet Explorer, Netscape Navigator, Station and Dynamic web page Introduction to HTML. HTML tags: • <HTML>, <TITLE>, <HEAD>, <BODY> • <P>, , (ALIGN>, <I>, <B>, <DIV>, <PRE>, and their attributers • <IMG> <a> and their attributes • Ordered and unordered list tages • Tabes and associated tags and its properties Creation of simple forms using text, Password, text area, radio, submit, Rest and Hidden. Brief idea about HTTP. Search engine, its working, types of search engines: sub directories meta search engines, search function-AND and OR. Population search engines.

Suggested Readings:

1. Let us C : Yashwat Kanetkar
2. Programming with C : Balaguruswami
3. Internet and Web Page : V. K Jain

   'O' level module M1.2
4. Internet and Web Page design : Dr. P.D Murarka

   'O' level module M1.2
5. Internet and web page design : Pearl Software

   'O' level module M1.2
6. C# 2008 in simple step

   Dreamtech press
7. C# 2008 programming block book

   Dreamtech press

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER IV

Paper IV (Digital Electronics)

The objective of this elective paper comprising OP-AMP and Microprocessor specializes the student in Digital Electronics.

- Students will be able to understand integrated components of OP-AMP design and packaging of IC 741 understand various modes of OP-AMP and its linear/ Non Linear applications.
- Students will be able to understand and analyze IC 741 operational amplifier and its characteristics.
- Students will be able to design and understand various linear and nonlinear application of OP-AMP using IC 741.
- Students will be able to elucidate and design the active filter and oscillator.
- Students will be able to understand Microprocessor 8086-architecture and addressing modes and simple assembly language programming.

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Session –2021-22

Class / d{kk	**% M.Sc.**
Semester / lsesLVj	**% IV**
Subject / fo"k;	**% Physics**
Title of Subject Group	**% Digital Electronics**
fo"k; lewg dk 'kh"kZd	**%**
Paper No. / iz'ui= dzekad	**% IV-E**
Compulsory / vfuok;Z ;k Optional / oSdfYid vfuok;Z	**% Optional**

Max. Marks vf/kdre vad 100 % CCE : 30, Main Exam : 70 Total - 100

Particulars / fooj.k

Unit-1	**OP-AMP:-** Differential amplifier circuit configurations: dual input balanced output ,dual input, single input unbalanced output (ac analysis) only, block diagram of a typical op amp analysis, schematic symbol of an op-amp. IC 555 timer Introduction, Architecture, Application as astable and monostable multivibraters.
Unit-2	**OP-AMP Parameters:-** Ideal op-amp parameters; input offset voltage, input offset current, input bias current, CMRR, SVRR, large signal voltage gain, Slew rate, Gain band width product, output resistance, supply currents power consumption, inverting and non-inverting inputs.
Unit-3	**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, L-C tunable oscillator, square wave generator.
Unit-4	**Microprocessors and Micro Computers:** Microprocessor and Architecture: Intel 8086, Microprocessor architecture modes of memory addressing, 8086/8088 Hardware specification: Pin-outs and pin functions, clock generator (8284A) Bus buffering and latching, Bus timing, Ready and wait State, Minimum mode versus maximum mode.
Unit-5	**Programming the Microprocessors:** Addressing modes: Data addressing modes, program memory addressing modes, stack memory-addressing modes. Instruction set: data movement Instructions, Arithmetic and login instructions, program control instructions. Programming example: Simple Assembly language programs table

	handling direct table addressing, searching a table sorting a table using pseudo ops.

Suggested Readings :

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

COURSE LEARNING OUTCOME

PAPER IV - B (Material science)

By the end of this course the student will be able

1. To know the different classes of materials and would be able to choose the right materials for specific applications.
2. To understand and appreciate the significance of the composites as an important class of materials.
3. They will be able to know different kind of polymers and their properties, variation of properties of polymer by crystallinity and glass transition temperature.
4. To define phase transitions and phase transition temperatures and will be able to explain the relation between phase transition temperatures and intermolecular attractive forces.
5. To give information about phase diagrams.
6. To Explain the limit where a deformation of material is elastic.
7. To analyse elasticity and plasticity on a stress-strain diagram and to explain elastic constants.
8. To understand the electrical conductivity in metals, transport properties and electrical properties of materials according to material type, structure and physical properties.

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SESSION: 2021-22

THEORY

Class (d{kk)	M. Sc.	
Semester (lsesLVj)	**IV**	
Subject (fo"k;)	**PHYSICS**	
Paper No. (iz'ui= Øekad)	**IV - B**	
Title of the paper (iz'ui= dk 'kh"kZd)	**MATERIAL SCIENCE**	
Compulsory/ optional (vfuok;Z@oSdfYid)	**optional@oSdfYid**	
Marks in CCE: 30	**Marks in main Exam: 70**	**Max. Marks: 100**

Unit	Syllabus
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 Inelastic Behaviour:- Atomic models for elastic behavior, Elastic deformation in single crystals, Elastic anisotropy, Elastic constant and elastic module (Cubic system, isotropic body), Rubber like elasticity, anelasticbehaviour, 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.

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER IV

Paper IV D (Communication Electronics)

On successful completion of the course students will be able to

- **Understand basic element of communication system**
- **conduct analysis of base band signals in time domain and frequency domain**
- **Demonstrate understanding of various analog and digital modulation and demodulation techniques**
- **Analyse the preformance of modulation & demodulation technique in various transmission environment**
- **Appreciate importance synchronisation in communication systems.**
- **Equip the students with theory of waveguides, transmission lines, microwave components, microwave devices.**
- **Able to learn the dynamics of satellite understand communication satellite design and understand how analog and digital technique are used for satellite communication network.**

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SHIVAJI NAGAR,BHOPAL
AS RECOMMENDED BY THE BOARD OF STUDIES
SESSION: 2021-22

THEORY

Class (d{kk)	M.Sc.	
Semester (lsesLVj)	**IV**	
Subject (fo"k;)	**PHYSICS**	
Paper No. (iz'ui= Øekad)	**IV - D**	
Title of the paper (iz'ui= dk 'kh"kZd)	**COMMUNICATION ELECTRONICS**	
Compulsory/ optional (vfuok;Z@oSdfYid)	**optional**@oSdfYid	
Marks in CCE: 30	**Marks in main Exam: 70**	**Max. Marks: 100**

Unit	Syllabus
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 Microwaves: K.C. Gupta
3. Microwave Devices & Circuits: S.Y. Lio
4. Principle of Communication system: Taub&Schiling

As Recommended by the Board of Studies

Session – 2021-22

Practical

Class	M. Sc	Semester - IV
Subject	Physics	
Title of Practical	Lab- A (Programing in C and HTML)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. C Programme for simple arithemetic operation.
2. C programme for calculation
3. C programme for finding factorial of a given number using a using defind function.
4. C programme for addition of 2 or 3 matrices.
5. C programme for selecting a prime number from 1 to 100.
6. Least square fitting.
7. To find the root of a quadratic equation.
8. To find product of two matrices.
9. To evaluate sum of finite series and the area under a curve.
10. To print all natural even/odd numbers between given limits.
11. HTML programme for making a web page using various headers and <B>, <T> and <U> tag.
12. HTML programme using ordered and un ordered list.
13. HTML programme for inserting image and table.
14. HTML Programme for preparing 3 linked web pages.
15. HTML Programme for making a web page using a Marquee, Animation and sound file.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

As Recommended by the Board of Studies

Session – 2021-22

Practical

Class	M. Sc	Semester - IV
Subject	Physics	
Title of Practical	Lab- B (QP. Amp., IC – 555 and Microprocessor)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. To study QP. Amp. as and adder and sub tractor.
2. To studyQP. Amp. as inverting and non-inverting amplifier.
3. To study QP. Amp. as differentiator.
4. To study QP. Amp. as integrator.
5. To study QP. Amp.as Schmith Trigger.
6. To study QP. Amp. as squire wave generator.
7. To study QP. Amp.as low pass filter.
8. To study QP. Amp. as high pass filter.
9. To study QP. Amp. as band pass filter.
10. To study QP. Amp.as voltage follower
11. To study IC-555 as table multivibrator.
12. To studyIC-555 as bisable multivibrator.
13. To studyIC-555 as monostable multivibrator.
14. To studyIC-555timer as frequency divider.
15. To studyIC-555 as Schmitt Trigger.
16. To write programme to find the largest number.
17. To arrange numbers in ascending and descending order using 8086 microprocessor.
18. To write a programme in assembly language of INTEL 8086 processor for simple arithmetic operations.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

SAROJINI NAIDU GOVT. GIRLS PG (AUTONOMOUS) COLLEGE, Shivaji Nagar, Bhopal

Semester Wise Syllabus for Physics

(As Recommended by Board of Studies)

Session: 2021-22

Scheme of Examination

Course: M.Sc. (2 Year Degree Course)

Semester	Theory Paper/Practical	Title of Paper	Marks	Total Marks
I	Paper I	Mathematical Physics	100	600
	Paper II	Classical Mechanics	100	
	Paper III	Quantum Mechanics-I	100	
	Paper IV	Electronic Devices	100	
	PRACTICAL-I	Lab-A (Electronics)	100	
	PRACTICAL-II	Lab-B (General)	100	
II	Paper I	Quantum Mechanics-II	100	600
	Paper II	Statistical Mechanics	100	
	Paper III	Electrodynamics & Plasma Physics	100	
	Paper IV	Atomic and Molecular Physics	100	
	PRACTICAL-I	Lab-A (Electronics)	100	
	PRACTICAL-II	Lab-B(General)	100	
III	Paper I	Condensed matter Physics-I	100	600
	Paper II	Nuclear and Particle Physics	100	
	Paper III	Digital Electronics	100	
	Paper IV	Atomic and Molecular Physics	100	
	PRACTICAL-I	Lab-A (Electronics)	100	
	PRACTICAL-II	Lab-B (General)	100	600
IV	Paper I	Condensed Matte Physics-II	100	
	Paper II	LASER Physics	100	
	Paper III	Computer Programming and Informatics	100	
	Paper IV	Digital Electronics	100	
	PRACTICAL-I	Lab-A (Electronics)	100	
	PRACTICAL-II	Lab-B (General)	100	
		Grand Total		**2400**

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE, BHOPAL

SYLLABUS FOR M.Sc (Physics)

SEM ; I, II, III & IV

SESSION : 2021-22

PROGRAM SPECIFIC OUTCOME

M.Sc. (Physics)

Objectives

- Students will be able to conduct experiments, analyze and interpret data for investigating problems in the field of Physics.
- Student of Physics can pursue higher studies (M. Phil, Ph. D) to attain research positions Students can get jobs in various fields of Physics both in the private and public sector. Some of the common job positions or profiles for a physics graduates are in College lecturer and

Teaching Fields, Scientific Positions as Research Associates in various Research institutes. Assistant Professor. They can apply for jobs in Aerospace and Defense, Automobile. IT and Software, Railways, Nuclear and Renewable energy. Oil and Gas Electronics and Telecommunications and the Manufacturing sector.

- Besides Industrial sector these are ample opportunities in Academics, like in School Education Department and Higher Education Department.
- Students will be able to understand the wide potential of the subject Physics and its implementation in sustainable development.

COURSE LEARNING OUTCOMES
M.Sc. (Physics)
SEMESTER-1

Paper I (Mathematical Physics)	The objective is to provide students the ability to develop the mathematical skills necessary to approach problems in advanced physics courses. ➢ The students will be able to understand and apply the mathematical skills to solve quantitative problems in the study of physics. ➢ The students will be able to apply integral transform to solve Mathematical problems of

interest in physics.

- The students will be able to use Fourier transforms as an aid for analyzing Experimental data.
- The students should be able to solve differential equation of various types.
- Describe basics of group theory, Special functions, and Recurrence relations.

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As Recommended by the Board of Studies

Session 2021-22

Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : I**
Title of the Paper	**MATHEMATICAL PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**<u>Differential equations</u>: Recursion relation, generating functions and orthogonality of Bessel functions of first and second kind, Hermite, Legendre, Associate Legendre and Laguerre Polynomials, Curvilinear coordinate system with specific cases of Cartesian, Cylindrical and Spherical coordinate systems.**	1. L.A. Pipes Mathematics of Engineers and Physicists. 2. Arfken Mathematical Methods for Physicists. 3. P.K. Chattopadhyay Machematical Physics. 4. H.K.Dass Mathematical Physics 5. Ghatak, Goyal & Guha Mathematical Physics 6. M.R. Spiegal (Schaum Series) Complex variable & Laplace Transform.
Unit - II (English)	**Integral transforms. Fourier integral. Fourier transforms and inverse Fourier transforms. Fourier transform of derivatives. Convolution theorem. Elementary Laplace transforms. Laplace transform to derivatives. Application to a damped harmonic oscillator.**	
Unit - III (English)	**<u>Green's functions</u>: Non-homogenous boundary value problems, Green's function for one dimensional problems, eigen function expansion of Green's function, Fourier transforms. Method of constructing. Green's functions, Green's function for electrostatic boundary value. Problems and quantum-mechanical scattering problem.**	
Unit - IV (English)	**<u>Complex variables</u>: analyticity of complex functions. Cauchy Riemann equations. Cauchy theorem. Cauchy integral formula. Taylors, Maclaurin Laurent series and mapping. Theorem of residues. Simple cases of contour integration. Jordan's lemma Integrals involving multiple valued function (Branch points)**	
Unit - V (English)	**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.**	

COURSE LEARNING OUTCOMES
M.Sc. (Physics)
SEMESTER-1

Paper II
(Classical Mechanics)

The objective aims to develop an understanding of Lagrangian and Hamiltoman formulation which allow for simplified treatments of many complex problems in classical mechanics and provide the foundation for the modern understanding of dynamics.

- The students will be able to apply the Variational principles to real physical problems.
- The students will be able to model mechanical systems, both in inertial and rotating frames, using Lagrange's and Hamilton's equations.

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As Recommended by the Board of Studies

Session 2021-22

Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : II**
Title of the Paper	**CLASSICAL MECHANICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**<u>Newtonin mechanics of one and many particles systems</u>: Conservation laws, Constraints their classification, Principle of virtual work; D'Almbert's principle in generalized coordinates, The Lagrange's equitation from D'Almbert's principle. Configuration space, Hamilton's principle deduction from D'Almberts principle, Generalized momenta and Lagragian 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.**	1. H. Goldsetin (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) R.G. Takwale & P.s. Puranik Introduction to Classical Mechanics.
Unit - II (English)	**<u>The equitation of canonical transformation and generating functions</u>: The Hamilton-Jacobi Action and Angle 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.**	
Unit - III (English)	**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 (English)	**Symmetries of space and time. Invariance under galilion transformation, Covariant four-dimensional 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 Hamiltonioan, Examples.**	
Unit - V (English)	**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.**	

COURSE LEARNING OUTCOMES
M.Sc. (Physics)
SEMESTER-1

Paper III (Quantum Mechanics)	The objective is to provide an understanding of the formalism and language of non-relativistic quantum mechanics and understand the concepts of time-independent. perturbation theory and their applications to physical situations. ➢ The students will be able to formulate and solve problems in quantum mechanics using Dirac representation. ➢ The students will be able to grasp the concepts of spin and angular momentum, as well as their quantization and addition rules. ➢ The students will be familiar with various approximation methods applied to atomic nuclear and solid-state physics.

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As Recommended by the Board of Studies
Session 2021-22
Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : III**
Title of the Paper	**QUANTIUM MECAHNICS – I**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**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.**	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 Mathews and Venkatesan Quantum Mechanics.
Unit - II (English)	**Linear vector space, concept of Hilbert 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).**	
Unit - III (English)	**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 (deuteron).**	
Unit - IV (English)	**Angular momentum in quantum mechanics, Eigen values and Eigen function of L_2 and L_z in term of spherical harmonics, commutation relation. Time independent perturbation theory. Non-degenerate and degenerate cases.**	
Unit - V (English)	**This unit will have a short note question covering all the four units.** **The students will have to answer any two questions of the four.**	

COURSE LEARNING OUTCOMES
M.Sc. (Physics)
SEMESTER-1

Paper IV (Electronic device)	The objective is to develop an understanding of fundamentals of electronics in order to deepen the understanding of electronic devices that are part of the technologies that surround us ➢ The Students will be able to use techniques for electronic circuits, and formulate the concepts of Field Effect Transistors (FET), identity its major properties and main types of FET circuits ➢ The Students will develop ability to describe the behavior of special Purpose Diode LDR, LED, and Solar Cells. ➢ The Students will be able to recognize various storage devices like RAM, ROM, Hybrid memories. ➢ The Students will be able to understand electro-optics magneto-optics and acousto-optics effects material and properties.

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As Recommended by the Board of Studies
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Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : IV**
Title of the Paper	**ELETRONIC DEVICES**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**Transistors : JFET, BJT, MOSFET and MOSFET, structure derivations of the equations for I-V characteristics under different conditions, microwave devices, tunnel diode, transfer electron devices (Gunn diode) avalanche transits time devices, Impatt diodes and parametric devices.**	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. Ajoy Ghatak and Thyagrajam Optical Electrics.
Unit - II (English)	**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 (English)	**Memory Devices: Read Only Memory (ROM) and Random Access Memory (RAM). Types of ROM: PROM, EPRON, EEPROM AND EAPROM, Static and dynamic RAMs (SRAM & DRAM), characteristics of SRAM and DRAM.** **Hydbrid Memories : CMOS and NMOS memories, Nonvolatile RAM, ferro-electric memories, charge coupled devices (CCD), storage devices : Geometry and organization of magnetic (FDD and HDD) and Optical (CD-ROM, CD-R, CD-R/W, DVD) Storage Devices.**	
Unit - IV (English)	**Eletro-optics, Magneto-optic and Acousto-optic effects, materials properties related to get these effect, important ferro electric, Liquid crystal and polymeric materials for these devices, piezoelectric, electrostrictive and magnetostrictive effects. Important materials for these properties and their applications in sensors and actuator devices, acoustic delay lines, peizoelectric resonators and filters, high frequency piezoelectric devices-surface, acoustic wave devices.**	
Unit - V (English)	**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.**	

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Practical

Class	M. Sc	Semester - I
Subject	Physics	
Title of Practical	LAB – A (Electronics)	
Medium of Instruction/Teaching	English	
Maximum Marks	100	

List of Experiments

1. To study characteristics of Zener Diode.
2. To study characteristics of Silicon Controlled Rectifier (SCR).
3. To study characteristics of Light Emitting Diode (LED).
4. To study characteristics of Tunnel Diode.
5. To study characteristics of Junction Field Effect Transistor (JFET)n
6. To study characteristics of Metal Oxide Semiconductor Field Effect Transistor (MOSFET).
7. To study characteristics of PN Diode.
8. To study characteristics of Thermistor.
9. To study characteristics of Triac.
10. To study characteristics of Uni junction Transistor (UJT)
11. To study characteristics Diac.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

As Recommended by the Board of Studies
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Practical

Class	M. Sc	Semester - I
Subject	Physics	
Title of Practical	LAB – B (General)	
Medium of Instruction/Teaching	English	
Maximum Marks	100	

List of Experiments

1. To find Characteristics of Photo cell.
2. To find energy band gap of semiconductor.
3. To find electronic charge by rectifier.
4. To study characteristics of solar cell.
5. To find e/m by Thomson method.
6. To find resolving power of grating.
7. To verify Cauchy's formula.
8. To study hysteresis loss of transformer using CRO.
9. To study wave form and frequency by CRO.
10. To study characteristics of VR Tube.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER II

Paper I (Quantum Mechanics - II)	The objective is to understand the concepts of the time-dependent perturbation theory and their applications to physical situations and the basics of scattering theory. ➢ The students will be able to grasp the concepts of Dirac equation and Klein Gordon equation. ➢ The students will be familiar with various approximation methods applied to atomic nuclear and solid-state physics.

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : I**
Title of the Paper	**QUANTUM MECHANICS -II**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - I (English)	**<u>Approximation method for bound states</u>: Rayleigh - Schrodinger Perturbation theory of non-degenerate and degenerate 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.**	1. LI Schiff Quantum Mechanics 2. S Gasirowicaz 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 A.K.Ghatak and Loknathan Quantum Mechanics.
Unit - II (English)	**<u>Time dependant perturbation theory</u> : 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 (English)	**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 practices with spin, Pauli's spin matrices.**	
Unit - IV (English)	**Schrodinger.s relativistic equation (Klein-Gordon equation), Probability and current denisity, 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 (English)	**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.**	

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER II

Paper II (Statistical Mechanics)	The objective is to have an appreciation for the modern aspects of equilibrium and non-equilibrium statistical physics ➢ The students will be able to describe the features and examples of Maxwell Boltzmann Bose Einstein and Fermi-Dirac statistics. ➢ The students will be able to work out equations of state and thermodynamic potentials for elementary systems of particles, and use and develop mean field theory for first and second order phase transitions.

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Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : II**
Title of the Paper	**STATISTICAL MECHANICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**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. Micro canonical ensemble, phase space, trajectories and density of states, Liouvelle theorem, canonical and grand canonical ensembles, partition function, calculation of statistical quantities, energy sand density fluctuations.**	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.
Unit - II (English)	**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 (English)	**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 - IV (English)	**Thermodynamics fluctuation spatial correlation Brownian motion, Langevin theory, fluctuation dissipation theorem, the Fokker-Planck equation, Onsager reciprocity relations.**	
Unit - V (English)	**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.**	

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER II

Paper III (Electrodynamics and Plasma Physics)	The objective is to evaluate fields and forces in Electrodynamics and Magneto dynamics using basic scientific method To provide concepts of relativistic electrodynamics and applications in branches of Physical Sciences. ➢ The students will be able to explain and solve advanced problems based on classical electrodynamics using Maxwell's equation. ➢ The students will be able to analyze radiation systems in which the electric dipole magnetic dipole or electric quadruple dominate. ➢ The students will have an understanding of the covariant formulation of electrodynamics and the concept of retarded time for charges undergoing acceleration.

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : III**
Title of the Paper	**ELECTRODYNAMICS AND PLASMA PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - I (English)	**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.**	1. Bitteneerort Plasma Physics 2. Chen Plasma Physics 3. Gupta, Kumar, Singh Electro dynamics 4. Sen Plasma state and matter 5. Jackson Classical electrodynamics 6. Pamolsky & Philips Classical electricity and Magnetism.
Unit - II (English)	**Fields of an 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-demension Maxwell equation, Four Vector current and potential and their invariance under Lortentz transformation, covariance of electro-dynamics.** **Langragian and Hamiltonian for a relativistic charged particle in External EM field; motion of charged particles in electromagnetic fields, uniform and non-uniform E and B fields.**	
Unit - III (English)	**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 plasma. Debye screening distance. Plasma oscillations: Transverse oscillations and longitudinal oscillations.**	

Unit - IV (English)	<u>**Domain of Magneto hydrodynamics and plasma Physics**</u> **:** **Magneto hydrodynamic equations, magnetic hydro-static pressure hydrodynamic waves: Magneto-sonic and Alfven waves, particle orbits and drift motion in plasmas. Experimental study of Plasma the theory of single and double probes.**	
Unit - V (English)	**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.**	

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER II

Paper IV (Atomic and molecular Physics)	The objective is to get the better understanding of the fundamental aspects of atomic and molecular physics and to study spectroscopy of it multi-electron atoms and diatomic molecules. ➢ The students will have an understanding of quantum behavior of atoms in external electric and magnetic fields. ➢ The students will understand important concepts of Atomic and molecular physics IR Raman and Electronic Band Spectra of Di- Atomic molecule will be studied. ➢ Also NMR and ESR technique will be introduced.

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : IV**
Title of the Paper	**ATOMIC AND MOLECULAR PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**Quantum states of one electron atom. Atomic orbitals. Hydrogen spectrum, Pauli's 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).**	1. H.E. White Introduction to atomic spectra 2. C.B. Banwell Fundamental of molecular spectroscopy 3. Walker and Strengthen Spectroscopy Vol. I , II and III 4. G.N. Barrow Introduction of molecular spectroscopy 5. Herzberg Spectra of diatomic molecules 6. Jeanne L and McHale Molecular spectroscopy 7. J.M. Brown Molecular spectroscopy 8. P.F. Benmath Spectra of atoms and molecules J.M. Halian Modern Spectroscopy
Unit - II (English)	**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 (English)	**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 (English)	**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 photo acoustic spectroscopy and Moss Bauer spectroscopy (principle).**	

Unit - V (English)	**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.**	

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Practical

Class	M. Sc	Semester - II
Subject	Physics	
Title of Practical	LAB – A (Electronics)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. To Study frequency response of RC Coupled Amplifier.
2. To study Characteristics of Photo Transistor
3. To find ‘h’ Parameters of Transistor.
4. To compare Characteristics of Ge and Si Transistor.
5. To study Transistor as a switch.
6. To Study regulated and unregulated power supply.
7. To verify De morgan’s law.
8. To study Basic logic Gates
9. To sutudy ‘NAND’ Gate.

10.To study Passive Filters.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

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Practical

Class	M. Sc	Semester - II
Subject	Physics	
Title of Practical	LAB – B (General)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. To study ‘Hall Effect’
2. To determine resistivity of given material by ‘Four Probe Method’.
3. To determine band gap in semiconductor by ‘Four Probe Method’.
4. To find Stefan’s Constant.
5. To find thickness of mica sheet by biprism.
6. To find capacitance by ‘Shearing Bridge’
7. To study Lissanjou’s figure.
8. To study ‘Push Pull Amplifier’
9. To study ‘Wein Bridge Oscillator’
10. To study diffraction at single slit.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER-III

Paper I (Condensed matter physics)	The objective is to provide extended knowledge of solid state physics by understanding structure, thermal and elastic properties of matter. ➢ Student will have achieved the ability to differentiate between different lattice types and explain the concept of reciprocal lattice and crystal diffraction. ➢ The students will be able to formulate basic models for electrons and lattice vibrations for describing the physics of crystalline materials; and predict electrical and thermal properties of solids and explain their origin. ➢ The students will be able to explain concept of energy bands and their effect on electrical properties.

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Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : I**
Title of paper	**Condensed Matter Physics-I**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional %	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit-1	**Crystal structure:** Bravis lattice in two and three dimension. Simple crystal structures, Hexagonal close packed structure, Diamond structure, zinc blende structure, sodium chloride structure, cesium chloride structure.	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.
Unit-2	**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-3	**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-4	**Lattice vibration and phonons:** Lattice dynamics 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-5	**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.	

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER-III

Paper II (Nuclear and Particle Physics)	The objective is to provide an understanding of static properties of nuclei nuclear decay modes, nuclear force and nuclear models and to provide bread understanding of basic experimental nuclear-detection techniques. ➢ The students will have an understanding of the structure of the nucleus, radioactive decay, nuclear reactions and the interaction of nuclear radiation with matter; and develop an insight into the building block of matter along with the fundamental interactions of nature. ➢ This course gives knowledge on fundamental principles of various particle accelerators and the motion of charged particles in electromagnetic field. ➢ The students will able to understand the classification and fundamental properties elementary particles.

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Theory

Class	**M.Sc.**		**Semester: III**
Subject (English)	**Physics**		**Paper No : II**
Title of Paper	**Nuclear and Particle Physics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional %	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit-1	**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.	1. Introduction of Nuclear physics : H.A. Enge 2. Nuclear radiation detectors : S.S. Kapoor and V.S. Ramamurthy 3. Atomic and Nuclear physic : S.N. Ghoshal 4. Nuclear and Particle physics : D.C. Tayal 5. Nuclear physics : R.C. Sharma 6. Introduction of Nuclear physics: KRANE 7. Nuclear physics Principles & Application : Lilley
Unit-2	**Acclerators of charged particles:** Study of cyclotron, phase stability, frequency modulated cyclotron (synchorocyclotron) magnetic induction accelerator (Betatron) Electron synchrotron and linear accelerator (Linac)	
Unit-3	**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-4	**Nuclear decay and elementary particles:** ß Decay, general features of ß ray spectrum, Fermi theory of ß decay, selection rules, parity in ß decay, multipole radiation, internal conversion, nuclear isomerism.	
Unit-5	**Elementary particles:** Classification of elementary particles, fundamental interaction, parameters of elementary particles. Symmetry and conservation laws, symmetry schemes of elementary particles SU(3).	

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER-III

Paper III (Digital Electronics)	At the end of this course, the student will be able to understand the basic of digital circuit. ➢ Students will be capable to design different type of digital logic circuit ➢ Student will learn about basic knowledge of Digital Electronics. ➢ Student will develop ability to understand, analyze and design various combinational and Sequential Circuit

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Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : III**
Title of Paper	**Digital Electronics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional %	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit-1	Number system (Binary, Octal, Decimal, hexadecimal) and conversion between them. Boolean arithmetic, signed and unsigned binary numbers, I's complement, 2's complement.	1. "Digital principles and applications" by A.P. Malvino and Donald P. Leach, Tata Megraw-Hill Company, New Delhi, 1993. 2. "Microprocessor Architecture, 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.
Unit-2	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-3	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-4	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-5	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)	

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER-III

Paper IV (Atomic and molecular Physics)	The objective to provide an understanding of the fundamental aspects of atomic and molecular structure. ➢ Students will have the understanding of the interaction of atomic and molecular systems with external homogenous static electric, magnetic fields and electromagnet radiations. ➢ Student will be familiar with different type of atomic and diatomic models and their spectra. ➢ Student will also be familiar NMR ESR techniques and Raman and Mossbauer Spectroscopy.

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Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : IV**
Title of Paper	**Atomic and Molecular Physics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional %	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit-1	**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 interation and spin-spin coupling between two and more nuclei (Qualitative)	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
Unit-2	**Electronic spectra of Diatomic Molecules and fourier transform infrared spectroscopy** Frank Condon principles, dissociation and pre-dissociation, dissociation energy. Born-Oppenheimer-approximation, vibrational coarse structure of electronic spectra (bands progression and sequence). fourier transform infrared spectroscopy :Theory and application FTIR peaks of common bands and functional groups	
Unit-3	**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-4	**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, Quadrapole splitting magnetic field effect).	
Unit-5	**Electron Spin Resonance Spectroscopy:** Elementary Idea about ESR, Principle of ESR, ESR	

	spectrometer, spliting of electron energy levels by a magnetic field, G-Values, simple experimental set-up of ESR. ESR spectra of free radicals in solution, Anisotropic system.	

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Practical

Class	M. Sc	Semester - III
Subject	Physics	
Title of Practical	LAB – A (Electronics)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. Seven Segment Display.
2. BCD to Hexadecimal Converter.
3. UP Down Counter.
4. RS,JK,T,D, flip flop
5. Master Slave fillip flop.
6. Hexadecimal to binary encoder.
7. Encoder Decoder(decimal to binary)
8. Half adder and full adder (IC7483)
9. A to D converter.
10. Study of binary to decimal decoder.
11. Design and study 4 bit binary ripple counter.
12. Study of decimal to octal converter.
13. 4 bit binary full adder.
14. Decimal to octal and decimal to binary converter using Digital Lab Trainer Kit.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

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Class	M. Sc	Semester - III
Subject	Physics	
Title of Practical	LAB – B (General)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. To study divergence of LASER beam.
2. To find refractive index of a liquid using LASER source.
3. To find wavelength of LASER.
4. To study frequency response of negative feedback amplifier.
5. To study effect of feedback network on gain of feedback amplifier.
6. To find Rydberg Constant by Hydrogen Discharge Tube.
7. To Study differential comparator.
8. To study ‘Push Pull Amplifier’.
9. To analyse elliptically polarized light by Babinet’s compensator.
10. Use of Michelson Interferometer.
11. To study emitter follower.
12. To study Colpitt’s Oscillator.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER IV

Paper I (Condensed matter physics -II)	The objective of this paper will give students fare idea of concept of super conductivity, types of super conductor's theory, and AC and DC effects. ➢ The student will have the understanding of Weiss theory of Ferromagnetisms, Domain and Bloch wall energy. ➢ The student will able to understand Curie Weiss Law Ferri and Anti Ferrimagnetism. ➢ The student will able to learn about Basic physics behind Nano material and used. ➢ Different technique for synthesis and characterization of Nano Material and tube. ➢ The student will able to gain the knowledge of basic principles of material science in thin film technology and used various techniques to synthesis thin films of desired characteristics and various properties like electrical conductivity and hall coefficient quantum size effect in thin films.

Sarojini Naidu Govt. Girls P. G. Autonomous College, Shivaji Nagar, Bhopal

Session –2021-22

Class / d{kk **% M.Sc.**
Semester / lsesLVj **% IV**
Subject / fo"k; **% Physics**
Title of Subject Group **% Condensed Matter Physics-II**
fo"k; lewg dk 'kh"kZd **%**
Paper No. / iz'ui= dzekad **% I**
Compulsory / vfuok;Z ;k Optional / oSdfYid vfuok;Z **% Compulsory**
Max. Marks vf/kdre vad 100 **% CCE : 30, Main Exam : 70 Total - 100**

Particulars / fooj.k

Unit-1	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-2	Magnetism: Weiss theory of ferromagnetic, Heisenberg model and molecular field theory, Domain and Bloch wall energy, Spin waves and magnons, Curie Weiss law for susceptibility, Ferri and anti ferrimagnetism.
Unit-3	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-4	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.
Unit-5	Nano structure: Definition and properties of nano structured material, different method of preparation of nano materials, plasma enchanted chemical vapour deposition, electro deposition. structure of single wall carbon nono tubes (classification, chiral vector Cn, Translational vector T, Symmetry vector R, Unit Cell, Brillouin Zone) Electronic, mechanical, thermal and phonon properties.

Suggested Readings:

1. Kittel: Solid State Physics
2. Huang: Theoretical Solid State Physics
3. Weertmon and Weertman: Elementary Dislocation theory
4. Thomes: Multiple Electron microscopy
5. Tolansky: Multiple Beam Interferometer

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER IV

Paper II (Laser Physics)	The objective is to provide an understanding of various concepts of Laser Physics. ➢ Student will be able to analyze the intensity variation of light using laser. ➢ Student will be able to explain working principles knowledge and conceptual understanding in Laser Physics. ➢ Students approach an ability to analyze quantitatively and to design such Lasers. ➢ Student comes to know basic idea about non liner optics.

Sarojini Naidu Govt. Girls P. G. Autonomous College, Shivaji Nagar, Bhopal
Session –2021-22

Class / d{kk % **M.Sc.**
Semester / lsesLVj % **IV**
Subject / fo"k; % **Physics**
Title of Subject Group % **Laser Physics**
fo"k; lewg dk 'kh"kZd %
Paper No. / iz'ui= dzekad % **II**
Compulsory / vfuok;Z ;k Optional / oSdfYid vfuok;Z % **Compulsory**
Max. Marks vf/kdre vad 100 % **CCE : 30, Main Exam : 70 Total - 100**

Particulars / fooj.k

Unit-1	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-2	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-3	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 HCI and HF lasers.
Unit-4	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 welding, Hole drilling, laser cutting, application of lasers in medicine.
Unit-5	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.

Suggested Readings:

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

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER IV

Paper III (Computer Programming and Informatics)	The objective is to demonstrate an understanding of computer programming language concepts. ➢ Students will able to develop basic understanding of computers the concept of algorithm and logical thinking. ➢ Students will develop ability to design Computer programs, analyze and interpret the concept of variable declarations, Initialization, operations and their usage and able to use the concept of array of structures. ➢ Students will be able to build an understanding of the fundamental concepts of computer networking and familiarize with the basic taxonomy and terminology of the computer networking area. ➢ Students will be able to use knowledge of HTML and HTML editor to create websites for current professional and industry standards and use critical thinking skills to design and create websites.

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Session –2021-22

Class / d{kk **% M.Sc.**
Semester / lsesLVj **% IV**
Subject / fo"k; **% Physics**
Title of Subject Group **% Computer Programming and Informatics**
fo"k; lewg dk 'kh"kZd **%**
Paper No. / iz'ui= dzekad **% III**
Compulsory / vfuok;Z ;k Optional / oSdfYid vfuok;Z **% Compulsory**
Max. Marks vf/kdre vad 100 **% CCE : 30, Main Exam : 70 Total - 100**

Particulars / fooj.k

Unit-1	Conceptual framework of computer languages (Algorithm, Flowcharts) Need of structured programming, Top-down, bottom-up and modular programming design. Introduction to C languages-basic structure of C programme. Character set, keyword and identifiers, C data types, variable and data type declaration. Various operators like arithmetic, relational, logical assignment, conditional, increment and decrement operators. Evaluation of expression and operator precedence.
Unit-2	Input and output statement, control statement (If, If-else, If nested If-else statements switch, while, Do... while and for statements) Simple C programmes like search of prime number between given range of numbers, finding the smallest and largest of three numbers, sume of algebraic series, factorial of given number, roots of a quadratic equation, binary of decimal and decimal to binary conversion etc.
Unit-3	Functions: need of functions, calling the function by value and by reference, category of functions: no argument no return, argument but not return, argument with return. Recursion. One and two dimensional arrays. String and string handling functions like sprinf (), strepy (), sscanf (), strlen(), sizeorf () strcmp ()etc. Simple programs using user define functions, arrays and string functions.
Unit-4	Network: Terminals-Dumb terminals, smart terminals, intelligent tgerminals. Types of network: • According to range: LAN,MAN,WAN, Client server • According to topologies: BUS, RING, STAR, Mesh Network. Internet: History of Internet Service Provider (ISP), introduction to type of internet account-shell/Ac, TCP/IP A/c. types of connectivity-Dialup, Leased lines, Satellite. IP Address-Class A, Class B, Class C Domain Name address. URL-absolute and relative
Unit-5	Web enabled technology (Email and HTML): Web Browser: Internet Explorer, Netscape Navigator, Station and Dynamic web page Introduction to HTML. HTML tags: • <HTML>, <TITLE>, <HEAD>, <BODY>

	• <P>, , (ALIGN>, <I>, <B>, <DIV>, <PRE>, and their attributers • <IMG> <a> and their attributes • Ordered and unordered list tages • Tabes and associated tags and its properties Creation of simple forms using text, Password, text area, radio, submit, Rest and Hidden. Brief idea about HTTP. Search engine, its working, types of search engines: sub directories meta search engines, search function-AND and OR. Population search engines.

Suggested Readings:

1. Let us C : Yashwat Kanetkar
2. Programming with C : Balaguruswami
3. Internet and Web Page : V. K Jain
   'O' level module M1.2
4. Internet and Web Page design: Dr. P.D Murarka
   'O' level module M1.2
5. Internet and web page design : Pearl Software
   'O' level module M1.2
6. C# 2008 in simple step
   Dreamtech press
7. C# 2008 programming block book
   Dreamtech press

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER IV

Paper IV (Digital Electronics)

The objective of this elective paper comprising OP-AMP and Microprocessor specializes the student in Digital Electronics.

- Students will be able to understand integrated components of OP-AMP design and packaging of IC 741 understand various modes of OP-AMP and its linear/ Non Linear applications.
- Students will be able to understand and analyze IC 741 operational amplifier and its characteristics.
- Students will be able to design and understand various linear and nonlinear application of OP-AMP using IC 741.
- Students will be able to elucidate and design the active filter and oscillator.
- Students will be able to understand Microprocessor 8086-architecture and addressing modes and simple assembly language programming.

Sarojini Naidu Govt. Girls P. G. Autonomous College, Shivaji Nagar, Bhopal
Session –2021-22

Class / d{kk **% M.Sc.**
Semester / lsesLVj **% IV**
Subject / fo"k; **% Physics**
Title of Subject Group **% Digital Electronics**
fo"k; lewg dk 'kh"kZd **%**
Paper No. / iz'ui= dzekad **% IV-E**
Compulsory / vfuok;Z ;k Optional / oSdfYid vfuok;Z **% Optional**
Max. Marks vf/kdre vad 100 **% CCE : 30, Main Exam : 70 Total - 100**

Particulars / fooj.k

Unit-1	**OP-AMP:-** Differential amplifier circuit configurations: dual input balanced output ,dual input, single input unbalanced output (ac analysis) only, block diagram of a typical op amp analysis, schematic symbol of an op-amp. IC 555 timer Introduction, Architecture, Application as astable and monostable multivibraters.
Unit-2	**OP-AMP Parameters:-** Ideal op-amp parameters; input offset voltage, input offset current, input bias current, CMRR, SVRR, large signal voltage gain, Slew rate, Gain band width product, output resistance, supply currents power consumption, inverting and non-inverting inputs.
Unit-3	**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, L-C tunable oscillator, square wave generator.
Unit-4	**Microprocessors and Micro Computers:** Microprocessor and Architecture: Intel 8086, Microprocessor architecture modes of memory addressing, 8086/8088 Hardware specification: Pin-outs and pin functions, clock generator (8284A) Bus buffering and latching, Bus timing, Ready and wait State, Minimum mode versus maximum mode.
Unit-5	**Programming the Microprocessors:** Addressing modes: Data addressing modes, program memory addressing modes, stack memory-addressing modes. Instruction set: data movement Instructions, Arithmetic and login instructions, program control instructions. Programming example: Simple Assembly language programs table handling direct table addressing, searching a table sorting a table using pseudo ops.

Suggested Readings :

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

COURSE LEARNING OUTCOME

PAPER IV - B (Material science)

By the end of this course the student will be able

1. To know the different classes of materials and would be able to choose the right materials for specific applications.
2. To understand and appreciate the significance of the composites as an important class of materials.
3. They will be able to know different kind of polymers and their properties, variation of properties of polymer by crystallinity and glass transition temperature.
4. To define phase transitions and phase transition temperatures and will be able to explain the relation between phase transition temperatures and intermolecular attractive forces.

5. To give information about phase diagrams.
6. To Explain the limit where a deformation of material is elastic.
7. To analyse elasticity and plasticity on a stress-strain diagram and to explain elastic constants.
8. To understand the electrical conductivity in metals, transport properties and electrical properties of materials according to material type, structure and physical properties.

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SHIVAJI NAGAR,BHOPAL
AS RECOMMENDED BY THE BOARD OF STUDIES
SESSION: 2021-22

THEORY

Class (d{kk)	M. Sc.	
Semester (lsesLVj)	**IV**	
Subject (fo"k;)	**PHYSICS**	
Paper No. (iz'ui= Øekad)	**IV - B**	
Title of the paper (iz'ui= dk 'kh"kZd)	**MATERIAL SCIENCE**	
Compulsory/ optional (vfuok;Z@oSdfYid)	**optional**@oSdfYid	
Marks in CCE: 30	**Marks in main Exam: 70**	**Max. Marks: 100**

Unit	**Syllabus**

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 Inelastic Behaviour:- Atomic models for elastic behavior, Elastic deformation in single crystals, Elastic anisotropy, Elastic constant and elastic module (Cubic system, isotropic body), Rubber like elasticity, anelasticbehaviour, 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.

COURSE LEARNING OUTCOMES
M. Sc. Physics
SEMESTER IV

Paper IV D (Communication Electronics)

On successful completion of the course students will be able to

* **Understand basic element of communication system**

* **conduct analysis of base band signals in time domain and frequency domain**

* **Demonstrate understanding of various analog and digital modulation and demodulation techniques**

* **Analyse the preformance of modulation & demodulation technique in various transmission environment**

* **Appreciate importance synchronisation in communication systems.**

* **Equip the students with theory of waveguides, transmission lines, microwave components, microwave devices.**

* **Able to learn the dynamics of satellite understand communication satellite design and understand how analog and digital technique are used for satellite communication network.**

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SHIVAJI NAGAR,BHOPAL
AS RECOMMENDED BY THE BOARD OF STUDIES
SESSION: 2021-22

THEORY

Class (d{kk)	M.Sc.
Semester (lsesLVj)	**IV**
Subject (fo"k;)	**PHYSICS**
Paper No. (iz’ui= Øekad)	**IV - D**

Title of the paper (iz'ui= dk 'kh"kZd)	**COMMUNICATION ELECTRONICS**	
Compulsory/ optional (vfuok;Z@oSdfYid)	**optional**@oSdfYid	
Marks in CCE: 30	**Marks in main Exam: 70**	**Max. Marks: 100**

Unit	Syllabus
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 Microwaves: K.C. Gupta
3. Microwave Devices & Circuits: S.Y. Lio
4. Principle of Communication system: Taub&Schiling

As Recommended by the Board of Studies
Session – 2021-22
Practical

Class	M. Sc	Semester - IV
Subject	Physics	
Title of Practical	Lab- A (Programing in C and HTML)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments
1. C Programme for simple arithemetic operation. 2. C programme for calculation 3. C programme for finding factorial of a given number using a using defind function. 4. C programme for addition of 2 or 3 matrices. 5. C programme for selecting a prime number from 1 to 100. 6. Least square fitting. 7. To find the root of a quadratic equation. 8. To find product of two matrices. 9. To evaluate sum of finite series and the area under a curve. 10. To print all natural even/odd numbers between given limits. 11. HTML programme for making a web page using various headers and <B>, <T> and <U> tag. 12. HTML programme using ordered and un ordered list. 13. HTML programme for inserting image and table. 14. HTML Programme for preparing 3 linked web pages. 15. HTML Programme for making a web page using a Marquee, Animation and sound file. • **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

As Recommended by the Board of Studies
Session – 2021-22
Practical

Class	M. Sc	Semester - IV
Subject	Physics	
Title of Practical	Lab- B (QP. Amp., IC – 555 and Microprocessor)	

Medium of Instruction /Teaching	English
Maximum Marks	100

List of Experiments

1. To study QP. Amp. as and adder and sub tractor.
2. To studyQP. Amp. as inverting and non-inverting amplifier.
3. To study QP. Amp. as differentiator.
4. To study QP. Amp. as integrator.
5. To study QP. Amp.as Schmith Trigger.
6. To study QP. Amp. as squire wave generator.
7. To study QP. Amp.as low pass filter.
8. To study QP. Amp. as high pass filter.
9. To study QP. Amp. as band pass filter.
10. To study QP. Amp.as voltage follower
11. To study IC-555 as table multivibrator.
12. To studyIC-555 as bisable multivibrator.
13. To studyIC-555 as monostable multivibrator.
14. To studyIC-555timer as frequency divider.
15. To studyIC-555 as Schmitt Trigger.
16. To write programme to find the largest number.
17. To arrange numbers in ascending and descending order using 8086 microprocessor.
18. To write a programme in assembly language of INTEL 8086 processor for simple arithmetic operations.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

Department of Higher Education, Government of Madhya Pradesh
Under Graduate (UG) Annual Syllabus as Recommended by Central Board of Studies and Approved by Governor of M.P.
(w.e.f. session **2021-2022**)

उच्च शिक्षा विभाग, मध्यप्रदेशशासन
स्नातक कक्षाओं के लिए वार्षिक पाठ्यक्रम केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा मध्यप्रदेश के राज्यपाल द्वारा अनुमोदित
(शैक्षणिक सत्र 2021-2022 से लागू)

Class: B.Sc. Third Year
Max. Marks: 40 + (CCE) 10 = 50

Subject	: **Physics**
Paper	: **First**
Title of Paper	: **Quantum Mechanics and Spectroscopy**

Unit-I: Quantum Mechanics-1 [15 Lectures]

Particles and Waves: Photoelectric effect. Black body radiation. Planck's radiation law, Stefan Boltzmann law, Wien's displacement law and Rayleigh-Jean's law. Compton effect. De Broglie hypothesis. Wave particle duality. Davisson-Germer experiment. Wave packets. Concept of phase and group velocity. Two slit experiment with electrons. Probability. Wave amplitude and wave functions. Heisenberg's uncertainty principle with illustrations. Basic postulates and formalism of Schrodinger's equation. Eigenvalues. Probabilistic interpretation of wave function. Equation of continuity. Probability current density. Boundary conditions on the wave function. Normalization of wave function.

इकाई–1: क्वांटम यांत्रिकी–1 [15 Lectures]

कण एवं तरंग: प्रकाश विद्युत प्रभाव, कृष्ण पिण्ड विकिरण, प्लांक का विकिरण नियम, स्टीफन बोल्टज्मेन का नियम, वीन का विस्थापन नियम, रेले–जींस का नियम, क्राम्पटन प्रभाव, डी–ब्रोगली परिकल्पना, तरंग–कण द्वैतता, डेवीस जर्मर प्रयोग, तरंग पैकेट, तरंग व समूह वेग की अभिधारणा, इलेक्ट्रॉन का द्वि–स्लिट प्रयोग, प्रायिकता, तरंग आयाम व तरंग फलन, हाइज़नबर्ग का अनिश्चितता का सिद्धांत व उदाहरण, श्रोडिंज़र समीकरण व उसकी मूलभूत अवधारणाएँ। आइगन मान, तरंग फलन की प्रायिकता आधारित व्याख्या, सातत्य समीकरण, प्रायिकता धारा धनत्व, तरंग फलन पर सीमांत शर्तें। तरंग फलन का प्रसामान्यीकरण।

Unit-II: Quantum Mechanics-2 [15 Lectures]

Time independent Schrodinger equation: One dimensional potential well and barrier. Boundary conditions. Bound and unbound states. Reflection and transmission coefficients for a rectangular barrier in one dimension. Explanation of alpha decay. Quantum phenomenon of tunneling. Free particle in one-dimensional box, eigen functions and eigen values of a free particle. One-dimensional simple harmonic oscillator, energy eigenvalues from Hermite differential equation, wave function for ground state. Particle in a spherically symmetric potential. Rigid rotator. Particle in a three dimensional box, Angular Momentum, properties of Pauli spin matrices.

इकाई–2 क्वांटम यांत्रिकी–2 [15 Lectures]

समय अनिर्भर श्रोडिंजर समीकरण: एक–विमीय विभव कूप व प्राचीर, सीमांत शर्ते, बद्ध व अबद्ध अवस्थाएँ, आयाताकार प्राचीर (I-D) से परावर्तन व पारगमन गुणांक। α–क्षय की व्याख्या, सुरंगन की क्वाटंम घटना। एक–विमीय बाक्स में मुक्त कण, मुक्त कण हेतु आइगन फलन एवं आइगन मान। एक विमीय सरल आवर्त दौलित्र, हरमाइट अवकल समीकरण से उसके आइगन मान, मूल

(Sanjay Sahu) (Prof. RAKESH BAJPAI) (Dr A. K. Rastogi) Dr VVS Murty Dr Seema Singh

अवस्था का आइगन फलन, गोलीय सममित विभव में कण, दृढ़ धूर्णक। त्रिविमीय प्रकोष्ठ में कण,कोणीय संवेग, पॉली स्पिन मेट्रीसेस के गुण।

Unit-III: Atomic Spectroscopy [15 Lectures]

Atoms in electric and magnetic fields: Quantum numbers, Bohr model and selection rules. Stern-Gerlach experiment. Spin as an intrinsic quantum number. Incompatibility of spin with classical ideas. Orbital angular momentum. Fine structure. Total angular momentum. Pauli exclusion principle. Many particles in one dimensional box. Symmetric and anti-symmetric wave functions. Atomic shell model. Spectral notations for atomic states. Spin-orbit coupling, **L-S** and **J-J** coupling. Zeeman effect. Continuous and characteristic X-rays. Mossley's law.

इकाई–3 **परमाणु स्पेक्ट्रोस्कोपी** **[15 Lectures]**

विद्युतीय व चुम्बकीय क्षेत्र में परमाणु – क्वांटम संख्यांक, बोहर मॉडल व वरण (Selection) के नियम, स्टर्न–गर्लक प्रयोग, चक्रण – मूलभूत (Intrinsic) क्वांटम संख्या। चक्रण की चिरसम्मत सिद्धांत से असंगति। कक्षीय कोणीय संवेग, फाइन स्ट्रेक्चर कुल कोणीय संवेग, पाऊली का अपर्वजन सिद्धांत। एक विमीय बाक्स में बहुलकण–सममिती व असममिती तरंग फलन, परमाणु कोश मॉडल। परमाण्वीय अवस्था हेतु स्पेक्ट्रमी संकेतन, स्पिन आरबिट कपलिंग, L-S व J-J युग्मन, ज़ीमन प्रभाव। सतत व अभिलाक्षणिक X-किरण स्पेक्ट्रा, मोसले का नियम।

Unit-IV: Molecular Spectroscopy [15 Lectures]

Various types of spectra. Rotational spectra. Intensity of spectral lines and determination of bond distance of diatomic molecules. Isotope effect. Vibrational energies of diatomic molecules. Zero point energy. Anharmonicity. Morse potential. Raman effect, Stokes and anti-Stokes lines and their intensity difference. Electronic spectra. Born-Oppenheimer approximation. Frank-Condon principle, singlet and triplet states. Fluorescence and phosphorescence. Introduction to Laser Raman spectroscopy. Elementary concept and applications of NMR and EPR.

इकाई–4 **आणविक स्पेक्ट्रोस्कोपी** **[15 Lectures]**

विभिन्न प्रकार के स्पेक्ट्रा (वर्णक्रम), धूर्णी स्पेक्ट्रा, वर्णक्रम रेखाओं की तीव्रता व द्वि–परमाणविक अणु की बद्ध दूरी, समस्थानिक प्रभाव/द्वि–परमाणविक अणु की कम्पन उर्जा, शून्य बिन्दु उर्जा, अनहार्मोनिसीटी (अनावृति)। मोर्स विभव, रमन प्रभाव। स्टोक व प्रति स्टोक रेखाएँ व इनकी तीव्रता, इलेक्ट्रॉनिक वर्णक्रम। बार्न ऑपनहायमर सन्निकटता, फ्रेंक कार्डन सिद्धांत, एकल व त्रिक अवस्थाएँ, प्रतिदीप्ति व स्फुरदीप्ति। लेसर रमन स्पेक्ट्रोस्कोपी की प्रस्तावना, NMR तथा EPR की प्रारम्भिक अवधारणा एवं अनुप्रयोग।

(Dr A.K. Rastogi)

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Unit-V: Nuclear Physics and Elementary Particles
[15 Lectures]

Basic properties of nucleus: Shape, Size, Mass and Charge of the nucleus. Stability of the nucleus and Binding energy. Alpha particle spectra – velocity and energy of alpha particles. Geiger-Nuttal law. Nature of beta ray spectra. The neutrino and its physics. Energy levels and decay schemes. Positron emission and electron capture. Selection rules. Beta absorption and range of beta particles. Kurie plot. Nuclear reactions, pair production. Q-values and threshold of nuclear reactions. Nuclear reaction cross-sections. Examples of different types of reactions and their characteristics. Compound nucleus, Bohr's postulate of compound nuclear reaction, Semi empirical mass formula, Shell model, Liquid drop model, Nuclear fission and fusion (concepts). Classification of elementary particles and their interactions; Conservation laws; Quark Structure of hadrons; Elementary ideas about unification of forces.

इकाई–5 नाभिकीय भौतिकी एवं मूल कण [15 Lectures]

नाभिक के मूलभूत गुणः न्युट्रॉन तथा आवेशित कणों की द्रव्य के साथ अनुक्रिया, नाभिकीय संसूचक–आयनन कोष्ठ, गाइगर मूलर गणक, अनुपातिक गणक, प्रस्फुरण गणक, अभ्रकोष्ठ, नाभिक के मूल गुण, नाभिक की आकृति, संहति, आवेश तथा आकार, नाभिक का स्थायित्व एवं बंधन ऊर्जा, अल्फा–कण का वेग एवं ऊर्जा, गाइगर–नेटल नियम, बीटा–किरण वर्णक्रम की प्रकृति, न्यूट्रीनों एवं उसकी भौतिकी, ऊर्जा स्तर एवं क्षय पद्धति, पोजीट्रान उत्सर्जन एवं इलेक्ट्रॉन प्रग्रहण, चयन (वरण) नियम, बीटा अवशोषण एवं बीटा कण का परास, क्यूरी आरेख, नाभिकीय अभिक्रियाएँ, युग्म उत्पादन, Q-मान एवं नाभिकीय अभिक्रिया की देहली, नाभिकीय अभिक्रिया का अनुप्रस्थ काट, विभिन्न प्रकार की अभिक्रियाओं के उदाहरण एवं अभिलाक्षणिक, यौगिक नाभिक, यौगिक नाभिकीय अभिक्रिया की बोहर अभिकल्पना, अर्धमूलानुपाती सूत्र, द्रव बूंद मॉडल, कोश मॉडल, नाभिकीय विखंडन एवं संलयन। मूल कणों का वर्गीकरण एवं उनकी अन्योय क्रियायें, संरक्षण नियम, हेड्रोन की क्वार्ड संरचना, बलों के एकीकरण की प्रारम्भिक अवधारणा।

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(Sanjay Sathe) (Rakesh Bajpai) 3-6-19 (Dr A.K Rastogi) Dr VVS Murty Dr Seema

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Subject	: **Physics**
Paper	: **Second**
Title of Paper	: **Solid State Physics & Electronic Devices**

Unit-I: Solid state Physics-1 **[15 Lectures]**

Crystal Structure and bonding: Crystalline and amorphous solids. Translational symmetry. Lattice and basis. Unit cell. Reciprocal lattice. Fundamental types of lattices (Bravias Lattice). Miller indices Lattice planes. Simple cubic. Face centered cubic. Body centered cubic lattices. Laue and Bragg's equations. Determination of crystal structure with X-rays, X-ray spectrometer. Ionic, covalent, metallic, van der Waals and hydrogen bonding. Band theory of solids. Periodic potential and Bloch theorem. Kronig-Penny model (Qualitative).

इकाई–1: ठोस अवस्था भौतिकी–1 **[15 Lectures]**

क्रिस्टलीय, संरचना एवं आबंधनः क्रिस्टलीय व अक्रिस्टलीय ठोस, स्थानांतरण सममिति, जालक व आधार, इकाई सेल, व्युत्क्रम जालक, जालकों के मौलिक प्रकार (ब्रेवाइस लेटिस), मिलर सूचकांक, जालक तल। सरल घनाकार, फलक केन्द्रित घनाकार, अन्तः केन्द्रित घनाकार लेटिसेस। लॉवे व ब्रेग का समीकरण, X-किरणों से क्रिस्टल की संरचना ज्ञात करना, X-किरण स्पेक्ट्रममापी। आयनिक, सह–संयोजक, धात्विक वॉण्डरवाल एवं हायड्रोजन बंधन। ठोस पदार्थो के लिए बैण्ड सिद्धांत, आवर्ती विभव एवं ब्लॉच प्रमेय। क्रोनिंग–पैनी मॉडल (गुणात्मक विवेचना)।

Unit-II: Solid state Physics-2 **[15 Lectures]**

Lattice structure and properties: Dulong Petit, Einstein and Debye theories of specific heats of solids. Elastic and atomic force constants. Dynamics of a chain of similar atoms and chain of two types of atoms. Optical and acoustic modes. Electrical resistivity. Specific heat of electron. Wiedemann-Franz law. Hall effect. Response of substances in magnetic field, dia-, para- and ferromagnetic materials. Classical Langevin theory of dia and paramagnetic domains. Curie's law. Weiss' theory of ferromagnetism and ferromagnetic domains. Discussion of BH hysteresis. Super conductivity, Meissner's effect, Josephson junction effect and high temperature superconductivity.

इकाई–2: **ठोस अवस्था भौतिकी–2** **[15 Lectures]**

विशिष्ट उष्मा का ड्यूलोंग–पेटिट, आइन्सटीन व डिबाई सिद्धांत, प्रत्यास्थ एवं परमाण्विक बल नियतांक। एक परमाण्विक व द्विपरमाण्विक कड़ी (Chain) का गतिक समीकरण, प्रकाशीय व ध्वनिकी विधाएँ, विद्युतीय प्रतिरोधकता, इलेक्ट्रॉन की विशिष्ट उष्मा, वाइडमेन–फ्रेंज नियम। हॉल प्रभाव, चुम्बकीय क्षेत्र में पदार्थों की अनुक्रिया। प्रति, अनु एवं लौह चुम्बकीय पदार्थ। प्रति एवं अनु चुम्बकीय डोमेन्स का चिरसम्मत सिद्धांत। क्यूरी का नियम, लौह चुम्बकत्व एवं लौह चुम्बकीय डोमेन्स के लिए Weiss का सिद्धांत। B-H शैथिल्यता की विवेचना। अति चालकता, मेसनर प्रभाव, जोसेफसन–संधि प्रभाव, उच्च ताप अतिचालकता।

(Sanjay Saxena) (Dr. V.V.S. Murty)
(Prof. Rakesh Bajpai) Dr. Seema Singh

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Unit-III: Semiconductor devices-1 [15 Lectures]

Electronic devices: Types of Semiconductors (**p** and **n**). Formation of Energy Bands, Energy level diagram. Conductivity and mobility. Junction formation, Barrier formation in **p-n** junction diode. Current flow mechanism in forward and reverse biased diode (recombination), drift and saturation of drift velocity. Derivation of mathematical equations for barrier potential, barrier width. Single **p-n** junction device (physical explanation, current voltage characteristics and one or two applications). Two terminal devices. Rectification. Zener diode. Photo diode. Light emitting diode. Solar cell. Three terminal devices. Junction field effect transistor (JFET). Two junction devices. Transistors as **p-n-p** and **n-p-n**. Physical mechanism of current flow. Characteristics of transistor.

इकाई–3: **अर्धचालक युक्तियां–1** **[15 Lectures]**

ऊर्जा बैण्डों का बनना, ऊर्जा स्तर का डायग्राम, अर्धचालक के प्रकार (p व n), चालकता और गतिशीलता, संधि का बनना, p-n संधि, डायोड में रोधिका विभव का बनना, अग्र व पश्च अभिनति डायोड में धारा प्रवाह (पुनः संयोजन), अनुगमन वेग व अनुगमन वेग की संतृप्तता, रोधिका विभव के गणितीय समीकरण की व्युत्पत्ति, रोधिका चौड़ाई, एकल p-n संधि। डायोड (भौतिकीय विवेचना), धारा–विभव अभिलाक्षणिक (एक–दो अनुप्रयोग), द्वि–टर्मीनल युक्ति, दिष्टकरण, जेनर डायोड, फोटो डायोड, प्रकाश उत्सर्जक डायोड, सोलर सेल, त्रि–टर्मीनल युक्ति, संधि क्षेत्र प्रभाव ट्रांजिस्टर (JFET), द्वि–संधि युक्तियाँ, p-n-p व n-p-n ट्रांजिस्टर, धारा–प्रवाह की भौतिकीय प्रक्रिया, ट्रांजिस्टर के अभिलाक्षणिक वक्र।

Unit-IV: Semiconductor devices-2 [15 Lectures]

Amplifiers (only bipolar junction transistor). CB, CE and CC configurations. Single stage CE amplifier (biasing and stabilization circuits), Q-point, equivalent circuit, input impedance, output impedance, voltage and current gain. Class **A**, **B**, **C** amplifiers (definitions). RC coupled amplifiers (frequency response). Class **B** push-pull amplifier. Feedback amplifiers. Voltage feedback and current feedback. Effect of negative voltage series feedback on input impedance. Output impedance and gain. Stability, distortion and noise. Principle of an Oscillator, Barkhausen criterion, Colpitts, RC phase shift oscillators. Basic concepts of amplitude, frequency and phase modulations and demodulation.

Digital Electronics : Boolean Identities, De-Morgan's law, Logic gate and truth tables; simple logics Circuits; Thermistors , solar cells. Concepts of Microprocessors and digital computer.

इकाई–4: अर्धचालक युक्तियां–2 **[15 Lectures]**

प्रवर्धक (द्वि–ध्रुव संधि ट्रांजिस्टर) CB, CE व CC विधा, एकल स्टेज (चरण) CE प्रवर्धक (अभिनन व स्थायीकरण परिपथ), Q बिन्दु समतुल्य परिपथ, निवेशी व निर्गत प्रतिबाधा, विभव एवं धारा लाभ। वर्ग A, B, C प्रवर्धक (परिभाषा), RC युग्मित प्रवर्धक (आवृत्ति अनुक्रिया वक्र), वर्ग–B पुश–पुल प्रवर्धक, पुर्ननिवेशन प्रवर्धक, विभव एवं धारा, पुर्ननिवेशन, निवेशी प्रतिबाधा पर ऋणात्मक विभव, श्रेणी फीडबेक, निर्गमन प्रतिबाधा एवं लाभ।

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(Sanjay Sobti)

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स्थायित्व, विकृति व शोर, दोलित्र का सिद्धांत तथा बार्क–हाउसन का प्रतिबन्ध, कॉलपिट दोलित्र, RC कला विस्थापी दौलित्र, आयाम, आवृति एवं कला माडुलेशन एवं संसूचक की मूल अवधारणा।

डिजिटल इलेक्ट्रानिक्सः बूलियन सर्वसमिकायें, डि मार्गन नियम, लॉजिक गेट्स एवं सत्य सारिणी, सरल लॉजिक परिपथ, थरमिस्टर्स, सोलर सेल, माईक्रोप्रोसर की अवधारण एवं डिजिटल गणक।

Unit-V: Nano materials **[15 Lectures]**

Nanostructures: Introduction to nanotechnology, structure and size dependent properties. 3D, 2D, 1D, 0D nanostructure materials and their density of states, Surface and Interface effects. Modelling of quantum size effect. Synthesis of nanoparticles - Bottom Up and Top Down approach, Wet Chemical Method. Nanolithography. Metal and Semiconducting nanomaterials. Essential differences in structural and properties of bulk and nano materials (qualitative description). Naturally occurring nano crystals. Applications of nanomaterials.

इकाई–5: नैनो पदार्थ **[15 Lectures]**

नैनों संरचनाएंः नैनो टेक्नॉलाजी की प्रस्तावना, संरचना, आकार निर्भर गुण। 3D, 2D, 1D, 0D नैनो सरंचना प्रदार्थ एवं उनकी अवस्थाओं का घनत्व, सतह एवं अंतराफलक प्रभाव, क्वांटम आकार प्रभाव का प्रतिरूपण, नैनो कणों का संश्लेषण–नीचे से ऊपर (बॉटम अप) और ऊपर से नीचे (टॉप डाउन) विधियॉं, वेट रसायनिक विधि, नैनो लिथोग्राफी (नैनो मुद्रण), धातु एवं अर्द्ध चालकों के नैनो पदार्थ (गुणात्मक विवरण), विस्तृत (Bulk) और नैनो पदार्थों की संरचना एवं गुणों में अन्तर (गुणात्मक विवरण), प्राकृतिक रूप में पाये जाने वाले नैनो क्रिस्टल। नैनो पदार्थों के अनुप्रयोग।

References:

1. **Introduction to Solid State Physics**, C. Kittel, VIII[th] Edition, John Wiley and Sons, New York, 2005.
2. **Intermediate Quantum theory of Crystalline Solids**, A. O. E. Animalu, Prentice–Hall of India private Limited, New Delhi 1977
3. **Solid State Electronic devices**, B. G. Streetman, II Edition Prentice Hall, India.
4. **Microelectronics**, J. Millman and A. Grabel McGraw Hill New York
5. **The Physics and Chemistry of Nanosolids**: Frank J. Owens, and Charles P. Poole Jr., Wiley Inter Science, 2008
6. **Physics of Low Dimensional Semiconductors**: An introduction; J.H. Davies, Cambridge University Press, U.K., 1998
7. **Electronic fundamentals and applications**, J. D. Ryder, Prentice Hall, India.

(Sanjay Sahu) Rakesh Bajpai 3.6.21 Dr Seema Singh

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उच्च शिक्षा विभाग, मध्यप्रदेशशासन
स्नातक कक्षाओं के लिए पाठ्यक्रम केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा मध्यप्रदेश के राज्यपाल द्वारा अनुमोदित
(शैक्षणिक सत्र 2021-2022 से लागू)

Class: B.Sc. Third Year
Max. Marks: 50

Subject : **Physics**

For Regular Students

Practical	Sessional	Viva	Total
25	10	15	50

For Ex–Student

Practical	Sessional	Viva	Total
35	00	15	50

List of Practical's

1. Specific resistance and energy gap of a semiconductor.
2. Study of half wave and full wave rectification.
3. Characteristics of Zener diode.
4. Characteristic of a tunnel diode.
5. Characteristics of JFET.
6. Characteristic of a transistor.
7. Study of regulated power supply.
8. Study of RC coupled amplifiers
9. Determination of Planck's constant.
10. Determination of **e**/m using Thomson's method.
11. Determination of **e** by Millikan's method.
12. Study of spectra of hydrogen and deuterium (Rydberg constant and ratio of masses of electron to proton).
13. Absorption spectrum of iodine vapour.
14. Study of Zeeman effect for determination of Lande g-factor.
15. Study of Raman spectrum using laser as an excitation source
16. To draw B-H curve of ferro-magnetic material with the help of CRO
17. Hysteresis curve a transformer core.
18. Hall probe method for measurement of resistivity.

3.6.19 3/6/19
(Sanjay Sethi) (Dr. A.K. Rastogi)
Dr(Mrs) Seema Syl

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Under Graduate year wise syllabus
As recommended by central board of studies and approved by
The governor of M.P.
(w.e.f.session **2021-2022**)
उच्च शिक्षा विभाग, म.प्र. शासन
स्नातक कक्षाओं के लिये वार्षिक पद्धति अनुसार पाठ्यक्रम
केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के राज्पाल द्वारा अनुमोदित
सत्र **2021–2022**

B.Sc Final Year

There will be three sections of a Question Paper Section (A) Contains 5 Objective Question of 1 mark each. Section (B) contains 5 short answer type Question of 2 marks each. Section (C) contains 5 long answers of 5 marks each.

1- For Regular students :

Section (A)	Objective Questions	5	1	5
Section (B)	Short Questions	5	2	10
Section (C)	Main Questions	5	5	25
		Total Marks		40

2- For Private students :

Section (A)	Objective Questions	5	1	05
Section (B)	Short Questions	5	3	15
Section (C)	Main Questions	5	6	30
		Total Marks		50

3.6.19
Rakesh Bajpai
(Sanjay Sathe)
(Dr. A.K. Rastogi)
3/6/19
Dr(Mrs) Seema Singh
(UVS Murty)

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Class: B.Sc. First Year
Max. Marks: 40 + (CCE) 10 = 50

Subject	:	**Physics**
Paper	:	**First**
Title of Paper	:	**Mathematical Physics, Mechanics and Properties of Matter**

Unit-I: Mathematical Physics **[15 Lectures]**

Addition, subtraction and product of two vectors; Polar and axial vectors and their examples from physics; Triple and quadruple product (without geometrical applications); Scalar and vector fields; Differentiation of a vector; Repeated integral of a function of more than one variable; Unit tangent vector and unit normal vector; Gradient, Divergence and Curl; Laplacian operator; Idea of line, surface and volume integrals; Gauss', Stokes' and Green's Theorems.

इकाई–1: गणितीय भौतिकी **[15 Lectures]**

दो सदिशो का योग, अंतर व गुणनफल; ध्रुवीय एवं अक्षीय सदिश एवं उनके भौतिकी उदाहरण; तीन व चार सदिशोंका गुणन(ज्यामितीय अनुप्रयोग के बिना); अदिश व सदिश क्षेत्र; सदिश का अवकलन; एक से अधिक चरों के फलन का बारम्बार समाकलन; इकाई स्पर्श सदिश व इकाई नार्मल सदिश;सदिश का ग्रेडियन्ट, डायवर्जेंस एवं कर्ल; लाप्लासीयन आपरेटर; रेखीय, पृष्ठीय, आयतन समाकलन; गॉस, स्टोक व ग्रीन प्रमेय।

Unit-II: Mechanics **[15 Lectures]**

Position, velocity and acceleration vectors, Components of velocity and acceleration in different coordinate systems. Newton's Laws of motion and its explanation with problems, various types of forces in nature (explanation),Pseudo Forces (e.g. Centrifugal Force), Coriolis force and its applications. Motion under a central force, Derivation of Kepler's laws. Gravitational law and field, Potential due to a spherical body.Gauss & Poisson'sequation of Gravitational self-energy. System of particles, Centre of mass and reduced mass ;Rutherford scattering . Elastic and inelastic collisions.

इकाई–2: यांत्रिकी **[15 Lectures]**

स्थिति, वेग एवं त्वरण सदिश, गति व त्वरण के विभिन्न निंदेशांक पद्वतियों में घटक। न्यूटन के गति के नियम व इसकी व्याख्या; प्रकृति में विभिन्न बल व व्याख्या, छद्म बल(उदाहरण: अभिकेंद्रीय बल)कोरियालिस बल व इसके उदाहरण; केंद्रीय बल के अर्न्तगत गति, केप्लर के नियमों की निष्पति; गुरूत्वाकर्षण का नियम व क्षेत्र; गोलाकर पिण्ड का गुरूत्वीय विभव; गॉस व पायसन की गुरूत्वीय स्व उर्जा की समीकरण; कणों का निकाय; द्रव्यमान केंद्र व समानीत द्रव्यमान; रदरफोर्ड प्रकीर्णन। प्रत्यास्थ व अप्रत्यास्थ टक्कर।

3/6/19 Rakesh Bajpai 3/6/19 Dr Dilip Soni (A.K. Rastogi) 3/6/19 Dr VUS Murty 3/6/19 (Sanjay Sahu) M. Singh

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Unit-III: General Properties of Matter **[15 Lectures]**

Elastic moduli and their relations, Determination of Y of rectangular thin bar loaded at the centre; Torsional oscillations, Torsional rigidity of a wire, to determine η by torsional oscillations. Surface Tension, Angle of Contact, Capillary Rise Method; Energy required to raise a liquid in capillary tube; Factors affecting surface tension; Jeager's method for Determination of surface tension; Applications of Surface Tension. Concept of Viscous Forces and Viscosity; Steady and Turbulent Flow, Reynolds's number; Equation of Continuity; Bernoulli's Principle; Application of Bernoulli's equation - (i) Speed of Efflux (ii) Venturimeter(iii) Aspirator Pump(iv) Change of plane of motion of a spinning ball.

इकाई–3: द्रव्य के सामान्य गुण **[15 Lectures]**

प्रत्यास्थता गुणांक एवं उनके संबंध, मध्य में भारितपतली आयताकार छड(केन्टीलीवर) के Y का निर्धारण; ऐठन दोलन; किसी तार की ऐंठन दृढ़ता,व इसका ऐंठन दोलन विधि से निर्धारण। पृष्ठ तनाव, स्पर्श कोण, केशिका उन्नयन विधि, केशिका में द्रव चढ़ाने में आवश्यक उर्जा, पृष्ठ तनाव को प्रभावित करने वाले कारक,जेगर की विधि से पृष्ठ तनाव का निर्धारण, पृष्ठ तनाव के अनुप्रयोग। श्यानबल की संकल्पना व श्यानता गुणांक, धारारेखीय व विक्षुब्ध प्रवाह, रेनॉल्ड संख्या, सातत्य समीकरण, बरनॉली का सिद्धांत, बरनॉली प्रमेय के अनुप्रयोग: 1. एफ्लक्स की चाल 2. वेन्चुरीमीटर 3. एस्पिरेटर पम्प 4. स्पिनिंग बॉल के तल का परिवर्तन।

Unit-IV: Oscillations **[15 Lectures]**

Concept of Simple, Periodic & Harmonic Oscillation with illustrations; Differential equation of harmonic oscillator; Kinetic and potential energy of Harmonic Oscillator; Oscillations of two masses connected by a spring; Translational and Rotational motion, Moment of Inertia and their Product, Principal moments and axes, Theorem of parallel and perpendicular axes, Motion of Rigid Body, Euler's theorem.

इकाई–4: दोलन **[15 Lectures]**

सरल, आवर्ती व हार्मोनिक गति की सचित्र संकल्पना, आवर्ती दोलित्र का समीकरण, आवर्ती दोलित्र की गतिज व स्थितिज उर्जा, स्प्रिंग से जुड़े दो पिंडों का दोलन, स्थानान्तरणीय व घूर्णीय गति, जड़त्व आघूर्ण व उनका गुणन, मुख्य आघूर्ण एवं अक्ष, समानान्तर तथा लंबवत् अक्ष प्रमेय, दृढ़ पिण्ड की गति,यूलर प्रमेय।

Unit-V: **[15 Lectures]**

Relativistic Mechanics: Michelson-Morley experiment and its outcome; Postulates of Special Theory of Relativity; Lorentz Transformations. Simultaneity and order of events; Lorentz contraction; Time dilation; Relativistic transformation of velocity, frequency and wave number; Relativistic addition of velocities; Variation of mass with velocity. Doppler effect.Four dimensional momentum vector, Covariance of equations of physics.

Seema Singh 2/6/19 (Dr S C Dubey) Rakesh Bajpai Dr. Dilipsoni Barnow Dr VVS Murty 3/6/19 (Sanjay Saxena) (Dr. A.K. Rastogi) M. Singh

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Earlier Developments in Physics up to 18th Century: Contributions of Aryabhatt, Archimedes, Nicolus Copernicus, Galileo Galilei, Huygens, Robert Hooke, Torricelli,Vernier, Pascal, Kepler, Newton, Boyle, Young, Thompson, Coulomb, Amperes, Gauss, Biot-Savarts, Cavendish, Galvani, Franklin and Bernoulli.

इकाई–5: **[15 Lectures]**

सापेक्षकीय यांत्रिकी: माइकल्सन व मोरले का प्रयोग एवं इसके निष्कर्ष, विशिष्ट सापेक्षिकता के सिद्धांत की अवधारणाएं, लॉरेंज रूपांतरण, समकालिक घटना एवं घटनाओं के क्रम, लॉरेंज संकुचन, समय विस्तारण; वेग, आवृत्ति तथा वेव नम्बर का सापेक्षकीय रूपान्तरण; वेगों का सापेक्षिकीय योग; वेग के साथ द्रव्यमान परिवर्तन। डॉपलर प्रभाव। चार आयामी संवेग सदिश, भौतिकी के समीकरणों का सहसंयोजन।

भौतिकी का प्रारंभिक विकास 18वीं सदी तक: आर्यभट्ट, आर्कमिडिज, निकोलस कोपरनिकस, गेलिलीओ गेलिली, हॉयगन, राबर्टहुक, टॉरसेली, वर्नियर, पॉस्कल, केप्लर, न्यूटन, बॉयल, यंग, थॉमसन, कुलॉम्ब, ऍम्पीयर, गॉस, बॉयो–सेवर्ट, केवनडिश, गेलवानी, फ्रेंकलीन और बरनॉली।

Reference Books:

1. University Physics: Sears and Zeemansky, XIth edition, Pearson Education
2. Concepts of Physics: H.C. Varma, Bharati Bhavan Publishers
3. Problems in Physics: P. K. Srivastava, Wiley Eastern Ltd.
4. Berkley Physics Course, Vol 1, Mechanics: E.M. Purcell, Mcgraw hill
5. Properties of Matter: D. S. Mathur, Shamlal Chritable Trust, New Delhi
6. Mechanics: D.S. Mathur, S Chand and Company, New Delhi-5.
7. The Feymman Lectures in Physics Vol. 1: R.P. Feymman, R.B. Lighton and M. Sands

3/6/19 (Dr S C Dubey) Dr VVS Murty 3/6/19 Rakesh Bajpai M. Singh

Dr(Mrs) Seema Singh Dr. Dilip Soni (Dr. A.K. Rastogi) 3/6/19 (Sanjay Sathe)

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Max. Marks: 40 + (CCE) 10 = 50

Subject	:	**Physics**
Paper	:	**Second**
Title of Paper	:	**Thermodynamics and Statistical Physics**

Unit-I: Thermodynamics-I **[15 Lectures]**

Reversible and irreversible process, Heat engines, Definition of efficiency, Carnot's ideal heat engine, Carnot's cycle, Effective way to increase efficiency, Carnot's engines and refrigerator, Coefficient of performance, Second law of thermodynamics, Various statements of Second law of thermodynamics, Carnot's theorem, Claussius Clapeyron's equation, Carnot's cycle and its applications. Steam engine, Otto engine, Petrol engine, Diesel engine.

इकाई–1: उष्मागतिकी-I **[15 Lectures]**

उत्क्रमणीय एवं अनुत्क्रमणीय प्रक्रम, कार्नो का आदर्श चक्र, इसकी दक्षता बढ़ाने के प्रभावी तरीकें, कार्नो का उष्मीय इंजन व प्रशीतक, दक्षता गुणांक, उष्मागतिकी का द्वितीय नियम व इसके विभिन्न कथन, कार्नो का प्रमेय, क्लॉउसियस क्लेपरियॉन समीकरण, कार्नोचक्र एवं उसके अनुप्रयोग। उष्मीय इंजिन, ऑटो इंजिन, पेट्रोल इंजिन, डीजल इंजिन।

Unit II: Thermodynamics-II **[15 Lectures]**

Concept of entropy, Change in entropy in adiabatic process, Change in entropy in reversible cycle. Principle of increase of entropy, Change in entropy in irreversible process. T-S diagram, Physical significance of Entropy, Entropy of a perfect gas, Kelvin's thermodynamic scale of temperature, The size of a degree, Zero of absolute scale, Identity of a perfect gas scale and absolute scale. Third law of thermodynamics, Zero point energy, Negative temperatures (not possible), Heat death of the universe. Relation between thermodynamic variables (Maxwell's relations). Adiabatic demagnetisation, Joule-Kelvin effect and Liquefaction of gases.

इकाई–2: उष्मागतिकी-II **[15 Lectures]**

एन्ट्रापी की संकल्पना, रूद्धोष्म प्रक्रम में एन्ट्रापी का परिवर्तन, चक्रीय प्रक्रम में एन्ट्रापी का परिवर्तन, एन्ट्रापी के वृद्धि का सिद्धांत, उत्क्रमणीय व अनुत्क्रमणीय प्रक्रम में एन्ट्रोपी का परिवर्तन। T-S आरेख, एन्ट्रापी का भौतिक महत्व, आदर्श गैस की एन्ट्रापी, केलविन का उष्मागतिक ताप पैमाना,परम पैमाने का शून्य ताप, आदर्श गैस व परम ताप पैमाने में साम्यता। उष्मागतिकी का तृतीय नियम, शून्य बिन्दू उर्जा, ऋणात्मक तापक्रम (सम्भव नही), ब्रहमाण्ड की उष्मीय समाप्ति। उष्मागतिकी चरों में संबंध (मेक्सवेल के समीकरण)। रूद्धोष्म विचुम्बकन, जूल कैल्विन प्रभाव तथा गैसों का द्रवीकरण।

Unit-III: Statistical Physics-I **[15 Lectures]**

Description of a system: Significance of statistical approach, Particle-states, System-states, Microstates and Macro-states of a system, Equilibrium states,Fluctuations, Classical & Statistical Probability, The equi-probability postulate, Statistical ensemble, Number of states accessible to a system, Phase space. Micro Canonical Ensemble, Canonical Ensemble,

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Helmholtz free energy, Enthalpy, First law of thermodynamics, Gibbs free energy, Grand Canonical Ensemble.

इकाई–3: सांख्यिकीय भौतिकी-I **[15 Lectures]**

निकाय का वर्णन: सांख्यिकीय अवधारणा का महत्व, कण एवं निकाय की अवस्थाऐं, निकाय की सूक्ष्म एवं स्थूल अवस्थाऐं, साम्य अवस्थाऐं, विचलन, चिरसम्मत व सांख्यिकी प्रायिकता, पूर्व प्रायिकता सिद्धान्त, सांख्यिकी एन्सेम्बल, किसी निकाय के लिये अभिगम्य अवस्थाऐं, कला आकाश। माइक्रो केनोनीकल एन्सेम्बल, केनोनीकल एन्सेम्बल, हेल्मोल्टज मुक्त उर्जा, एन्थलपी, ऊष्मागतिकी का प्रथम नियम, गिब्स मुक्त उर्जा, ग्रेंड केनोनीकल एम्सेम्बल.

Unit-IV: Statistical Physics-II **[15 Lectures]**

Statistical Mechanics: Phase space, The probability of a distribution, The most probable distribution and its narrowing with increase in number of particles, Maxwell-Boltzmann statistics, Molecular speeds, Distribution and mean, r.m.s. and most probable velocity, Constraints of accessible and inaccessible states. **Quantum Statistics:** Partition Function, Relation between Partition Function and Entropy, Bose-Einstein statistics, Black-body radiation, The Rayleigh-Jeans formula, The Planck radiation formula, Fermi-Dirac statistics, Comparison of results, Concept of Phase transitions.

इकाई–4: सांख्यिकीय भौतिकी-II **[15 Lectures]**

सांख्यिकी यांत्रिकी: कला आकाश, वितरण की प्रायिकता, अधिकतम संभाव्य वितरण व इसका कणों की संख्या बढने पर संकुचन, मेक्सवेल बोल्टजमैन सांख्यिकी, आणविक चाल का वितरण, औसत चाल, वर्ग–माध्य–मूल चाल और अधिकतम प्रसम्भाव्य वेग, प्रतिबंध, अभिगम्य एवं अनअभिगम्य अवस्थाओं के प्रतिबंध। **क्वांटम सांख्यिकी:** पार्टीशन फलन,एंट्रापी व पार्टीशन फलन में संबंध, बोस आइन्सटीन सांख्यिकी, कृष्ण पिण्ड विकिरण, रेले जीन्स सूत्र, प्लांक विकिरण सूत्र, फर्मी–डिराक सांख्यिकी, परिणामों की तुलना, फेस संक्रमण की संकल्पना।

Unit-V: Contributions of Physicists **[15 Lectures]**

S.N. Bose, M.N. Saha, Maxwell, Clausius, Boltzmann, Joule, Wien, Einstein, Planck, Bohr, Heisenberg,Fermi, Dirac, Max Born, Bardeen.

इकाई–5: भौतिकविदों का योगदान **[15 Lectures]**

एस.एन.बोस, एम.एन. साहा, मैक्सवेल, क्लासियस, बोल्टजमैन, जूल, वीन, आइन्सटीन, प्लांक, बोहर, हाईजनबर्ग, फर्मी, डिराक, मेक्सबार्न, बार्डीन।

Text and Reference Books:

1. **Heat and Thermodynamics:** Mark W. Zemansky, Richard H. Dittman, Seventh Edition, McGraw-Hill International Editions.
2. **Thermal Physics (Heat and Thermodynamics)**: A.B. Gupta, H. P. Roy, Books and Allied (P) Ltd, Calcutta.

Dr. (Ms) Samaly
(Sanjay Sethe)
3/6/19 (Dr SC Dubey)
Dr VVS Murty 3/6/19
Dr. Dilip Soni
3/6/19 Rakesh Bajpai
3/6/19 (Dr. A.K. Rastogi)
M. Singh

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3. **Heat and Thermodynamics:** Brijlal and N. Subrahmanyam, S. Chand & Company Ltd, New Delhi.
4. Berkley Physics Course, Vol 3, Thermodynamics: F. Reif, Mcgraw Hill
5. **Thermodynamics and Statistical Physics,** D. P. Khandelwal and A. K. Pandey, Himalaya Publication.
6. **Laboratory manual of Physics for undergraduate classes**, D. P. Khandelwal, Vani publishing house, New Delhi.

3/6/19
(Dr S C Dubey) Rakesh Bajpai 3/6/19 Dr VS Murty 3/6/19

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Class: B.Sc. First Year
Max. Marks: 50

Subject : **Physics**

For Regular Students

Practical	Sessional	Viva	Total
25	10	15	50

For Ex–Student

Practical	Sessional	Viva	Total
35	00	15	50

List of Practical's
1. To verify laws of parallel and perpendicular axes for moment of inertia.
2. To determine acceleration due to gravity using compound pendulum.
3. To determine damping coefficient using a bar pendulum.
4. To determine Young's Modulus by bending of beam method.
5. To determine Young's Modulus using Cantilever method.
6. To determine coefficient of rigidity by static method.
7. To determine coefficient of rigidity by dynamic method.
8. To determine Surface Tension by Jaegar's method.
9. To determine Surface Tension of a liquid by capillary rise method.
10. To determine Viscosity of fluid using Poisellie's method.
11. To study conversion of mechanical energy into heat using Calender & Barne's method.
12. To determine heating efficiency of electrical Kettle with various voltages.
13. To determine heating temperature coefficient of resistance using platinum resistance thermometer.
14. To determine thermo electromotive force by a thermocouple method.
15. To determine heating efficiency of electrical Kettle with various voltages.
16. To determine heat conductivity of bad conductors of different geometry by Lee's method.
17. To verify Newton's Laws of cooling.
18. To determine specific heat of Coefficient of thermal conductivity by Searl's method.
19. To determine specific heat of a liquid.
20. To compare Maxwell-Boltzmann, Bose Einstein and Fermi-Dirac Distribution function vs temperature using M.S. Excel / C++.
21. To plot equation of state and Vander-wall equation with temperature using M.S. Excel / C++.

Dr VVS Murty
03.5.19
Rakesh Bajpai
(A.K. Rastogi)
(Dr S C Dubey)
Dr Dilip Soni
(S. Jain)
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केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के राज्पाल द्वारा अनुमोदित
सत्र **2019–2020**

B.Sc First Year

There will be three sections of a Question Paper Section (A) Contains 5 Objective Question of 1 mark each. Section (B) contains 5 short answer type Question of 2 marks each. Section (C) contains 5 long answers of 5 marks each.

1- For Regular students :

Section (A)	Objective Questions	5	1	5
Section (B)	Short Questions	5	2	10
Section (C)	Main Questions	5	5	25
		Total Marks		40

2- For Private students :

Section (A)	Objective Questions	5	1	05
Section (B)	Short Questions	5	3	15
Section (C)	Main Questions	5	6	30
		Total Marks		50

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Class: B.Sc. Second Year
Max. Marks: 40 + (CCE) 10 = 50

Subject : **Physics**
Paper : **First**
Title of Paper : **Optics**

Unit-I Geometrical Optics & Waves [15 Lectures]

Fermat's Principle, Refraction at a spherical surface, Aplanatic points and its applications, Lens formula, Combination of thin lenses and equivalent focal length. Dispersion and dispersive power, chromatic aberration and achromatic combination, different types of aberration (qualitative) and their remedy. Need for multiple lenses in eyepieces, Ramsden and Huygens eye-piece. Simple Harmonic Motion, Damped oscillations, Forced oscillations and resonance, Beats, Stationary wave in a string; pulse and wave packets: Phase and group velocities, Reflection and Refraction from Huygen's principle.

इकाई–1 ज्यामितीय प्रकाशिकी [15 Lectures]

परावर्तन और अपवर्तन, फर्मेट का सिद्धांत, गोलाकार सतह पर अपवर्तन, अपलेनेटिक बिन्दु एवं अनुप्रयोग, लैंस सूत्र, पतले लैंसों का संयोजन व समतुल्य फोकस दूरी। विक्षेपण व विक्षेपण क्षमता, वर्ण विपथन व अवर्णक संयोजन। विभिन्न प्रकार के विपथन (गुणात्मक) एवं उनका समाधान, नेत्रिका में बहुल लैंस निकाय की आवश्यकता। रेम्सडन व हाइगन नेत्रिकाएं। सरल आर्वत गति, अवमंदित दोलन, प्रणोदित दोलन तथा अनुनाद, विस्पंदन। तनी हुई डोरी में अप्रगामी तंरगे, स्पंद तथा तंरग पैकिट, कला एवं समूह वेग, हायगन सिद्वांत द्वारा परावर्तन एवं अपवर्तन।

Unit-II Interference of light [15 Lectures]

The principle of superposition, two slit interference, coherence requirement for the sources, optical path retardations, Lateral shift of fringes. Localised fringes, thin films, interference by a film with two non-parallel reflecting surfaces, Newton's rings. Haidinger fringes (Fringes of equal inclination), Michelson interferometer, its application for precision determination of wavelength, wavelength difference and the width of spectral lines. Intensity distribution in multiple beam interference, Fabry-Perot interferometer and Etalon.

इकाई–2 प्रकाश का व्यतिकरण [15 Lectures]

अध्यारोपण का सिद्धांत, द्विस्लिट व्यतिकरण, स्त्रोतों की कला संबद्वता की आवश्यकता, प्रकाशीय पथ का मंदन, फ्रिजों का पार्श्विक विस्थापन, स्थानीकृत फ्रिंजे, पतली फिल्म, दो असमानान्तर परावर्तक सतह से बनी फिल्म से व्यतिकरण, न्यूटन वलय। हैडिन्जर फ्रिंजे (समान झुकाव की फ्रिंजे), माइकल्सन व्यतिकरणमापी, इसके द्वारा प्रकाश की तरंगदैर्ध्य (λ), दो अत्यंत समीपस्थ

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तरंगदैर्ध्य का अंतर तथा वर्णक्रम रेखा की चौड़ाई का परिशुद्ध निर्धारण। बहुल पुंज व्यतिकरण में तीव्रता का वितरण, फेब्री पैरो व्यतिकरणमापी एवं इटालॉन।

Unit-III Diffraction [15 Lectures]

Fresnel's and Fraunhofer diffraction: Half period zone, Zone plate. Diffraction at straight edge, rectilinear propagation. Diffraction at a slit, phasor diagram and integral calculus methods. Diffraction at a circular aperture. Rayleigh criterion of resolution of images. Resolving power of telescope and microscope. Diffraction at N-parallel slits, Intensity distribution, Plane diffraction grating, Resolving power of a grating.

इकाई–3 विवर्तन [15 Lectures]

फ्रेनल तथा फ्राउनहोफर विवर्तन: अर्द्धआवर्ती कटिबंध, जोन प्लेट। सीधी कोर पर विवर्तन, सरलरेखीय गमन। एकल झिरी पर विवर्तन का आरेख एवं समाकलन विधियां, वृत्तीय द्वारक पर विवर्तन, प्रतिबिम्बों के विभेदन की रैले की कसौटी। दूरदर्शी व सूक्ष्मदर्शी की विवेदन क्षमता। N समानान्तर झिरियों पर विवर्तन, तीव्रता विवरण, समतल विवर्तन ग्रेटिंग।ग्रेटिंग की विभेदन क्षमता।

Unit-IV Polarisation [15 Lectures]

Transverse nature of light waves, Polarization of electromagnetic waves, Plane polarised light – production and analysis, Description of Linear, circular and elliptical polarisation. Propagation of electro magnetic waves in anisotropic media, uniaxial and biaxial crystals, symmetric nature of dielectric tensor, Double refraction, Hygen's principle, Ordinary and extraordinary refractive indices, Fresnel's formula, light propagation in uniaxial crystal, Nicol prism, Production of circularly and elliptically polarized light, Babinet compensator and applications, Optical rotation, Optical rotation in liquids and its measurement through Polarimeter.

इकाई–4 ध्रुवण [15 Lectures]

प्रकाश तरंग की अनुप्रस्थ प्रकृति, विद्युत चुम्बकीय तरंग का ध्रुवण, समतल ध्रुवित प्रकाश – उत्पादन व विश्लेषण। रेखिक, वृत्तीय व दीर्घवृत्तीय ध्रुवण का वर्णन। विद्युत चुम्बकीय तरंग का असंमागी माध्यम में संचरण, एक–अक्षीय व द्वि–अक्षीय क्रिस्टल, परावैद्युत टेन्सर की सममित प्रकृति, द्वि–अपर्वतन, हाइगन का सिद्धांत, साधारण व असाधारण वर्तनांक, फ्रेनल का सूत्र, एक अक्षीय क्रिस्टल में प्रकाश संचरण। निकॉल प्रिज्म, वृत्तीय व दीर्घवृत्तीय प्रकाश का उत्पादन व विश्लेषण, बेबिनेट संकारक व अनुप्रयोग, प्रकाशीय धूर्णन व पोलारीमीटर से इसका मापन।

Unit-V Fibre Optics and Laser [15 Lectures]

Principle of fiber optics, attenuation: pulse dispersion and step index and parabolic index fibres. A brief history of lasers, characteristics of laser light, Einstein prediction,

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Relationship between Einstein's coefficients (qualitative discussion), Pumping schemes, Resonators, Ruby laser, He-Ne laser, Applications of lasers, Principle of Holography. Photodiodes, Phototransistors, and Photomultipliers.

इकाई–5 **फाईबर आप्टिक्स तथा लेज़र** **[15 Lectures]**

फायवर आप्टिक्स का सिंद्वात, क्षीणता, स्पंद विसरण एवं स्टेप इंडेक्स, परवलायिक इंडेक्स फायवर, लेज़र का संक्षिप्त इतिहास, लेज़र प्रकाश के अभिलाक्षणिक गुण, आइन्सटीन की संकल्पना, आइन्सटीन गुणांको में सम्बन्ध (गुणात्मक विवेचना), पम्पिंग प्रणालियाँ, रेज़ोनेटर्स, रूबी लेज़र, हीलियम–निआन लेज़र, लेज़र के उपयोग, होलोग्राफी का सिद्धांत। फोटोडायोड, फोटो ट्रांजिस्टर व फोटो मल्टीप्लायर।

References Books:

1. **Fundamentals of Optics**: F.A. Jenkins and H. E. White, 1976, McGraw-Hill.
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3. **University Physics**: F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986. Addison-Wesley.
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6. **Optics and Atomic Physics,** D. P. Khandelwal, Himalaya Publication.
7. **Lasers: Theory and Applications**: K. Thyagrajan and A. K. Ghatak.

M. Srfh- (Sanjay Sethi) Rakesh Bajpai 3.6.19 (Dr. A.K. Rastogi)

(VVS Murty) Dr Seema

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उच्च शिक्षा विभाग, मध्यप्रदेश शासन
स्नातक कक्षाओं के लिए वार्षिक पाठ्यक्रम केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा मध्यप्रदेश के राज्यपाल द्वारा अनुमोदित

(शैक्षणिक सत्र **2020–2021** से लागू)

Class: B.Sc. Second Year
Max. Marks: 40 + (CCE) 10 = 50

Subject : **Physics**
Paper : **Second**
Title of Paper : **Electrostatics, Magneto statics and Electrodynamics**

Unit-1 Electrostatics [15 Lectures]

Fundamental's of Electrostatics, Gauss's law and its application for finding **E** for symmetric charge distributions. Capacitors, conducting sphere in a uniform electric field, point charge in front of a grounded infinite conductor. Dielectrics, parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector **P**, relation between displacement vector **D**, **E** and **P**. Molecular interpretation of Claussius-Mossotti equation.

Laplace and poissson equations in electrostatics and their applications; Energy of system of charges, multiple expression of scalar potential; method of images and its application. potential and field due to a dipole, force and torque on a dipole in an external electric field.

इकाई–1 स्थिरविद्युतिकी [15 Lectures]

.स्थिर वैद्युतिकी के मूलभूत तत्व,गॉस का नियम व इसका सममित आवेश वितरण हेतु **E** के परिकलन में उपयोग। संधारित्र, समरूप विद्युत क्षेत्र में गोलकार चालक, किसी पृथ्वीकृत अनन्त चालक के सम्मुख बिन्दु पर आवेश। पराविद्युत, पराविद्युत की उपस्थिति में समानांतर प्लेट संधारित्र, परावैद्युतांक, ध्रुवण व ध्रुवण सदिश **P**, विस्थापन सदिश **D**, **P** एवं **E** में संबंध, क्लासियस–मोसाटी समीकरण की आणविक व्याख्या।

स्थिर वैद्युतिकी में लाप्लास व पाइजन के समीकरण एवं उनके अनुप्रयोग। आवेशो के निकाय की उर्जा, अदिश विभव का बहुलिक विस्तार, प्रतिबिम्बों की विधि एवं अनुप्रयोग, विद्युत् द्विध्रुव के कारण उत्पन्न क्षेत्र की तीव्रता एवं विभव, बाह्य विद्युत् क्षेत्र में विद्युत् द्विध्रुव का बल एवं बलयुग्म।

Unit-2 Magnetostatics [15 Lectures]

Force on a moving charge, Lorentz force equation and definition of **B**, force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment, angular momentum and gyromagnetic ratio, Biot and Savart's law, calculation of **H** for simple geometrical situations such as Solenoid, Anchor ring. Ampere's Law, $\nabla\times\mathbf{B} = \mu_0\mathbf{J}$, $\nabla\cdot\mathbf{B} = 0$. Field due to a magnetic dipole, free and bound currents, magnetization vector (**M**), relationship between **B**, **H** and **M**. Derivation of the relation $\nabla\times\mathbf{M} = \mathbf{J}$ for non-uniform magnetization.

VVS Murty

(S. Jain) 3.6.19 3/6/19 (Dr. A. K. Rastogi) (Sanjay Sethi) Dr. Dilip Soni Dr (Mrs) Seema Singh M. Singh

(21)

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Class: B.Sc. Second Year
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इकाई–2 स्थिर चुम्बकत्व [15 Lectures]

किसी गतिमान आवेश पर बल: लारेंज बल समीकरण एवं **B** की परिभाषा, सीधे धारावाही चालक को चुम्बकीय क्षेत्र में रखने पर बल, धारा लूप पर बल आधूर्ण, चुम्बकीय बल आधूर्ण, कोणीय संवेग व जाइरोमैग्नेटिक अनुपात, बायोट–सेवार्ट का नियम, सरल ज्यामितीय परिस्थितियों में **H** की गणना (परनलिका एवं एंकर वलय), एम्पीयर का परिपर्थीय नियम, $\nabla\times\mathbf{B} = \mu_0\mathbf{J}$ व $\nabla.\mathbf{B} = 0$, चुम्बकीय द्विध्रुव द्वारा बद्ध व मुक्त धाराएँ, चुम्बकन सदिश (**M**); **B**, **H** एवं **M** में संबंध, असमरूप से चुम्बकित पदार्थ हेतु $\nabla\times\mathbf{M} = \mathbf{J}$ का निगमन।

Unit-3 Current Electricity and Bio Electricity [15 Lectures]

Steady current, current density **J**, non-steady currents and continuity equation, Kirchoff's laws and analysis of multiloop circuits, growth and decay of current in LR and CR circuits, decay constants, LCR circuits. Mean and RMS values of A.C., AC circuits, complex numbers and their applications in solving AC circuits problems, complex impedance and reactance, series and parallel resonance. Q-factor, power consumed by an A.C. circuit, power factor, Y and Δ networks and transmission of electric power. Electricity observed in living systems, Origin of bioelectricity.

इकाई–3 विधुत धारा व बायो–धारा [15 Lectures]

स्थाई धारा, धारा घनत्व **J**, अस्थाई धारा समीकरण एवं सांतत्य समीकरण, किरचॉफ के नियम व मल्टीलूप परिपथ विश्लेषण, LR व CR परिपथ में धारा की वृद्धि व क्षय, क्षय–नियतांक, LCR परिपथ। प्रत्यावर्ती धारा का माध्य एवं वर्गमूल माध्य मान,AC परिपथ, सम्मिश्र संख्याएं और उनके अनुप्रयोग द्वारा AC परिपथ में सम्मिश्र प्रतिबाधा, रीएक्टेंस, श्रेणी एवं समानांतर अनुनाद को हल करना। Q गुणांक, AC परिपथ द्वारा शक्ति का उपयोग, शक्ति गुणांक, Y एवं Δ नेटवर्क व विद्युत शक्ति का प्रेषण। जैविक निकायों में विद्युत का अवलोकन, जैव विद्युत की उत्पति।

Unit-4 Motion of Charged Particles in Electric and Magnetic Fields [15 Lectures]

(Note: The emphasis here should be on the mechanical aspects and not on the details of the apparatus mentioned which are indicated as applications of principles involved.)

E as an accelerating field, electron gun, discharge tube, linear accelerator. **E** as deflecting field - CRO, Sensitivity of CRO. Transverse **B** field; 180° deflection, Mass spectrograph and velocity selector, Curvatures of tracks for energy determination for nuclear particles; Principle and working of Cyclotron. Mutually perpendicular and parallel **E** & **B** fields; Positive ray parabolas, Discovery of isotopes, Elements of Mass Spectrographs, Principle of magnetic focusing (lenses).

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UG
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इकाई–4 विद्युत व चुम्बकीय क्षेत्र में अविशित कणों की गति [15 Lectures]

Rakesh Bajpai 3.6.19
(Sanjay Sathe)

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(Dr. A.K. Rastogi)
3/6/19
M. Singh

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(शैक्षणिक सत्र **2020-2021** से लागू)

Class: B.Sc. Second Year
Max. Marks: 40 + (CCE) 10 = 50

(यहाँ उपकरणों के वर्णन की अपेक्षा उनके यांत्रिकीय पक्ष पर अधिक ध्यान दिया जाना चाहिए।)

त्वरण क्षेत्र के रूप में **E**, इलेक्ट्रान गन, विर्सजन नलिका, रेखीय त्वरक, **E** विक्षेपक क्षेत्र के रूप में CRO, CRO की सुग्राहिता। अनुप्रस्थ **B** क्षेत्र; 180° विचलन, द्रव्यमान स्पेक्ट्रोग्राफ या वेग सिलेक्टर, नाभिकीय कणों के संसूचन हेतु कणों के पथों की वक्रता, साइक्लोट्रॉन (उर्जा मापन) का सिद्धांत व कार्य पद्धति, समानान्तर व लम्बवत **E** व **B** क्षेत्र, धन–किरण के परवलय, आइसोटोप की खोज, द्रव्यमान स्पेक्ट्रोग्राफ के मूलतत्व, चुम्बकीय फोकस का सिद्धांत (लैंस)।

Unit-5 Electrodynamics [15 Lectures]

Electromagnetic induction, Faraday's Laws, Electromotive force, Integral and differential forms of Faraday's laws, Self and mutual inductance, Transformers, Energy in a static magnetic field, Maxwell's displacement current, Derivations of Maxwell's equations, Electromagnetic field energy density. Poynting vector, Vector and scalar protentionals; Electromagnetics field Tensors, Fresnel's relations, Rayleigh scattering. Electromagnetic wave equation, Plane electromagnetic waves in vacuum and dielectric media, Reflection at a plane boundary of dielectrics, Fresnel's Laws, Polarization by reflection and total internal reflection, Waves in a conducting medium, Reflection and refraction by the ionosphere.

इकाई–5 विद्युत गतिकी [15 Lectures]

विद्युत चुम्बकीय प्रेरण, फेराडे के नियम, विद्युत बाहक बल, फेराडे नियम के अवकलन व समाकलन रूप, स्वः व अन्योन्य प्रेरण, ट्रान्सफार्मर, स्थिर विद्युत क्षेत्र में उर्जा, मेक्सवैल की विस्थापन धारा घनत्व की संकल्पना, मैक्सवेल की समीकरणों की स्थापना, विद्युत चुम्बकीय क्षेत्र का उर्जा धनत्व। पॉयंटिग सदिश,सदिश एवं अदिश विभव, विद्युत चुम्बकीय क्षेत्र टेन्सर , फ्रेनल के संबंध, रैले प्रकीर्णन, विद्युत चुम्बकीय तरंग समीकरण, निर्वात एवं परावैधुत माध्यम में समतल विद्युत चुम्बकीय तरंग, परावैद्युत की समतल सतह से परावर्तन, फ्रेनेल के नियम, परावर्तन से ध्रुवण व पूर्ण आंतरिक परावर्तन, चालक माध्यम में तरंग, आयनमण्डल के द्वारा परावर्तन व अपवर्तन।

References:

1. **Berkley Physics Course**, Electricity and Magnetism Ed. E. M. Purcell Mcgraw Hill
2. **Physics Volume 2**, D. Halliday and R. Resnick
3. **Introduction to Electrodynamics:** D. J. Griffiths, 4th Edition, Printice Hall.
4. **Electricity and Magnetism:** S. S. Atwood Dover.
5. **Electrodynamics:** Emi Cossor and Bassin Lorraine, Asahi Shimbunsha Publishing Ltd.
6. **From Neuron to Brain:** Kuffler and Nicholas, Sinauer Associates, Inc Pub. Sunderland, Masschuetts.
7. **Schaums Outline of Begining Physics II: Electricity and Magnetism**

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3/6/19

Department of Higher Education, Government of Madhya Pradesh
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(शैक्षणिक सत्र **2020-2021** से लागू)

Class: B.Sc. Second Year
Max. Marks: 50

Subject : **Physics**

For Regular Students

Practical	Sessional	Viva	Total
25	10	15	50

For Ex–Student

Practical	Sessional	Viva	Total
35	00	15	50

List of Practical's

1. Study of interference using biprism.
2. Study of diffraction at straight edge.
3. Use of plane diffraction grating to determine D_1, D_2 lines of Sodium lamp.
4. Resolving power of telescope.
5. Polarization by reflection and verification of Brewster's Law.
6. Study of optical rotation in Sugar solution.
7. Refractive index and dispersive power of prism using spectrometer.
8. Absorption spectrum of material using constant deviation spectrograph.
9. Beam divergence of He-Ne Laser.
10. Determination of wavelength of Laser by diffraction.
11. Determination of radius of curvature of plano-convex lense by Newton's rings.
12. Characteristics of a Ballistic galvanometer.
13. Setting up and using an electroscope or electrometer.
14. Measurement of low resistance by Carey-Foster bridge or otherwise.
15. Measurement of inductance using impedance at different frequencies.
16. Measurement of capacitance using, impedance at different frequencies.
17. Response curve for LCR circuits and response frequencies.
18. Sensitivity of a cathode- ray oscilloscope.
19. Use of a vibration magnetometer to study a field.
20. Study of Magnetic field due to current using Tangent Galvanometer.
21. Study of decay of currents in LR and RC circuits.
22. Study of Lissajous figures using CRO.
23. Verification of Network theorems.

(S. Jain) 3.6.19 Rakesh Bajpai (Sanjay Sethi) 3/6/19 (R. Sethi) (Dr. A.K. Rastogi)

Dr (Mrs) Seema (V U S Murty) Dr Dilip Soni M. Singh

Department of higher Education Govt.of M.P
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केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के राज्पाल द्वारा अनुमोदित
सत्र **2020–2021**

B.Sc Second Year

There will be three sections of a Question Paper Section (A) Contains 5 Objective Question of 1 mark each. Section (B) contains 5 short answer type Question of 2 marks each. Section (C) contains 5 long answers of 5 marks each.

1- For Regular students :

Section (A)	Objective Questions	5	1	5
Section (B)	Short Questions	5	2	10
Section (C)	Main Questions	5	5	25
		Total Marks		40

2- For Private students :

Section (A)	Objective Questions	5	1	05
Section (B)	Short Questions	5	3	15
Section (C)	Main Questions	5	6	30
		Total Marks		50

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(Dr. A.K. Rastogi)
Dr. Dilip Soni
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Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal
Syllabus of Physics

(As Recommended by the Board Studies)
Session : 2020-2021

Theory

Session		2020-21	
Class		B.Sc. I Year	Paper - 1
Subject	English	Physics	
	fgUnh	HkkSfrd 'kkL=	
Tital of the Paper	English	Mathematical Physics, Mechanics ad Properties of Matter	
	fgUnh	xf.krh; HkkSfrdh ;kaf=dh rFkknzO; ds xq.k	
Medium of Instruction (Teaching)		Both ¼nksuksa½	Question Paper Language – Both
Max. Marks		50	

Subject : Physics

Paper : I

Title of the Paper : Mathematical Physics, Mechanics and Properties of Matter

Unit- I Mathematical Physics [15 Lectures]

Addition, Subtraction and Product of two vectors : Polar and axial vectors and their examples from physics : Triple and quadruple product (without geometrical application) : Scalar and Vector fields : Differentiation of a Vector : Repeated integral of a function of more than one variable : Unit tangent and unit normal vector Gradient, Divergence and Curl Laplaction operator ; Idea of line Surface and volume integrals; Gauss: Stokes and Green's Theorems.

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Unit - II Mechanics [15 Lectures]

Position, Velocity and acceleration Vectors Components of Velocity and acceleration in different coordinate systems Newton's Laws of motion and its explanation with problems various types of forces in Nature (explanation), Pseudo Forces (e.g. Centrifugal Force), coriolis force and its applications. Motions under a central force.Derivation of Kepler's laws.Gravitational law and field, Potential due to a spherical body.Gauss & Poisson's equation of Gravitational self-energy.System of particles. Centre of mass and reduced Mass. Rutherford scattering Elastic and inelastic collisions.

bdkbZZ& 2 % ;kaf=dh [15 Lectures]

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sanit - III General Properties os Matter [15 Lectures]

Elastic moduli and their relations, Determination of Y of rectangular thin bar loaded at the center: Torsional oscillations. Torsional rigidity of a wire, to determine n by torsional oscillations.Surface Tension. Angle of Contact, Capillary Rise Method; Energy required to raise a liquid in capillary tube; Factors affecting surface tension; Jeager's method for Determination of surface tension : Applications of Surface Tension. Concept of Viscous Forces and Viscosity. Steady and Turbulent flow Reynold's number : Equation of continuity : Bernoulli's Principle: Application of Bernoulli's equation-(i) Speed of Efflux (ii) Venturimeter (iii) Aspirator Pump (iv) Change of Plane of motion of a spinning ball.

bdkbZ&3 % nzO; ds lkekU; xq.k [15 Lectures]

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Unit - IV Oscillations [15 Lectures]

Concept of Simple, Periodic & Harmonic Oscillation with illustrations ; Differential equation of harmonic oscillator, Kinetic and potential energy of Harmonic Oscillator, Oscillation of two masses connected by a spring; Translational and Rotational motion, Moment of lnertia and their Product, Principal moments and axes, Theorem of parallel and perpendicular axis, Motion of Rigid Body, Euler's Theorem.

bdkbZ&4 nksyu [15 Lectures]

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Unit - V [15 Lectures]

Relativistic Mechanics : Michelson - Morley experiment and its outcome; Postulates of Special Theory of Relativity. Lorentz Transformation Simultaneity and order of events; Lorentz contraction; time dilation; Relativistic, transformation of velocity.Frequency and wave number Relativistic addition of velocities; Variation of mass with velocity.Four dimensional momentum vector, covariance of equation of Physics.

Earlier Developments in Physics up to 18th Century Contributions of Aryabhatt. Archimedes, Nicolas Copernicus, Galileo galilei, Huygens. Rebert Hooke. Torricelli, Vernier, Pascal, Kepler, Nweton, Boyle, Young, Thompson, Coulomb. Amperes.Gauss.Biot-Savarts.Cavendish. Galvani, Franklin and Bernoulli.

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Reference Books :

1. University Physics Sears and Zeeman sky. IXth edition.Pearson Education.
2. Concepts of Physics : H.C. Verma, BhartiBhavan Publishers
3. Problems in Physics P.K.Shrivastava. Willey Eastern Ltd.
4. Bakely Physics Course. Vol 1.Machanics : E.M. Purcell, McGraw hill
5. Properties of Matter. D.S. MathurShamlalChritable Trust, New Delhi.
6. Mechnics : D.S. Mathur, S Chand And Company New Delhi - 5
7. The Feymman Lectures in Physics Vol1 : R.P. Feymman. R.B. Lightonand M Sands.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College,
Shivaji Nagar, Bhopal
Syllabus of Physics

(As Recommended by the Board Studies)

Session : 2020-2021

Theory

Session		2020-21	
Class		B.Sc. I Year	Paper – 2
Subject	English	Physics	
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Tital of	English	Thermodynamics and Statistical Physics	

the Paper	fgUnh	m"ekxfrdhrFkklkaf[;dh HkkSfrdh	
Medium of Instruction (Teaching)		Both ¼nksuksa½	Question Paper Language – Both
Max. Marks		50	

Subject : Physics

Paper : II

Title of the Paper : Thermodynamics and Statistical Physics

Unite-I Thermodynamics-I [15 Lectures]

Reversible and irreversible process, Heat engines Definition of efficiency Carnot's ideal heat engine, Carnot's cycle, Effective way to increase efficiency, Carnot's engines and refrigerator, Coefficient of performance, Second law of thermodynamics, Various statements of second law of thermodynamics, Carnot's theorem, ClaussiusClapeyron's equation, Carnot's cycle and its applications, Steam engine Otto engine. Petrol engine.Diesel engine.

bdkbZ&1% m"ekxfrdh& I [15 Lectures]

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Unitu- II Thermodynamics-II [15 Lectures]

Concept of entropy, Change in entropy in adiabatic process, Change in entropy in reversible cycle, Principle of increase of entropy, Change in entropy in irreversible process. T-S diagram.

Physical Significance of Entropy Entropy of perfect gas. Kelvin's thermodynamic scale of temperature.The size of a degree. Zero of absolute Scale, ldentityof a perfect gas scale and absolute scale. Third law of thermodynamics. Zero point energy, Negative temperatures (not possible), Heat death of the universe, Relation between thermodynamic variable (Maxwell's Relations). Adiabatic demagnetization, Joule Kelvin effect and liquefaction of gases.

bdkbZ&2% m"ekxfrdh&II [15 Lectures]

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Unit-III Statistical Physics-I [15 Lectures]

Description of a system: Significance of statistical approach, Particle-states, System-states. Microstate and Macro-states of a system.Equilibrium States, Fluctuations, Classical & Statistical Probability the equi-probability postulate, Statistical ensemble, Number of states accessible to a system. Phase space. Micro Canonical Ensemble, Canonical Ensemble.Helmholtz free energy, Enthalpy, First law of thermodynamics, Gibbs free energy.Grand Canonical Ensemble.

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Unti-IV Statistical Physics-II [15 Lectures]

Statistical Mechanics: Phase space, The Probability of a distribution. The most probable distribution and its narrowing with increase in number of particles. Maxwll-Boltzmnn statistics Molecular speeds. Distribution and mean.r.m.s and most probable velocity. Constraints of accessibie state.and inaccessible states Quantum Statistics: Partition Function, Relation between Partition Function and Entropy, Bose-Eistein statistics. Black-Body radiaton, The Rayleigh-Jeans formula, The Plamck radiation formula Fermi Dirac Statistics Comparison of results.Concept of Phase transitions.

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Unit-V Contributions of Physicists [15 Lectures]

S.N Bose, M.N. Saha, Maxwell, Clausois. Boltzmaan. Joule, Wien, Einstein, Plank Bohr. Heiesnberg. Fermi, Dirac, Max Born Bardeen.

bdkbZ&5% HkkSfrdfonksadk ;ksxnku [15 Lectures]

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Text and Reference Books:

1. Heat and Thermodynamics: Mark W. Zemansky. Richard H.Ditman. Sventh Edition. McGraw-Hill international Editions.

2. Thermal Physics (Heat and Thermodynamics) A.B. Gupta, H.P. Roy, Books and Allied (P) Ltd. Calcutta.

3. Heat and Thermodynamics: Brijlal and N. Subrahmanyam. S. Chand & Company Ltd. New Delhi.

4. Berkley Physics Course,lVol 3, Thermodynamics: F, Reif, Mergraw Hill

5. Thermodynamics and Statistical Physics, D.P. Khandelwal and A.K. Pandey, Himalaya Publication.

6. Laboratory manual of Physics for undergraduate classes, D.P. KhandelwalVani Publication house. New Delhin.

Class: B.Sc First Year

Max. Marks: 50

Subject : Physics

For Regular Students

Practcal	Sessional	Viva	Total
25	10	15	50

For Ex-Student

Practical	Sessional	Viva	Total
35	00	15	50

List of Practical's

1. To verify laws of parallel and perpendicular axes for moment of inertia.
2. To determine acceleration due to gravity using compound pendulum.
3. To determine damping coefficient using a bar pendulum.
4. To determine Young's Modulus by bending of beam Method.
5. To determine Young's Modulus using Cantilever method.
6. To determine coefficient of rigidity by static method.
7. To determine Coefficient of rigidity by dynamic method.
8. To determine Surface Tension by Jaeger is method.
10. To determine Viscosity of fluid using Poisellie's methods.
11. To study conversion of mechanical energy into heat using Calender&Barne's Method.
12. To determine heating efficiency of electrical Kettle with various voltages.
13. To determine heating temperature coefficient of resistance using platinum resistanc thermoumeter.
14. To determine thermo electromotive force by a thermoconplemethad.

15. To determine heat conductivity of bad conductors of different geometry by Lee's method.
16. To verify Newton's Laws of cooling.
17. To determine coefficient of thermal conductivity by Searl’s Method.
18. To determine Specific heat of a Liquid.
19. To compare Maxwell-Boltzmann, Bose Einstein and Fermi-oDirac Distribution Function vs temperature using M.S. Excel/C++
20. To plot equation of state and Vander-Wall equation with temperature using M.S. Excel/'C++

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)
Session : 2020-21

Class: B.Sc. Second Year
Max. Marks: 50

Subject : Physics
Paper : First
Title of Paper : Optics

Unit-I Geometrical Optics & Waves
Lectures

Fermat's Principle, Refraction at a spherical surface, Aplanatic points and its applications, Lens formula, Combination of thin lenses and equivalent focal length. Dispersion and dispersive power, chromatic aberration and achromatic combination, different types of aberration (qualitative) and their remedy. Need for multiple lenses in eyepieces, Ramsden and Huygens eye-piece, Simple Harmonic Motion, Dempend oscillations, forced oscillations and resonance, Beats, Stationary wave in a string; pulse and wave packets: Phase and group velocities, Refilaction and Refraction from Huygen's principle.

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Unit-II Interference of light

The principle of superposition, two slit interference, coherence requirement for the sources, optical path retardations, Lateral shift of fringes, Localised, fringes, thin films, interference by a film with two non-parallel reflecting surfaces, Newton's rings. Haidinger fringes (Fringes of equal inclination), Michelson interferometer, its appllication for precision determination of wavelength, wavelength difference and the width of spetral lines. intensity distribution in multiple beam interference, Fabry-Perot intrerferometer and Elalon.

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Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)

Session : 2020-21

Class: B.Sc. Second Year

Unit-III Diffraction

Fresnel's and Fraunhofer diffraction: Half period zone, Zone plate. Diffraction at straight edge, rectilinear propagation.Diffraction at a slit, phasor diagram and integral calculus methods.Diffraction at a circular aperture.Rayleigh criterion of resolution of images. Resolving power of telescope and microscope, Diffraction at N-parallel slits, Intensity distribution, Plane diffraction grating, Resolving power of a grating.

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Unit-IV Polarsation

Transverse nature of light waves, Polarization of electromagnetic waves, Plane polarised light - production and analysis, Description of Linear, circular and elliptical polarisation. Propagation of electro magnetic waves in anisotropic media, uniaxial and biaxial crystals, symmetric nature of dielectric tensor, Double refraction, Hygen's principle, Ordinary and extraordinary refractive indices, Fresnel's formula, light propagation in uniaxial crystal, Nicol prism, Production of circularly and elliptically polarized light, Babinet compensator and applications, Optical rotation, Optical rotation in liquids and its measurement through polarimeter.

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Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)
Session : 2020-21

Class: B.Sc. Second Year

Unit-V Fibre Optics and Laser

Principle of fiber optics, attenuation: pulse dispersion and step index and paradolic index fibres. A brief history of lasers, characteristics of laser light, Einstein prediction, Relationship between Einstein's coefficients (qualitative discussion), Pumping schemes, Resonators, Ruby laser, He-Ne laser, Applications of lasers, Principle of Holography. Photodiodes, Phototransistors, and Photomultipliers.

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Qk;oj vkfIVDl dk fl)kar] {kh.krk] Lian folj.k ,oa LVsi baMsDl] ijoykf;d baMsDl Qk;oj] ystj dk laf{kIr bfrgkl] ystj izdk'k ds vfHkyk{kf.kd xq.k] vkbUlVhu dh ladYiuk] vkbUlVhu xq.kkadks esa lEcU/k ¼xq.kkRed foospu½] ifEiax iz.kkfy;kW] jstksusVlZ] :ch ystj] ghfy;e& fuvku ystj] ystj ds mi;ksx] gksyksxzkQh dk fl)karA QksVksMk;ksM] QksVks VªkaftLVj o QksVks eYVhIyk;jA

References Books:

1. Fundamentals of Optics : F.A. Jenkins and H.E. White, 1976 Mc Graw-Hill.
2. Principles of Optics : B.K. Mathur, 1995, Gopal Printing.
3. University Physics: F.W. Sears, M.W. Zemansky and H.D. Yong, 13/c, 1986 Addison-Wesley.

4. Optics: A.K. Ghatak, McGraw Hill Publications.
5. Principles of Optics : Max Born and Wolf, Pregmon Press.
6. Optics and Atomis Physics, D.P. Khandelwal, Himalaya Publication.
7. Lasers : Theory and Application : K. Thyagrajen and A.K. Ghatak.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)
Session : 2020-21

Class: B.Sc. Second Year
Max. Marks: 50

Subject : Physics
Paper : Second
Title of Paper : Electrostatics, Magneto statics and Electrodynamics

Unit- 1 Electrostatics

Fundamental's of Electrostatics, Gauss's law and its application for finding E for symetric charge distributions, Capacitors, conducting sphere in a uniform electric field, point charge in front of a grounded infinite conductor. Dielectrics. Parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector P, relation between displacement vector D, E and P. Molecular interpretation of Claussius-Mossotti equation.

Laplace and poissson equations in electrostatics and their applications; Energy of system of charges, multiple expression of scalar potential; method of images and its application.potential and field due to a dipole, force and torque on a dipole in an external electric field.

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Unit-2 Magnetostatics

Force on a moving charge, Lorentz force equation and definition of B, force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment, angular momentum and gyromagnetic ration, Bior and Savart's law, calculation of H for simple geometrical situations such as solenoid, Anchor ring. Ampere's law, $VxB = M_0J$, V.B= 0. Field due to a magnetic dipole, free and bound currents, magnetization vector (M), relationship between B,H and M. Derivation of the relation Vx M = J for non-uniform magnetization.

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Syllabus for Physics

(As Recommended by the Board of Studies)
Session : 2020-21

Class: B.Sc. Second Year

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Unit-3 Current Electricity and Bio Electricity

Steady current, current density J, non-steady currents and continuity equation, Kirchoff's laws and analysis of multiloop circuits, growth and decay of current in LR and CR circuits, decay constants, LCR circuits. Mean and RMS values of A.C., AC circuits, complex numbers and their application in solving AC circuits problems, complex impedance and reactance, series and parallel resonance. Q-factor, power consumed by an A.C. circuit, power factor, Y and V networks and transmission of electric power, Electricity observed in living systems, Origin of bioelectricity.

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Unit-4 Motion of Charged Particles in Electric and Magnetic Fields

(Note: The emphasis here should be on the mechanical aspects and not on the details of the apparatus mentioned which are indicated as applications of principles involved.)

E as an accelerating field, electron gun, discharge tube, linear accelerator.E as deflecting field - CRO, Sensitivity of CRO. Transverse B Field; 180^0 deflection, Mass spectrograph and velocity selector, Curvatures of tracks for energy determination for nuclear particles; principle and working of Cyclotron. Mutually perpendicular and parallel E & B fields; Positive ray parabolas, Discovery of isotopes, Elements of Mass Spectrographs, Principle of magnetic focusing (lenses).

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)

Session : 2020-21

Class: B.Sc. Second Year

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Unit-5 Electrodynamics

Electromagnetic induction, Faraday's Laws, Electromotive force, Integral and differential forms of Faraday's laws, Self and mutual inductance, Transformers, Energy in a static magnetic field, Maxwell's displacement current, Derivations of Maxwell's equations, Electromagnetic field energy density. Poynting vector, vector and scalar protentionals; Electromagnetics field Tensors, Fresnel's relations, Rayleigh scattering. Electromagnetic wave equation, Plane electromagnetic waves in vacuum and dielectric media, Reflection at a plane boundary of dieletrics, Fresnel's Laws, Polarization by reflection and total internal reflection, Waves in a conducting medium, Reflection and refraction by the ionosphere.

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References:

1. Berkley Physics Course, Electricity and Magnetism Ed. E. M. Purcell Mcgraw Hill
2. Physics Volume 2, D. Halliday and R. Resnick
3. Introduction to Electrodynamics: D.J. Griffiths, 4 Edition, Printice Hall.
4. Electricity and Magnetism: S.S. Atwood Dover.
5. Electrodynamics: Emi Cossor and Bassin Lorraine, Ashahi Shimbunsha Publishing Ltd.
6. From Neuron to Brain : Kuffler and Nicholas, Sinauer Associates, Inc Pub. Sunderland Masschuetts.
7. Schaums Oulline of Begining Physics II: Electricity and Magnetism

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)

Session : 2020-21

Class: B.Sc. Second Year
Max Marks : 50

List of Practicals

1. Study of interference using biprism.
2. Study of diffraction at straight edge.
3. Use of plane diffraction grating to determine D1, D2 lines of sodium lamp.
4. Resolving power of telescope
5. Potarization by reflection and verification of Brewster's Law.

6. Study of optical rotation in sugar solution.]
7. Refractive index and dispersive power of prism using spectrometer.
8. Absorption spectrum of material using constant deviation spectrograph.
9. Beam divergence of He-Ne Laser.
10. Determination of wavelength of Laser by diffraction.
11. Determination of radius of curvature of plano-convex lense by Newton's rings.
12. Characteristics of a ballistic galvanometer.
13. Setting up and using an electroscope or electrometer.
14. Measurement of Low resistance by Carey-Foster bridge or otherwise.
15. Measurement of inductance using impedance at different frequencies.
16. Measurement of capacitance using, impedance at different frequencies.
17. Response curve for LCR circuits and response frequencies.
18. Sensitivity of a cathode-ray oscilloscope.
19. Use of a vibration magnetometer to study a field.
20. Study of Magnetic field due to current using Tangent Galvanometer.
21. Study of decay of currents in LR and RC circuits.
22. Study of Lissajous figures using CRO
23. Verification of Network theorems.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)
Session : 2020-21

Class: B.Sc. Third Year
Max Marks : 50
Subject :Physics
Paper : First
Title of Paper : Quantum Mechanics and Spectroscopy

Unit-I: Quantum Mechanics-1

Particles and Waves: Photoelectric effect. Black body radiation.Planck's radiation law, Stefan Boltzmann law, Wien's displacement law and Rayleigh-Jean's law. Compton effect. De Broglie hypothesis.Wave particle duality.Davisson-Germer experiment.Wave packets.Concept of phase and group velocity. Two slit experiment with electrons. Probability. Wave amplitude and wave functions. Heisenbcrg's uncertainty principle with illustrations.Basic postulates and formalism of Schrodinger's equation.Eigenvalues.Probabilistic interpretation of wave function.Equation of continuity.Probability current density. Boundary conditions on the wave function. Normalization of wave function.

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Unit-II: Quantum Mechanics-2

Time independent Schrodingcr equation: One dimensional potential well and barrier. Boundary conditions.Bound and unbound states.Reflection and transmission coefficients for a rectangular barrier in one dimension.Explanation of alpha decay.Quantum phenomenon of tunneling. Free particle in one-dimensional box, eigen functions and eigen values of a free particle. One-dimensional simple harmonic oscillator, energy eigenvalues from Hermite differential equation, wave function for ground state.Particle in a spherically symmetric potential.Rigid rotator.

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Unit-III: Atomic Spectroscopy

Atoms in **electric and magnetic fields:** Quantum numbers, Bohr model and selection rules. Stern-Gerlach experiment. Spin as an intrinsic quantum number. Incompatibility of spin with classical ideas.Orbital angular momentum.Fine structure.Total angular momentum. Pauli exclusion principle. Many particles in one dimensional box.Symmetric and anti-symmetric wave functions.Atomic shell model.Spectral notations for atomic states.Spin-orbit coupling, L-S and **J-J** coupling. Zeeman effect. Continuous and characteristic X-rays.Mossley's law.

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Unit-IV: Molecular Spectroscopy

Various types of spectra.Rotational spectra.Intensity of spectral lines and determination of bond distance of diatomic molecules.Isotope effect.Vibrational energies of diatomic molecules.Zero point energy.Anharmonicity.Morse potential. Raman effect, Stokes and anti-Stokes lines and their intensity difference. Electronic spectra.Born-Oppenheimer approximation.Frank-Condon principle, singlet and triplet states.Fluorescence and phosphorescence.

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Unit - V : Nuclear Physics and Elementary Particles

Basic properties of nucleus: Shape, Size, Mass and Charge of the nucleus. Stability of the nucleus and Binding energy.Alpha particle spectra - velocity and energy of alpha particles.Geiger-Nuttal law.Nature of beta ray spectra.The neutrino and its physics. Energy levels and decay schemes. Positron emission and electron capture. Selection rules.Beta absorption and range of beta particles.Kurie plot.Nuclear reactions, pair production.Q-values and threshold of nuclear reactions.Nuclear reaction cross-sections.Examples of different types of reactions and their characteristics. Compound nucleus, Bohr's postulate of compound nuclear reaction, Semi empirical mass formula, Shell model, Liquid drop model, Nuclear fission and fusion (concepts).

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References:

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2. **Quantum Mechanics: B. H. Bransden, Pearson Education, Singapore, 2005**
3. **Quantum Mechanics: Concepts and Applications, Nouredine Zcttili, Jacksonville tate University, Jacksonville, USA, John Wiley and Sons, Ltd, 2009**
4. **Physics of Atoms and molecules: B.H. Bransden and C.J. Joachaim, Pearson Education, Singapore, 2003**
5. **Fundamentals of Molecular Spectroscopy: C.M. Banwell and M. McCash, McGraw Hill (U.K. edition).**
6. **Introduction to Atomic Physics, H. E. White**
7. **Quantum Mechanics: Schaums Outlines, Y. Peleg, R. Pnini, E. Zaarur, E. Hecht.**

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)

Session : 2020-21

Class: B.Sc. Third Year

Max. Marks : 50

Subject :Physics

Paper : Second

Title of Paper : Solid State Physics & Electronic Devices

Unit-I: Solid state Physics-1

Crystal Structure and bonding: Crystalline and amorphous solids. Translational symmetry.Lattice and basis.Unit cell.Reciprocal lattice. Fundamental types of lattices (Bravias Lattice). Miller indices Lattice planes.Simple cubic. Face centered cubic. Body centered cubic lattices. Laue and Bragg's equations. Determination of crystal structure with X-rays, X-ray spectrometer.Ionic, covalent, metallic, van der Waals and hydrogen bonding.Band theory of solids.Periodic potential and Bloch theorem.Kronig-Penny model (Qualitative).

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Unit-LI: Solid state Physics-2

Lattice structure and properties: Dulong Petit, Einstein and Debye theories of specific heats of solids. Elastic and atomic force constants.Dynamics of a chain of similar atoms and chain of two types of atoms.Optical' and acoustic modes.Electrical resistivity.Specific heat of electron.Wiedemann-Franz law. Hall effect. Response of substances in magnetic field, dia-, para- and ferromagnetic materials.Classical Langevin theory of dia and paramagnetic domains.Curie's law.Weiss' theory of ferromagnetism and ferromagnetic domains.Discussion of BH hysteresis.

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Unit-III: Semiconductor devices-1

Electronic devices: Types of Semiconductors (p and n). Formation of Energy Bands, Energy level diagram.Conductivity and mobility.Junction formation, Barripr formation in p-n junction diode.

Current flow mechanism in forward and reverse biased diode (recombination), drift and saturation of drift velocity. Derivation of mathematical equations for barrier potential, barrier width.Single p-n junction device (physical explanation, current voltage characteristics and one or two applications).Two terminal devices.Rectification.Zener diode.Photo diode. Light emitting diode. Solar cell.Three terminal devices.Junction field effect transistor (JFET).Two junction devices.Transistors as p-n-p and n-p-n.Physical mechanism of current flow.Characteristics of transistor.

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Unit-IV: Semiconductor devices-2

Amplifiers (only bipolar junction transistor).CB, CE and CC configur'ations.Single stage CE amplifier (biasing and stabilization circuits), Q-point, equivalent circuit, input impedance, output impedance, voltage and current gain.Class A, B, C amplifiers (definitions).RC coupled amplifiers (frequency response). Class B push-pull amplifier.Feedback amplifiers.Voltage feedback and current feedback.Effect of negative voltage series feedback on input impedance.Output impedance and gain.Stability, distortion and noise.Principle of an Oscillator, Barkhausen criterion, Colpitts, RC phase shift oscillators.Basic concepts of amplitude, frequency and phase modulations and demodulation.

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Unit-V: Nano materials

Nanostructures: Introduction to nanotechnology, structure and size dependent properties. 3D, 2D, 1D, OD nanostructure materials and their density of states, Surface and Interface effects.Modelling of quantum size effect.Synthesis of nanoparticles - Bottom Up and Top Down approach, Wet Chemical Method.Nanolithography.Metal and Semiconducting nanomaterials.Essential differences in structural and properties of bulk and nano materials (qualitative description).Naturally occurring nano crystals.Applications of nanomaterials.

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References:

1. Introduction to Solid State Physics, C. Kittel, V11Ith Edition, John Wiley and Sons, New York, 2005.
2. Intermediate Quantum theory of Crystalline Solids, A. 0. E. Animalu, Prentice—Hall of India private Limited, New Delhi 1977
3. Solid State Electronic devices, B. G. Streetman, II Edition Prentice Hall, India.
4. Microelectronics, J. Millman and A. Grabel McGraw Hill New York
5. The Physics and Chemistry of Nanosolids: Frank J. Owens, and Charles P. Poole Jr., Wiley Inter Science, 2008
6. Physics of Low Dimensional Semiconductors: An introduction; J.H. Davies, Cambridge University Press, U.K., 1998
7. Electronic fundamentals and applications, J. D. Ryder, Prentice Hall, India.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Syllabus for Physics

(As Recommended by the Board of Studies)

Session : 2020-21

Class: B.Sc. Third Year

Subject : Physics

For Regular Students

Practical	Sessional	Viva	Total
25	10	15	50

List.Of Practicals

1. Specific resistance and energy gap of a semiconductor.
2. Study of half wave and full wave rectification.
3 Characteristics of Zener diode.
4. Characteristic of a tunhel diode.
5. Characteristics of JFET.
6. Characteristic of a transistor.
7. Study of regulated power supply.
8. Study of RC coupled amplifiers
9. Determination of Planck's constant.
10. Determination of e/m using Thomson's method.
11. Determination of e by Millikan's method.
12. Study of spectra of hydrogen and deuterium (Rydberg constant and ratio of masses of electron to proton).
13, Absorption spectrum of iodine vapour.
14. Study of Zeeman effect for determination of Lande g-factor.
15. Study of Raman spectrum using laser as an excitation source
16. To draw B-H curve of ferro-magnetic material with the help of CRO
17. Hysteresis curve a transformer core.
18. Hall probe method for measurement of resistivity.

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE,

BHOPAL

SYLLABUS FOR

M.Sc (Physics)

SEM ; I, II, III & IV

SESSION : 2020-21

SAROJINI NAIDU GOVT. GIRLS PG (AUTONOMOUS) COLLEGE, Shivaji Nagar, Bhopal

Semester Wise Syllabus for Physics

(As Recommended by Board of Studies)

Session: 2020-21

Scheme of Examination

Course: M.Sc. (2 Year Degree Course)

Semester	Theory Paper/Practical	Title of Paper	Marks	Total Marks
I	Paper I	Mathematical Physics	100	600
	Paper II	Classical Mechanics	100	
	Paper III	Quantum Mechanics-I	100	
	Paper IV	Electronic Devices	100	
	PRACTICAL-I	Lab-A (Electronics)	100	
	PRACTICAL-II	Lab-B (General)	100	
II	Paper I	Quantum Mechanics-II	100	600
	Paper II	Statistical Mechanics	100	
	Paper III	Electrodynamics & Plasma Physics	100	
	Paper IV	Atomic and Molecular Physics	100	
	PRACTICAL-I	Lab-A (Electronics)	100	
	PRACTICAL-II	Lab-B(General)	100	
III	Paper I	Condensed matter Physics-I	100	600
	Paper II	Nuclear and Particle Physics	100	
	Paper III	Digital Electronics	100	
	Paper IV	Atomic and Molecular Physics	100	
	PRACTICAL-I	Lab-A (Electronics)	100	
	PRACTICAL-II	Lab-B (General)	100	600
IV	Paper I	Condensed Matte Physics-II	100	
	Paper II	LASER Physics	100	
	Paper III	Computer Programming and Informatics	100	
	Paper IV	Digital Electronics	100	
	PRACTICAL-I	Lab-A (Electronics)	100	
	PRACTICAL-II	Lab-B (General)	100	
		Grand Total		**2400**

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As Recommended by the Board of Studies

Session 2020-21

Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : I**
Title of the Paper	**MATHEMATICAL PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - 1 (English)	**<u>Differential equations</u>: Recursion relation, generating functions and orthogonality of Bessel functions of first and second kind, Hermite, Legendre, Associate Legendre and Laguerre Polynomials, Curvilinear coordinate system with specific cases of Cartesian, Cylindrical and Spherical coordinate systems.**	1. L.A. Pipes Mathematics of Engineers and Physicists. 2. Arfken Mathematical Methods for Physicists. 3. P.K. Chattopadhyay Machematical Physics. 4. H.K.Dass Mathematical Physics
Unit - II (English)	**Integral transforms. Fourier integral. Fourier transforms and inverse Fourier transforms.** **Fourier transform of derivatives. Convolution theorem. Elementary Laplace transforms.** **Laplace transform to derivatives. Application to a damped harmonic oscillator.**	

Unit - III (English)	<u>**Green's functions**</u>**: Non-homogenous boundary value problems, Green's function for one dimensional problems, eigen function expansion of Green's function, Fourier transforms.** **Method of constructing.** **Green's functions, Green's function for electrostatic boundary value. Problems and quantum-mechanical scattering problem.**	5. Ghatak, Goyal & Guha Mathematical Physics 6. M.R. Spiegal (Schaum Series) Complex variable & Laplace Transform.
Unit - IV (English)	<u>**Complex variables**</u>**: analyticity of complex functions. Cauchy Riemann equations. Cauchy theorem. Cauchy integral formula.** **Taylors, Maclaurin Laurent series and mapping.** **Theorem of residues. Simple cases of contour integration. Jordan's lemma Integrals involving multiple valued function (Branch points)**	
Unit - V (English)	**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.**	

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As Recommended by the Board of Studies

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Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : II**
Title of the Paper	**CLASSICAL MECHANICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**<u>Newtonin mechanics of one and many particles systems</u>: Conservation laws, Constraints their classification, Principle of virtual work; D'Almbert's principle in generalized coordinates, The Lagrange's equitation from D'Almbert's principle. Configuration space, Hamilton's principle deduction from D'Almberts principle, Generalized momenta and Lagragian 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.**	1. H. Goldsetin (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)
Unit - II (English)	**<u>The equitation of canonical transformation and generating functions</u>: The Hamilton-Jacobi Action and Angle 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.**	

Unit - III (English)	**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.**	R.G. Takwale & P.s. Puranik Introduction to Classical Mechanics.
Unit - IV (English)	**Symmetries of space and time.** **Invariance under galilion transformation, Covariant four-dimensional 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 Hamiltonioan, Examples.**	
Unit - V (English)	**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.**	

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Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : III**
Title of the Paper	**QUANTIUM MECAHNICS – I**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**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.**	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
Unit - II (English)	**Linear vector space, concept of Hilbert 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).**	

		5. J.J. Sakurai Modern Quantum Mechanics Mathews and Venkatesan Quantum Mechanics.
Unit - III (Engilish)	**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 (deuteron).**	
Unit - IV (English)	**Angular momentum in quantum mechanics, Eigen values and Eigen function of L_2 and L_z in term of spherical harmonics, commutation relation. Time independent perturbation theory. Non-degenerate and degenerate cases.**	
Unit - V (English)	**This unit will have a short note question covering all the four units.** **The students will have to answer any two questions of the four.**	

Paper IV (Electronic device)

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Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : IV**
Title of the Paper	**ELETRONIC DEVICES**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - 1 (English)	**<u>Transistors</u> : JFET, BJT, MOSFET and MOSFET, structure derivations of the equations for I-V characteristics under different conditions, microwave devices, tunnel diode, transfer electron devices (Gunn diode) avalanche transits time devices, Impatt diodes and parametric devices.**	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.
Unit - II (English)	**<u>Photonic devices</u>: 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 (English)	**<u>Memory Devices</u>: Read Only Memory (ROM) and Random Access Memory (RAM). Types of ROM: PROM, EPRON, EEPROM AND EAPROM, Static and dynamic RAMs (SRAM & DRAM), characteristics of SRAM and DRAM.** **<u>Hydbrid Memories</u> : CMOS and NMOS memories, Nonvolatile RAM, ferro-electric memories, charge coupled devices (CCD), storage devices : Geometry and organization of magnetic (FDD and HDD) and Optical (CD-ROM, CD-R, CD-R/W, DVD) Storage Devices.**	Ajoy Ghatak and Thyagrajam Optical Electrics.
Unit - IV (English)	**Eletro-optics, Magneto-optic and Acousto-optic effects, materials properties related to get these effect, important ferro electric, Liquid crystal and polymeric materials for these devices, piezoelectric, electrostrictive and magnetostrictive effects. Important materials for these properties and their applications in sensors and actuator devices, acoustic delay lines, peizoelectric resonators and filters, high frequency piezoelectric devices-surface, acoustic wave devices.**	
Unit - V (English)	**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.**	

As Recommended by the Board of Studies

Session – 2020-21

Practical

Class	M. Sc	Semester - I
Subject	Physics	
Title of Practical	LAB – A (Electronics)	
Medium of Instruction/Teaching	English	
Maximum Marks	100	

List of Experiments

1. To study characteristics of Zener Diode.
2. To study characteristics of Silicon Controlled Rectifier (SCR).
3. To study characteristics of Light Emitting Diode (LED).
4. To study characteristics of Tunnel Diode.
5. To study characteristics of Junction Field Effect Transistor (JFET)n
6. To study characteristics of Metal Oxide Semiconductor Field Effect Transistor (MOSFET).
7. To study characteristics of PN Diode.
8. To study characteristics of Thermistor.
9. To study characteristics of Triac.
10. To study characteristics of Uni junction Transistor (UJT)
11. To study characteristics Diac.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

As Recommended by the Board of Studies

Session – 2020-21

Practical

Class	M. Sc	Semester - I
Subject	Physics	
Title of Practical	LAB – B (General)	
Medium of Instruction/Teaching	English	
Maximum Marks	100	

List of Experiments

1. To find Characteristics of Photo cell.
2. To find energy band gap of semiconductor.
3. To find electronic charge by rectifier.
4. To study characteristics of solar cell.
5. To find e/m by Thomson method.
6. To find resolving power of grating.
7. To verify Cauchy’s formula.
8. To study hysteresis loss of transformer using CRO.
9. To study wave form and frequency by CRO.
10. To study characteristics of VR Tube.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : I**
Title of the Paper	**QUANTUM MECHANICS -II**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - I (English)	**<u>Approximation method for bound states</u>: Rayleigh - Schrodinger Perturbation theory of non-degenerate and degenerate 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.**	1. LI Schiff Quantum Mechanics 2. S Gasirowicaz Quantum Physics 3. B.Craseman and J J Powell Quantum Mechanics (Addison Wessley) 4. A. Messiah Quantum
Unit - II (English)	**<u>Time dependant perturbation theory</u> : 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 (English)	**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 practices with spin, Pauli's spin matrices.**	Mechanics 5. J.J. Sakurai Modern Quantum Mechanics 6. Mathews and Venkatessan Quantum Mechanics
Unit - IV (English)	**Schrodinger.s relativistic equation (Klein-Gordon equation), Probability and current denisity, 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.**	A.K.Ghatak and Loknathan Quantum Mechanics.
Unit - V (English)	**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.**	

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : II**
Title of the Paper	**STATISTICAL MECHANICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - 1 (English)	**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. Micro canonical ensemble, phase space, trajectories and density of states, Liouvelle theorem, canonical and grand canonical ensembles, partition function, calculation of statistical quantities, energy sand density fluctuations.	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.
Unit - II (English)	**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 (English)	**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 - IV (English)	**Thermodynamics fluctuation spatial correlation Brownian motion, Langevin theory, fluctuation dissipation theorem, the Fokker-Planck equation, Onsager reciprocity relations.**	
Unit - V (English)	**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.**	

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : III**
Title of the Paper	**ELECTRODYNAMICS AND PLASMA PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - I (English)	**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.**	1. Bitteneerort Plasma Physics 2. Chen Plasma Physics 3. Gupta, Kumar, Singh Electro dynamics
Unit - II (English)	**Fields of an 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-demension Maxwell equation, Four Vector current and potential and their invariance under Lortentz transformation, covariance of electro-dynamics. **Langragian and Hamiltonian for a relativistic charged particle in External EM field; motion of charged particles in electromagnetic fields, uniform and non-uniform E and B fields.**	4. Sen Plasma state and matter 5. Jackson Classical electrodynamics 6. Pamolsky & Philips Classical electricity and Magnetism.
Unit - III (English)	**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 plasma. Debye screening distance. Plasma oscillations: Transverse oscillations and longitudinal oscillations.**	
Unit - IV (English)	**<u>Domain of Magneto hydrodynamics and plasma Physics</u> :** **Magneto hydrodynamic equations, magnetic hydro-static pressure hydrodynamic waves: Magneto-sonic and Alfven waves, particle orbits and drift motion in plasmas. Experimental study of Plasma the theory of single and double probes.**	
Unit - V (English)	**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.**	

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : IV**
Title of the Paper	**ATOMIC AND MOLECULAR PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - 1 (English)	**Quantum states of one electron atom. Atomic orbitals. Hydrogen spectrum, Pauli's 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).**	1. H.E. White Introduction to atomic spectra 2. C.B. Banwell Fundamental of molecular spectroscopy 3. Walker and Strengthen Spectroscopy Vol. I , II and III 4. G.N. Barrow Introduction of
Unit - II (English)	**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.	molecular spectroscopy 5. Herzberg Spectra of diatomic molecules
Unit - III (English)	**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)**	6. Jeanne L and McHale Molecular spectroscopy 7. J.M. Brown Molecular spectroscopy
Unit - IV (English)	**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 photo acoustic spectroscopy and Moss Bauer spectroscopy (principle).**	8. P.F. Benmath Spectra of atoms and molecules J.M. Halian Modern Spectroscopy
Unit - V (English)	**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.**	

As Recommended by the Board of Studies
Session – 2020-21
Practical

Class	M. Sc	Semester - II
Subject	Physics	
Title of Practical	LAB – A (Electronics)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. To Study frequency response of RC Coupled Amplifier.
2. To study Characteristics of Photo Transistor
3. To find ‘h’ Parameters of Transistor.
4. To compare Characteristics of Ge and Si Transistor.
5. To study Transistor as a switch.
6. To Study regulated and unregulated power supply.
7. To verify De morgan’s law.
8. To study Basic logic Gates
9. To sutudy ‘NAND’ Gate.
10. To study Passive Filters.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

As Recommended by the Board of Studies

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Practical

Class	M. Sc	Semester - II
Subject	Physics	
Title of Practical	LAB – B (General)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. To study ‘Hall Effect’
2. To determine resistivity of given material by ‘Four Probe Method’.
3. To determine band gap in semiconductor by ‘Four Probe Method’.
4. To find Stefan’s Constant.
5. To find thickness of mica sheet by biprism.
6. To find capacitance by ‘Shearing Bridge’
7. To study Lissanjou’s figure.
8. To study ‘Push Pull Amplifier’
9. To study ‘Wein Bridge Oscillator’
10. To study diffraction at single slit.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

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Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : I**
Title of paper	**Condensed Matter Physics-I**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional %	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit-1	**Crystal structure:** Bravis lattice in two and three dimension. Simple crystal structures, Hexagonal close packed structure, Diamond structure, zinc blende structure, sodium chloride structure, cesium chloride structure.	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
Unit-2	**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-3	**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.	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.
Unit-4	**Lattice vibration and phonons:** Lattice dynamics 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-5	**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.	

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Theory

Class	**M.Sc.**		**Semester: III**
Subject (English)	**Physics**		**Paper No : II**
Title of Paper	**Nuclear and Particle Physics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	

Compulsory / Optional %	Compulsory		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit-1	**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.	1. Introduction of Nuclear physics : H.A. Enge 2. Nuclear radiation detectors : S.S. Kapoor and V.S. Ramamurthy 3. Atomic and Nuclear physic : S.N. Ghoshal 4. Nuclear and Particle physics : D.C. Tayal 5. Nuclear physics : R.C. Sharma 6. Introduction of Nuclear physics: KRANE 7. Nuclear physics Principles & Application
Unit-2	**Acclerators of charged particles:** Study of cyclotron, phase stability, frequency modulated cyclotron (synchorocyclotron) magnetic induction accelerator (Betatron) Electron synchrotron and linear accelerator (Linac)	
Unit-3	**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-4	**Nuclear decay and elementary particles:** ß Decay, general features of ß ray spectrum, Fermi theory of ß decay, selection rules, parity in ß decay, multipole radiation, internal conversion, nuclear isomerism.	
Unit-5	**Elementary particles:** Classification of elementary particles, fundamental interaction, parameters of elementary particles. Symmetry and conservation laws, symmetry schemes of elementary particles SU(3).	

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As Recommended by the Board of Studies

Session –2020-21

Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : III**
Title of Paper	**Digital Electronics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional %	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit-1	Number system (Binary, Octal, Decimal, hexadecimal) and conversion between them. Boolean arithmetic, signed and unsigned binary numbers, I's complement, 2's complement.	1. "Digital principles and applications" by A.P. Malvino and Donald P. Leach, Tata Megraw-Hill Company, New Delhi, 1993. 2. "Microprocessor Architecture, Programming and Applications with 8085/8086 by Rames S.Gaonkar, Wiley-eastern Ltd., 1987 (for unit V)"
Unit-2	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-3	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-4	Counters-asynchronous (ripple) counter, synchronous (parallel) counter, MOD-5 counter and MOD-10 counter, BCD counter, Up-Down counter, Shift Register counter (Ring counter)	3. Digital electronics : S.N. Ali 4. Digital electronics: Morries Mano 5. Microprocessor and Microcomputers : B. Ram- Dhanpat Rai publications V edition.
Unit-5	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)	

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As Recommended by the Board of Studies

Session –2020-21

Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : IV**
Title of Paper	**Atomic and Molecular Physics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional %	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit-1	**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 interation and spin-spin coupling between two and more nuclei (Qualitative)	1. Fundamentals of Molecular Spectroscopy : C.B. Banwell. 2. Spectra of Diatomic Molecules : Herzberg. 3. Mossbauer Spectroscopy : M.R. Bhide 4. NMR and Chemistry :
Unit-2	**Electronic spectra of Diatomic Molecules and fourier transform infrared spectroscopy** Frank Condon principles, dissociation and pre-dissociation, dissociation energy. Born-Oppenheimer-approximation, vibrational coarse structure of electronic spectra (bands progression and sequence). fourier transform infrared spectroscopy :Theory and application FTIR peaks of common bands and functional groups	

Unit-3	**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.	J.W. Akitt 5. Modern Spectroscopy : J.M. Hollons
Unit-4	**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, Quadrapole splitting magnetic field effect).	
Unit-5	**Electron Spin Resonance Spectroscopy:** Elementary Idea about ESR, Principle of ESR, ESR spectrometer, spliting of electron energy levels by a magnetic field, G-Values, simple experimental set-up of ESR. ESR spectra of free radicals in solution, Anisotropic system.	

As Recommended by the Board of Studies

Session – 2020-21

Practical

Class	M. Sc	Semester - III
Subject	Physics	
Title of Practical	LAB – A (Electronics)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. Seven Segment Display.
2. BCD to Hexadecimal Converter.
3. UP Down Counter.

4. RS,JK,T,D, flip flop
5. Master Slave fillip flop.
6. Hexadecimal to binary encoder.
7. Encoder Decoder(decimal to binary)
8. Half adder and full adder (IC7483)
9. A to D converter.
10. Study of binary to decimal decoder.
11. Design and study 4 bit binary ripple counter.
12. Study of decimal to octal converter.
13. 4 bit binary full adder.
14. Decimal to octal and decimal to binary converter using Digital Lab Trainer Kit.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

As Recommended by the Board of Studies
Session – 2020-21
Practical

Class	M. Sc	Semester - III
Subject	Physics	
Title of Practical	LAB – B (General)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. To study divergence of LASER beam.
2. To find refractive index of a liquid using LASER source.
3. To find wavelength of LASER.
4. To study frequency response of negative feedback amplifier.
5. To study effect of feedback network on gain of feedback amplifier.
6. To find Rydberg Constant by Hydrogen Discharge Tube.
7. To Study differential comparator.
8. To study 'Push Pull Amplifier'.
9. To analyse elliptically polarized light by Babinet's compensator.
10. Use of Michelson Interferometer.
11. To study emitter follower.
12. To study Colpitt's Oscillator.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

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Session –2020-21

Class / d{kk % M.Sc.

Semester / lsesLVj % IV

Subject / fo"k; % Physics

Title of Subject Group % Condensed Matter Physics-II

fo"k; lewg dk 'kh"kZd %

Paper No. / iz'ui= dzekad % I

Compulsory / vfuok;Z ;k Optional / oSdfYid vfuok;Z % Compulsory

Max. Marks vf/kdre vad 100 % CCE : 30, Main Exam : 70 Total - 100

Particulars / fooj.k

Unit-1	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-2	Magnetism: Weiss theory of ferromagnetic, Heisenberg model and molecular field theory, Domain and Bloch wall energy, Spin waves and magnons, Curie Weiss law for susceptibility, Ferri and anti ferrimagnetism.
Unit-3	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-4	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.
Unit-5	Nano structure: Definition and properties of nano structured material, different method of preparation of nano materials, plasma enchanted chemical vapour deposition, electro deposition. structure of single wall carbon nono tubes (classification, chiral vector Cn, Translational vector T, Symmetry vector R, Unit Cell, Brillouin Zone) Electronic, mechanical, thermal and phonon properties.

Suggested Readings:

1. Kittel: Solid State Physics
2. Huang: Theoretical Solid State Physics
3. Weertmon and Weertman: Elementary Dislocation theory
4. Thomes: Multiple Electron microscopy
5. Tolansky: Multiple Beam Interferometer

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Session –2020-21

Class / d{kk	% M.Sc.
Semester / lsesLVj	% IV
Subject / fo"k;	% Physics
Title of Subject Group	% Laser Physics
fo"k; lewg dk 'kh"kZd	%
Paper No. / iz'ui= dzekad	% II
Compulsory / vfuok;Z ;k Optional / oSdfYid vfuok;Z	% Compulsory
Max. Marks vf/kdre vad 100	% CCE : 30, Main Exam : 70 Total - 100

Particulars / fooj.k

Unit-1	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-2	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-3	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-4	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 welding, Hole drilling, laser cutting, application of lasers in medicine.

Unit-5	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.

Suggested Readings:

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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Session –2020-21

Class / d{kk	**% M.Sc.**
Semester / lsesLVj	**% IV**
Subject / fo"k;	**% Physics**
Title of Subject Group	**% Computer Programming and Informatics**
fo"k; lewg dk 'kh"kZd	**%**
Paper No. / iz'ui= dzekad	**% III**
Compulsory / vfuok;Z ;k Optional / oSdfYid vfuok;Z	**% Compulsory**
Max. Marks vf/kdre vad 100	**% CCE : 30, Main Exam : 70 Total - 100**

Particulars / fooj.k

Unit-1	Conceptual framework of computer languages (Algorithm, Flowcharts) Need of structured programming, Top-down, bottom-up and modular programming design. Introduction to C languages-basic structure of C programme. Character set, keyword and identifiers, C data types, variable and data type declaration. Various operators like arithmetic, relational, logical assignment, conditional, increment and decrement operators. Evaluation of expression and operator precedence.
Unit-2	Input and output statement, control statement (If, If-else, If nested If-else statements switch, while, Do... while and for statements) Simple C programmes like search of prime number between given range of numbers, finding the smallest and largest of three numbers, sume of algebraic series, factorial of given number, roots of a quadratic equation, binary of decimal and decimal to binary conversion etc.
Unit-3	Functions: need of functions, calling the function by value and by reference, category of functions: no argument no return, argument but not return, argument with return. Recursion. One and two dimensional arrays. String and string handling functions like sprinf (), strepy (), sscanf (), strlen(), sizeorf () strcmp ()etc. Simple programs using user define functions, arrays and string functions.
Unit-4	Network: Terminals-Dumb terminals, smart terminals, intelligent tgerminals. Types of network: • According to range: LAN,MAN,WAN, Client server

	• According to topologies: BUS, RING, STAR, Mesh Network. Internet: History of Internet Service Provider (ISP), introduction to type of internet account-shell/Ac, TCP/IP A/c. types of connectivity-Dialup, Leased lines, Satellite. IP Address-Class A, Class B, Class C Domain Name address. URL-absolute and relative
Unit-5	Web enabled technology (Email and HTML): Web Browser: Internet Explorer, Netscape Navigator, Station and Dynamic web page Introduction to HTML. HTML tags: • <HTML>, <TITLE>, <HEAD>, <BODY> • <P>, , (ALIGN>, <I>, <B>, <DIV>, <PRE>, and their attributers • <IMG> <a> and their attributes • Ordered and unordered list tages • Tabes and associated tags and its properties Creation of simple forms using text, Password, text area, radio, submit, Rest and Hidden. Brief idea about HTTP. Search engine, its working, types of search engines: sub directories meta search engines, search function-AND and OR. Population search engines.

Suggested Readings:

1. Let us C : Yashwat Kanetkar
2. Programming with C : Balaguruswami
3. Internet and Web Page : V. K Jain

   'O' level module M1.2
4. Internet and Web Page design : Dr. P.D Murarka

   'O' level module M1.2
5. Internet and web page design : Pearl Software

   'O' level module M1.2
6. C# 2008 in simple step

   Dreamtech press
7. C# 2008 programming block book

   Dreamtech press

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Session –2020-21

Class / d{kk % **M.Sc.**

Semester / lsesLVj % **IV**

Subject / fo"k; % **Physics**

Title of Subject Group % **Digital Electronics**

fo"k; lewg dk 'kh"kZd %

Paper No. / iz'ui= dzekad % **IV-E**

Compulsory / vfuok;Z ;k Optional / oSdfYid vfuok;Z % **Optional**

Max. Marks vf/kdre vad 100 % **CCE : 30, Main Exam : 70 Total - 100**

Particulars / fooj.k

Unit-1	**OP-AMP:-** Differential amplifier circuit configurations: dual input balanced output ,dual input, single input unbalanced output (ac analysis) only, block diagram of a typical op amp analysis, schematic symbol of an op-amp. IC 555 timer Introduction, Architecture, Application as astable and monostable multivibraters.
Unit-2	**OP-AMP Parameters:-** Ideal op-amp parameters; input offset voltage, input offset current, input bias current, CMRR, SVRR, large signal voltage gain, Slew rate, Gain band width product, output resistance, supply currents power consumption, inverting and non-inverting inputs.
Unit-3	**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, L-C tunable oscillator, square wave generator.
Unit-4	**Microprocessors and Micro Computers:** Microprocessor and Architecture: Intel 8086, Microprocessor architecture modes of memory addressing, 8086/8088 Hardware specification: Pin-outs and pin functions, clock generator (8284A) Bus buffering and latching, Bus timing, Ready and wait State, Minimum mode versus maximum mode.
Unit-5	**Programming the Microprocessors:** Addressing modes: Data addressing modes, program memory addressing modes, stack memory-addressing modes. Instruction set: data movement Instructions, Arithmetic and login instructions, program control instructions. Programming example: Simple Assembly language programs table handling direct table addressing, searching a table sorting a table using pseudo ops.

Suggested Readings :

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

As Recommended by the Board of Studies
Session – 2020-21
Practical

Class	M. Sc	Semester - IV
Subject	Physics	
Title of Practical	Lab- A (Programing in C and HTML)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. C Programme for simple arithemetic operation.
2. C programme for calculation
3. C programme for finding factorial of a given number using a using defind function.
4. C programme for addition of 2 or 3 matrices.
5. C programme for selecting a prime number from 1 to 100.
6. Least square fitting.
7. To find the root of a quadratic equation.
8. To find product of two matrices.
9. To evaluate sum of finite series and the area under a curve.
10. To print all natural even/odd numbers between given limits.
11. HTML programme for making a web page using various headers and <B>, <T> and <U> tag.
12. HTML programme using ordered and un ordered list.
13. HTML programme for inserting image and table.
14. HTML Programme for preparing 3 linked web pages.
15. HTML Programme for making a web page using a Marquee, Animation and sound file.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

As Recommended by the Board of Studies

Session – 2020-21

Practical

Class	M. Sc	Semester - IV
Subject	Physics	
Title of Practical	Lab- B (QP. Amp., IC – 555 and Microprocessor)	
Medium of Instruction /Teaching	English	
Maximum Marks	100	

List of Experiments

1. To study QP. Amp. as and adder and sub tractor.
2. To studyQP. Amp. as inverting and non-inverting amplifier.
3. To study QP. Amp. as differentiator.
4. To study QP. Amp. as integrator.
5. To study QP. Amp.as Schmith Trigger.
6. To study QP. Amp. as squire wave generator.
7. To study QP. Amp.as low pass filter.
8. To study QP. Amp. as high pass filter.
9. To study QP. Amp. as band pass filter.
10. To study QP. Amp.as voltage follower
11. To study IC-555 as table multivibrator.
12. To studyIC-555 as bisable multivibrator.
13. To studyIC-555 as monostable multivibrator.
14. To studyIC-555timer as frequency divider.
15. To studyIC-555 as Schmitt Trigger.
16. To write programme to find the largest number.
17. To arrange numbers in ascending and descending order using 8086 microprocessor.
18. To write a programme in assembly language of INTEL 8086 processor for simple arithmetic operations.

- **Some other experiments may be added in the above list as and when required student will have to perform minimum ten experiments from the list.**

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As Recommended by the Board of Studies

Theory

<table>
<tr><td colspan="2">Session</td><td colspan="2">2019-20</td></tr>
<tr><td colspan="2">Class</td><td>Bsc. I Year</td><td>Paper I</td></tr>
<tr><td rowspan="2">Subject</td><td>(English)</td><td colspan="2">Physics</td></tr>
<tr><td>हिन्दी</td><td colspan="2">भौतिक शास्त्र</td></tr>
<tr><td rowspan="2">Title of the Paper</td><td>(English)</td><td colspan="2">Math Physics, Mechanics and Properties of Matter</td></tr>
<tr><td>(हिन्दी)</td><td colspan="2">गणितीय भौतिकी यांत्रिकी तथा द्रव्य के गुण</td></tr>
<tr><td colspan="2">Medium of instruction (Teaching)</td><td>Both (दोनो)</td><td>Question Paper Language - Both</td></tr>
<tr><td colspan="2">Max. Marks</td><td>(Theory) 40 + (CCE) 10</td><td>=50</td></tr>
</table>

Subject : **Physics**

Paper : **I**

Title of the Paper : **Mathematical Physics, Mechanics and Properties of Matter**

Unit-I : **Mathematical Physics** **[15 Lectures]**

Addition, subtraction and product of two vectors: Polar and axial vectors and their examples from physics: Triple and quadruple product (without geometrical application): Scalar and vector fields: Differentiation of a vector: Repeated integral of a function of more than one variable: Unit tangent and unit normal vector Gradient. Divergence and Curl: Laplacian operator; Idea of line surface and volume integrals; Gauss; Stokes and Green's Theorems.

इकाई–1: गणितीय भौतिकी **[15 Lectures]**

दो सदिशो का योग अंतर व गुणनफल, ध्रुवीय एवं अक्षीय सदिश एवं उनके भौतिकी उदाहरण तीन व चार सदिशों का गुणन (ज्यामितीय अनुप्रयोग के बिना), अदिश व सदिश क्षेत्र सदिश का अवकलन एक से अधिक चरों के फलन का बरम्बार समाकलन, इकाई स्पर्श सदिश, व इकाई नार्मल सदिश, सदिश का ग्रेडियन्ट, डायवर्जेस एवं कर्ल, लाप्लासीयन आपरेटर, रेखीय, पृष्ठीय, आयतन समाकलन गॉस, स्टोक व ग्रीन प्रमेय।

Unit-II **Mechanics** **[15 Lectures]**

Position, velocity, and acceleration vectors, Vectors. Components of velocity and acceleration in different coordinate systems Newton's Laws of motion and its explanation with problems various types of forces in nature (explanation). Pseudo Forces (e.g. Centrifugal Force), coriolis force and its applications. Motions under a central force. Derivation of Kepler's laws. Gravitational law and field, Potential due to a spherical body. Gauss & Poisson'sequation of

Gravitational self-energy. System of particles. Centre of mass and reduced Mass. Elastic and inelastic collisions.

इकाई–2: यांत्रिकी **[15 Lectures]**

स्थिति, वेग एंव त्वरण सदिश, गति व त्वरण के विभिन्न निर्देशांक पद्धतियों में घटक। न्यूटन के गति के नियम व इसकी व्याख्या, प्रकृति में विभिन्न बल व व्याख्या छद्म बल (उदाहरण, अभिकेन्द्रीय बल) कोरियालिस बल व इसके उदाहरण, केन्द्रीय बल के अन्तर्गत गति केप्लर के नियमों की निष्पति, गुरूत्वाकर्षण का नियम व क्षेत्र, गोलाकार पिण्ड का गुरूत्वीय विभव, गॉस व पायसन की गुरूत्वीय स्व उर्जा की समीकरण कणों का निकाय द्रव्यमान केन्द्र व समानीत द्रव्यमान, प्रत्यास्थ व अप्रत्यास्थ टक्कर।

Unit-III General Properties of Matter [15 Lectures]

Elastic moduli and their relations, Determination of Y of rectangular thin bar loaded at the centre: Torsional oscillations. Torsional rigidity of a wire, to determine n by torsional oscillations. Surface Tension. Angle to Contact, Capillary Rise Method; Energy required to raise a liquid in capillary tube; Factors affecting surface tension; Jeager's method for Determination of surface tension: Applications of Surface Tension. Concept of Viscous Forces and Viscosity. Steady and Turbulent Flow. Reynolds's number: Equation of continuity: Bernoulli's Principle: Application of Bernoulli's equation-(i) Speed of Efflux (ii) Venturimeter (iii) Aspirator Pump (iv) Change of Plane of motion of a spinning ball.

इकाई–3: द्रव्य के सामान्य गुण **[15 Lectures]**

प्रत्यास्थता गुणांक एवं उनके संबंध, मध्य में भारितपतली आयताकार छड (केन्टीलीवर) के Y का निर्धारण, ऐठन, दोलन, किसी तार की ऐंठन दृढ़ता व इसका ऐंठन दोलन विधि से निर्धारण। पृष्ठ तनाव, स्पर्श कोण, केशिका, उन्नयन विधि, केशिका में द्रव चढ़ाने में आवश्यक उर्जा, पृष्ठ, तनाव को प्रभावित करने वाले कारक जेगर, की विधि से पृष्ठ तनाव का निर्धारण, पृष्ठ तनाव के अनुप्रयोग। श्यानबल की संकल्पना व श्यानता गुणांक, धारोरेखीय व विक्षुब्ध प्रावह, रेनॉल्ड संख्या, सातत्य समीकरण बरनॉली का सिद्धांत बरनॉली प्रमेय के अनुप्रयोग : 1 एफ्लक्स की चाल 2. वेन्चुरीमीटर 3. एस्पिरेटर पम्प 4. स्पिनिंग बॉल के तल का परिवर्तन।

Unit-IV Oscillations [15 Lectures]

Concept of Simple, Periodic & Harmonic Oscillation with illustrations; Differential equation of harmonic oscillator; Kinetic and potential energy of Harmonic Oscillator; Oscillations of two masses connected by a spring; Translational and Rotational motion, Moment of Inertia and their Product, Principal moments and axes, Motion of Rigid Body, Euler's equation.

इकाई–4 : दोलन **[15 Lectures]**

सरल, आवर्ती व हार्मोनिक गति की सचित्र संकल्पना, आवर्ती दोलित्र का समीकरण, आवर्ती, दोलित्र की गतिज व स्थितिज उर्जा, स्प्रिंग से जुडे दो पिंड़ो का दोलन, स्थानांतरणीय व

घूर्णीय गति, जड़त्व आघूर्ण व उनका गुणन, मुख्य आघूर्ण एवं अक्ष, दृढ पिण्ड की गति, यूलर समीकरण।

Unit-V **[15 Lectures]**

Relativistic Mechanics: Michelson-Morley experiment and its outcome; Postulates of Special Theory of Relativity: Lorentz Transformation Simultaneity and order of events; Lorentz contraction; time dilation; Relativistic, transformation of velocity. Frequency and wave number Relativistic addition of velocities; Variation of mass with velocity. Doppler effect.

Earlier Developments in physics up to 18th Century Contributions of Aryabhatt. Archimedes, Nicolas Copernicus, Galileo galilei, Huygens. Rebert Hooke. Torricelli, Vernier, Pascal, Kepler, Newton, Boyle, Young, Thompson, Coulomb. Amperes. Gauss. Biot-Savarts. Cavendish. Galvani. Franklin and Bernoulli.

इकाई–5 : **[15 Lectures]**

सापेक्षकीय यांत्रिकीः माइकल्सन व मोरले का प्रयोग एवं इसके निष्कर्ष, विशिष्ट सापेक्षिकता के सिद्धांत की अवधारणाएं, लॉरेज, रूपांतरण समकालिक घटना एवं घटनाओं के क्रम, लॉरेंज संकुचन समय विस्तारण वेग, आवृत्ति तथा वेव नम्बर का सापेक्षकीय रूपान्तरण, वेगों का सापेक्षकीय योग, वेग के साथ द्रव्यमान परिवर्तन। **डाप्लर प्रभाव, चार आयामी संवेग सदिश भौतिकीके समीकरणों का साह सनयोजन** भौतिकी का प्रारंभिक विकास 18वीं सदी तकः आर्यभट्ट, आर्कमिडिज निकोलस कोपरनिकस, गेलिलीओ गैलिली, हॉयग्न, राबर्टहुक, टॉरसेली, वर्नियर, पॉस्कल, केप्लर, न्यूटन, बॉयल यंग, थॉमसन, कुलॉम्ब, एम्पीयर, गॉस, बॉयो–सेवर्ट, केवनडिश, गेलवानी, फ्रेंकलीन और बरनॉली।

Reference Books:

1. University Physics Sears and Zeeman sky. XIth edition. Pearson Education.
2. Concepts of Physics: H.C. Verma. Bharti Bhavan Publishers
3. Problems in Physics P.K. Srivastava. Wiley Eastern Ltd.
4. Berkley Physics Course. Vol I. Mechanics: E.M Purcell. McGraw hill
5. Properties. of Matter. D.S. Mathur Shamlal Chritable Trust, New Delhi
6. Mechnics: D.S. Mathur, S. Chand and Company new Delhi - 5
7. The Feymman Lectures in Physics Vol. I: R.P. Feymman. R.B. Lighton and M. Sands

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As Recommended by the Board of Studies

Theory

Session		**2019-20**	
Class		**Bsc. I Year**	**Paper 2**
Subject	**(English)**	**Physics**	
	हिन्दी	**भौतिक शास्त्र**	
Title of the Paper	**(English)**	**Thermodynamics and Statistical Physics**	
	(हिन्दी)	**उष्मागतिकी तथा सांख्यिकी भौतिकी**	
Medium of instruction (Teaching)		**Both (दोनों)**	**Question Paper Language – Both**
Max. Marks		**(Theory) 40 + (CCE) 10**	**=50**

Subject : Physics

Paper : II

Title of the Paper : Thermodynamics and Statistical Physics

Unit-I Thermodynamics-I [15 Lectures]

Reversible and irreversible process, Heat engines Definition of efficiency Carnot's ideal heat engine, Carnot's cycle, Effective way to increase efficiency, Carnot's engines and refrigerator, Coefficient of performance, Second law of thermodynamics, Various statements of second law of thermodynamics, Carnot's theorem, Chaperon's latent . heat equation, Carnot's cycle and its applications, Steam engine Otto engine. Petrol engine, Diesel engine.

इकाई–1: उष्मागतिकी–I **[15 Lectures]**

उत्क्रमणीय एवं अनुत्क्रमणीय प्रक्रम, कार्नो का आदर्श चक्र, इसकी दक्षता बढ़ाने के प्रभावी तरीकें कानों का उष्मीय इंजन व प्रशीतक, दक्षता गुणांक, उष्मागतिकी का द्वितीय नियम व इसके विभिन्न कथन, कानों का प्रमेय, क्लेपरियॉन की गुप्त उष्मा समीकरण कार्नोचक्र एवं उसके अनुप्रयोग। उष्मीय इंजिन, ऑटो इंजिन, पेंट्रोल इंजिन, डीजल इंजिन।

Unit-II Thermodynamics-II [15 Lectures]

Concept of entropy, Change in entropy in adiabatic process, Change in entropy in reversible cycle, Principle of increase of entropy, Change in entropy in irreversible process. T-S diagram. Physical signification of Entropy, Entropy of a perfect gas. Kelvin's thermodynamic scale of temperature. The size of a degree. Zero of absolute scale, Identity of a perfect gas scale and absolute scale. Third law of thermodynamics. Zero point energy, Negative temperatures (not

possible), Heart death of the universe, Relation between thermodynamic variable (Maxwell's Relations). Adiabatic demagnetization, Joule Kelvin effect and liquefaction of gases

इकाई–2: उष्मागतिकी–II **[15 Lectures]**

एन्ट्रापी की संकल्पना, रूद्धोष्म प्रक्रम में एन्ट्रीपी का परिवर्तन चक्रय प्रक्रम में एन्ट्रापी का परिवर्तन, एन्ट्रापी के वृद्धि का सिद्धांत, उत्क्रमणीय व अनुत्क्रमणीय प्रक्रम में एन्ट्रापी का परिवर्तन–T-S आरेख, एन्ट्रापी का भौतिक महत्व, आदर्श गैस की एन्ट्रापी, केल्विन का उष्मागतिक ताप पैमाना, परम पैमाने का शून्य ताप, आदर्श गैस व परम ताम पैमाने में साम्यता। उष्मागतिकी का तृतीय नियम, शून्य बिन्दू उर्जा, ऋणात्मक तापक्रम (सम्भव नहीं) ब्रहमाण्ड की उष्मीय समाप्ति। उष्मागिकी चरों में संबंध (मेक्सवेल के समीकरण), **रुद्धोशम विचुंबकन, जूल केल्विन प्रभाव तथा गैसों का द्रविकरण**

Unit-III Statistical Physics-I [15 Lectures]

Description of a system: Significance of statistical approach, Particle-states, System-states. Microstate and Macro-states of a system. Equlibrium States, Fluctuation Classical & Statistical Probability the equi-probability postulate, Statistical ensemble, Number of states accessible to a system. Phase space. Micro Canonical Ensemble, Canonical Ensemble. Helmholtz freee energy, Enthalpy, First law of thermodynamics, Gibbs free energy. Grand Canonical Ensemble.

इकाई–3: सांख्यिकीय भौतिकी–1 **[15 Lectures]**

निकाय का वर्णन: सांख्यिकीय अवधारणा का महत्व, कण एवं निकाय की अवस्थाऐं, निकाय की सूक्ष्म एवं स्थूल अवस्थाएं साम्य अवस्थाऐं विचलन, चिरसम्मत व सांख्यिकी प्रायिकता, पूर्व प्रायिकता सिद्धान्त सांख्यिकी एन्सेम्बल, किसी निकास के लिये अभिगम्य अवस्थाऐं, कला आकाश, माईक्रो केनोनीकल एन्सेम्बल, केनोनीकल एन्सेम्बल, हेल्मोल्टज मुक्त उर्जा, एन्थलपी, उष्मागतिकी का प्रथम नियम, गिब्स, मुक्त उर्जा, ग्रेंड केनोनीकल एन्सेम्बल.

Unit-IV Statistical Physics-II [15 Lectures]

Statistical Physics: Phase space, The Probability of a distribution. The most probable distribution and its narrowing with increase in number of particles. Maxwll-Boltzmnn statistics Molecular speeds. Distribution and mean. r.m.s and most probable velocity. Constraints of accessible state. and maccessible states Quantum Statistics: Partition Function, Relation between Partition Function and Entropy, Bose-Eistein statistics. Black-Body radiation, The Rayleigh-Jeans formula, The Planck radiation formula, Fermi-Dirac Statistics. Comparison of results. Concept of Phase transitions.

इकाई–4: सांख्यिकीय भौतिकी–II **[15 Lectures]**

सांख्यिकीय यांत्रिकी: कला आकाश, वितरण की प्रायिकता, अधिकतम, संभाव्य वितरण व इसका कणों की संख्या बढ़ने पर संकुचन, मेक्सवेल, बोल्टजमैन सांख्यिकी, आणविक चाल का

वितरण, औसत चाल, वर्ग–माध्य–मूल चाल और अधिकतम प्रसम्भाव वेग, प्रतिबंध अभिगम्य, एवं अनअभिगम्य अवस्थाओं के प्रतिबंध। क्वांटम सांख्यिकीः पार्टीशन फलन, एंट्रापी व पार्टीशन फलन में संबंध, बोस आइन्सटीन सांख्यिकी, कृष्ण पिण्ड विकिरण, रेले जीन्स सूत्र, प्लांक विकिरण सूत्र, फर्मी–डिराक सांख्यिकी परिणामों की तुलना फेस संक्रमण की संल्पना।

Unit-V Contributions of Physicists [15 Lectures]

S.N. Bose, M.N. Saha, Maxwell, Clausois. Boltzmaan. Joule, Wien, Einstein, Plank Bohr. Heiesnberg. Fermi, Dirac, Max Born Bardeen.

इकाई–5ः भौतिकविदों का योगदान **[15 Lectures]**

एस.एन. बोस, एम.एन. साहा, मैक्सवेल, क्लासियस, बोल्टमैन, जूल, वीन, आइन्सटीन, प्लाक बोहर, हाईजनबर्ग फर्मी, डिराक, मेस्कबार्न वार्डीन।

Text and Reference Books:

1. Heat and Thermodynamics: Mark W. Zemansky. Richard H.Ditman. Sventh Edition. McGraw-Hill International Editions.
2. Thermal Physics (Heat and Thermodynamics) A.B. Gupta, H.P. Roy, Books and Allied (P) Ltd. Calcutta.
3. Heat and Thermodynamics: Brijlal and N. Subrahmanyam. S. Chand & Company Ltd. New Delhi.
4. Berkley Physics Course, Vol 3, Thermodynamics: F, Reif, Mergraw Hill
5. Thermodynamics and Statistical Physics, D.P. Khandelwal and A.K. Pandey, Himalaya Publication.
6. Laboratory manual of Physics for undergraduate classes, D.P. Khandelwal Vani Publication house. New Delhi.

Class: B.Sc. First Year

Max. Marks: 50

Subject : **Physics**

For Regular Students

Practical	Sessional	Viva	Total
25	10	15	50

For Ex-Student

Practical	Sessional	Viva	Total
35	00	15	50

List of Practical's

1. To verify laws of parallel and perpendicular axes for moment of inertia.
2. To determine acceleration due to gravity using compound pendulum.
3. To determine damping coefficient using a bar pendulum.
4. To determine Young's Modulus by bending of beam Method.
5. To determine Young's Modulus using Cantilever method.
6. To determine coefficient of rigidity by static method.
7. To determine Coefficient of rigidity by dynamic method.
8. To determine Surface Tension by Jaegar's method.
9. To determine Surface Tension of a liquid by capillary rise method.
10. To determine Viscosity of fluid using Poisellie's methods.
11. To study conversion of mechanical energy into heat using Calender & Barne's Method.
12. To determine heating efficiency of electrical Kettle with various voltages.
13. To determine heating temperature coefficient of resistance using platinum resistance thermometer.
14. To determine thermo electromotive force by a thermocouple method.
15. To determine heat conductivity of bad conductors of different geometry by Lee's method.

16. To verify Newton's Laws of cooling.

17. To determine specific heat of Coefficient of thermal conductivity by Searl's Method.

18. To determine Specific heat of a liquid.

19. To compare Maxwell-Boltzmann, Bose Einstein and Fermi-Dirac Distribution function vs temperature using M.S. Excel/C++

20. To plot equation of state and Vander-Wall equation with temperature using M.S. Excel/C++

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Session 2019-20

Theory

Class	B.Sc.	Semester III
Subject	Physics	
Title of Paper	Optics	
Medium of Teaching	English/Hindi	
Compulsory/Optional	Compulsory	
Maximum Marks :100	70 + (C.C.E.) 30 = 100	

Unit-1 Geometrical Optics [15 Lectures]

Reflection and refraction: Fermat's Principle, Refraction at a spherical surface,
Aplanatic points and its applications, Lens formula, Combination of thin lenses and equivalent focal length.
Optical instruments: Dispersion and dispersive power, chromatic aberration and achromatic combination, different types of aberration (qualitative) and their remedy. Need for multiple lenses in eyepieces, Ramsden and Huygens eye-piece.

Unit-II Interference of light [**15 Lectures**]

The principle of superposition, two slit interference, coherence requirement for the sources, optical path retardations, Lateral shift of fringes, Rayleigh refractometer and other applications. Localised fringes, thin films, interference by a film with two nonparallel reflecting surfaces, Newton's rings. Haidinger fringes (Fringes of equal inclination), Michelson interferometer, its application for precision determination of wavelength, wavelength difference and the width of spectral lines. Intensity distribution in multiple beam interference, Fabry-Perot interferometer and Etalon.

Unit-III Diffraction [**15 Lectures**]

Fresnel diffraction: Fresnel's theory of half period zone, diffraction at straight edge, rectilinear propagation. *Fraunhoffer diffraction:* Diffraction at a slit, phasor diagram and integral calculus methods. Diffraction at a circular aperture and a circular disc, Rayleigh criterion of resolution of images. Resolving power of telescope and microscope. Outline of phase contrast microscopy.

Diffraction Grating: Diffraction at N-parallel slits, Intensity distribution, Plane diffraction grating, Concave grating and its mountings. Resolving power of a grating and comparison with resolving power of prism and of a Fabry Parot etalon.

Unit-IV Polarisation [**15 Lectures**]

Transverse nature of light waves, Polarization of electromagnetic (em) waves, Plane polarised light – production and analysis, Description of Linear, circular and elliptical polarisation. Propagation of em waves in anisotropic media, uniaxial and biaxial crystals, symmetric nature of dielectric tensor, Double refraction, Hygen's principle, Ordinary and extraordinary refractive indices, Fresnel's formula, light propagation in uniaxial crystal, Nicol prism, Production of circularly and elliptically polarized light, Babinet compensator and applications, Optical rotation, Optical rotation in liquids and its measurement through Polarimeter.

Unit-V Lasers and Photo Sensors [**15 Lectures**]

A brief history of lasers, characteristics of laser light, Einstein prediction, Relationship between Einstein's coefficients (qualitative discussion only), Pumping schemes, Resonators, Ruby laser, He-Ne laser, Applications of lasers, Principle of Holography. Light Sensors: Photodiodes, Phototransistors, and Photomultipliers.

References Books *(for Unit-I to Unit-IV)***:**

1. Fundamentals of Optics: F.A. Jenkins and H.E. White, 1976, McGraw-Hill.
2. Principles of Optics: B.K. Mathur, 1995, Gopal Printing.
3. Fundamentals of Optics: H.R. Gulati and D.R. Khanna, 1991, S.Chand Publication.
4. University Physics: F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986. Addison-Wesley.
5. Optics: Ajoy Ghatak, McGraw Hill Publications.
6. Principles of Optics: Max Born and Wolf, Pregmon Press.

References Books *(for Unit-V only)***:**

1. An introduction to Lasers – Theory and Applications: M. N. Avadhanalu, S. Chand and Co, Ltd.
2. Solid State Physics: P.K. Palanisamy, Scitech Publications (India) Pvt. Ltd.
3. Principles of Laser : Orazio Svelto, Plenum Press, NewYork
4. Instrument measurement and Analysis: B.C. Narka and K.K. Chaudhary, Tata McGraw Hill Publishing Company 16th reprint Chapter-1.

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As Recommended by the Board of Studies

Session 2019-20

Theory

Class	B.Sc.	Semester IV
Subject	Physics	
Title of Paper	Electrostatics, Magnetostatics and Electrodynamics	
Medium of Teaching	English/Hindi	
Compulsory/Optional	Compulsory	
Maximum Marks :100	70 + (C.C.E.) 30 = 100	

Unit-1 Electrostatics [15 Lectures]

Coulombs law in vacuum expressed in vector forms, calculations of electric field **E** for simple distributions of charge at rest, dipole and quadruple fields. Work done on a charge in an electrostatic field expressed as a line integral, conservative nature of the electrostatic field. Relation between electric field & electric potential ($\mathbf{E} = -\nabla V$), torque on a dipole in a uniform electric field and its energy, flux of the electric field, Gauss's law and its application for finding **E** for symmetric charge distributions, Gaussian pillbox, fields at a surface of a conductor, screening of **E** field by a conductor. Capacitors, electrostatic field energy, force per unit area of the surface of a conductor in an electric field, conducting sphere in a uniform electric field, point charge in front of a grounded
infinite conductor. Dielectrics, parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector **P**, relation between displacement vector **D**, **E** and **P**. Molecular interpretation of Claussius-Mossotti equation, boundary conditions satisfied by **E** and **D** at the interface between two homogenous dielectrics, illustration through a simple example.

Unit-2 Magnetostatics [15 Lectures]

Force on a moving charge, Lorentz force equation and definition of **B**, force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment, angular momentum and gyromagnetic ratio, Biot and Savart's law, calculation of **H** for simple geometrical situations such as Solenoid, Anchor ring. Ampere's Law, $\nabla\times\mathbf{B} = \mu_0\mathbf{J}$, $\nabla.\mathbf{B} = 0$. Field due to a magnetic dipole, free and bound currents, magnetization vector (**M**), relationship between **B**, **H** and **M**. Derivation of the relation $\nabla\times\mathbf{M} = \mathbf{J}$ for nonuniform magnetization.

Unit-3 Current Electricity and Bio electricity [**15 Lectures**]
Current Electricity: Steady current, current density **J**, non-steady currents and continuity equation, Kirchoff's laws and analysis of multiloop circuits, growth and decay of current in LR

and CR circuits, decay constants, LCR circuits. AC circuits, complex numbers and their applications in solving AC circuits problems, complex impedance and reactance, series and parallel resonance. Q-factor, power consumed by an A.C. circuit, power factor, Y and Δ networks and transmission of electric power.

Bioelectricity: Electricity observed in living systems, Origin of bioelectricity, Sodium and potassium transport, Resting potential and action potential, Nernst's equation, Conduction velocity, Origin of compound action potential, Neuron structure and function, An axon as cable, Membrane resistance and capacitance.

Unit-4 Motion of Charged Particles in Electric and Magnetic Fields [**15 Lectures**]

(Note: The emphasis here should be on the mechanical aspects and not on the details of the apparatus mentioned which are indicated as applications of principles involved.)

E as an accelerating field, electron gun, discharge tube, linear accelerator. **E** as deflecting field - CRO, Sensitivity of CRO. Transverse **B** field; 180° deflection, Mass spectrograph and velocity selector, Curvatures of tracks for energy determination for nuclear particles; Principle and working of Cyclotron. Mutually perpendicular and parallel **E** & **B** fields; Positive ray parabolas, Discovery of isotopes, Elements of Mass Spectrographs, Principle of magnetic focusing **(**lenses**).**

Unit-5 Electrodynamics [**15 Lectures**]

Electromagnetic induction, Faraday's Laws, Electromotive force, Integral and differential forms of Faraday's laws, Self and mutual inductance, Transformers, Energy in a static magnetic field, Maxwell's displacement current, Derivations of Maxwell's equations, Electromagnetic field energy density. Poynting vector, Electromagnetic wave equation, Plane electromagnetic waves in vacuum and dielectric media, Reflection at a plane boundary of dielectrics, Fresnel's Laws, Polarization by reflection and total internal reflection, Waves in a conducting medium, Reflection and refraction by the ionosphere.

References:

1. **Introduction to Electrodynamics:** David J. Griffiths, 4th Edition, Printice Hall.
2. **Classical Electrodynamics:** Jhon David Jackson, Jhon Wiley & Sons.
3. **Electrodynamics:** Emi Cossor & Bassin Lorraine, Asahi Shimbunsha Publishing Ltd.
4. **From Neuron to Brain:** Kuffler and Nicholas, Sinauer Associates, Inc Pub. Sunderland, Masschuetts *(Reference for topics of Bioelectricity)*

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Syllabus for Physics
(As Recommended by the Board of Studies)
Session: 2019-2020

Class		**B. Sc. Third Year**			
Subject	**(English)**	**Physics**		**Paper No.: I**	
	(हिन्दी)	**भौतिक शास्त्र**			
Title of the paper	**(English)**	**Quantum Mechanics and Spectroscopy**			
	(हिन्दी)	**क्वांटम यांत्रिकी एवं स्पेक्ट्रोस्कोपी**			
Compulsory Paper		**Medium of Teaching : Hindi, English**			
Maximum Marks		**Total : 50**	**Main Exam:**	**C.C.E.:**	

Theory

Unit		*Syllabus*	*Recommended Books*
Unit I	(English)	Quantum Mechanics – 1 Particles and waves: Photoelectric effect. Black body radiation. Compton effect. de Broglie hypothesis. Wave Particle duality. Davission – Germer experiment. Wave packets. Concept of phase and group velocity. Two slit experiment with electrons. Probability. Wave amplitude and wave functions. Heisenberg's uncertainty principle with illustrations. Basic postulates and formalism of Schrodinger's equation. Eigenvalues, probabilistic interpretation of wave function, Equation of continuity. Probability current density. Boundary conditions on the wave function. Normalization of wave function.	
	(हिन्दी)	**क्वांटम यांत्रिकी– 1** कण एवं तरंग – प्रकाश विद्युत प्रभाव, कृष्ण पिण्ड विकिरण, क्राम्पटन प्रभाव। डी–ब्रोगली परिकल्पना, तरंग – कण द्वैतता, डेवीसन जर्मर प्रयोग, तरंग पैकेट, तरंग एवं समूह वेग की अवधारणा, इलेक्ट्रॉन का द्वि – स्लिट प्रयोग, प्रायिकता, तरंग आयाम व तरंग फलन, हाइजनबर्ग का अनिश्चितता का सिंद्धांत व उदाहरण, श्रोडिंजर समीकरण व उसकी मूलभूत अवधारणाएँ। आइगन मान, तरंग फलन की प्रायिकता आधारित व्याख्या, सातात्य समीकरण, प्रायिकता धारा धनत्व, तरंग फलन पर सीमांत शर्तें। तरंग फलन का प्रसामान्यीकरण।	

Signature of Member of B.O.S. ....

Unit II	**(English)**	**Quantum Mechanics – 2** Time independent Schrodinger equation: One dimensional potential well and barrier. Boundary conditions. Bound and unbound states. Reflection and transmission coefficients for a rectangular barrier in one dimension. Explanation of alpha decay. Quantum phenomenon of tunneling. Free particale in one-dimensional box, eigen functions and eigen values of a free particle, one-dimensional simple harmonic oscillator, energy eigen values from hermite differential equation, wave function for ground state. Particle in a spherically symmetric potential. Rigid rotator.	
	(हिन्दी)	**क्वांटम यांत्रिकी– 2** समय अनिर्भर श्रोडिंजर समीकरणः एक विमीय विभव कूप व प्राचीर, सीमांत शर्ते, बद्ध व अबद्ध अवस्थाएँ, आयाताकार प्राचीर (I-D) से परावर्तन व पारगमन गुणांक। a क्षय की व्याख्या, सुरंगन की क्वाटंम घटना। एक–विमीय बाक्स में मुक्त कण हेतु आइगन फलन एवं आइगन मान। एक विमीय सरल आवर्त दोलित्र, हरमाइट अवकल समीकरण से उसके आइगन मान, मूल अवस्था का आइगन फलन, गोलीय सममित विभव मे कण, दृढ़ घूर्णक।	
Unit III	**(English)**	**Atomic Spectroscopy** Atoms in electric and magnetc fields Quantum numbers, Bohr model and selection rules, Stern-Gerlach experiment, Spin as an intrinsic quantum number. Incompatibility of spin with classical ideas. Orbital angular momentum. Fine structure. Total angular momentum. Pauli exclusion principle. Many particles in one dimensional box. Symmetric and anti-symmertric wave functions. Atomic shell model. Spectral notations for atomic states. Spin-orbit coupling. L-S and J-J coupling. Zeeman effect. Continuous and Characteristic X-rays. Mossley's law.	

	(हिन्दी)	**परमाणु स्पेक्ट्रोस्कोपी** विद्युतीय व चुम्बकीय क्षेत्र में परमाणु – क्वांटम संख्यांक, बोहर मॉडल व वरण के नियम, स्टर्न–गर्लक प्रयोग, चक्रण– मूलभूत क्वांटम संख्या। चक्रण की चिरसम्मत सिद्धांत से असंगति। कक्षीय कोणीय संवेग, फाइन स्ट्रक्चर कुल कोणीय संवेग, पाऊली का अपवर्जन सिद्धांत। एक विमीय बाक्स में बहुलकण सममिती व असममिती तरंग फलन, परमाणु कोश मॉडल। परमाणवीय अवस्था हेतु स्पेक्ट्रमी संकेतन, स्पिन आरबिट कपलिंग, L-S व J-J युग्मन, जीमन प्रभाव। सतत व अभिलाक्षणिक X–किरण वर्णक्रम, मोसले का नियम।	
Unit IV	(English)	**Molecular Spectroscopy** Various types of spectra. Rotational spectra. Intensity of spectral lines and determination of bond distance of diatomic molecules. Isotope effect. Vibrational energies of diatomic molecules. Zero point energy. Anharmonicity. Morse potential. Raman effect, Stokes and anti-Stokes lines and their intensity difference. Electronic spectra. Born-Oppenheimer approximation Frank-Condon principle. Singlet and triplet states. Fluorescence and phosphorescence.	
	(हिन्दी)	**आणविक स्पेक्ट्रोस्कोपी** विभिन्न प्रकार के स्पेक्ट्रा (वर्णक्रम), घूर्णी स्पेक्ट्रा, वर्णक्रम रेखाओं की तीव्रता व द्वि–परमाणविक अणु की बद्ध दूरी, समस्थनिक प्रभाव, द्वि–परमाणविक अणु की कम्पन उर्जा, शून्य बिन्दु उर्जा, अनहार्मोनिसीटी (अनावृत्ति)। मोर्स विभव, रमन प्रभाव। स्टोक व प्रति स्टोक रेखाएँ व इनका तीव्रता अन्तर, इलेक्ट्रॉनिक वर्णक्रम। बार्न ऑपनहायमर सन्निकटता, फ्रेंक कार्डन सिंद्धांत, एकल व त्रिक अवस्थाएँ, प्रतिदीप्ति एवं स्फुरदीप्ति।	

Unit V	**(English)**	**Nuclear Physics** Basic Properties of Nucleus: Shape, Size, Mass and charge of the nucleus. Stability of the nucleus and Binding energy. Interaction of Charged particles and Neutrons with matter, working of nuclear detecters. Ionisation chamber, G. M. Counter, proportional counter, Scintillation counter, cloud chamber. Alpha particle spectra-velocity and energy of alpha paricles. Geiger-Nuttal law.Nature of beta ray spectra the neutrino Energy levels and decay schemes. Positron emission and electron capture. Selection rules. Beta absorption and range of beta particles.Kurie plot. Nuclear rections. Pair production. Q-Values and threshold of nuclear reactions. Nuclear reaction cross-Sections. Examples of different type of reaction and their charactertistics. Compound nucleus. Bohr's postulate of compound nuclear reaction. Semi emphrical mass formula, Liquid drop model, shell model, nuclear fission and nuclear fusion	
	(हिन्दी)	**नाभिकीय भौतिकी** **नाभिक की आकृति सहती आवेश एवम आकार व नाभिक का स्थायीत्व** नाभिक के मूलभूत गुणः न्यूट्रॉन तथा आवेशित कणों की द्रव्य के साथ अनुक्रिया, नाभिकीय संसूचक–आयनन कोष्ठ, गाइगर मूलर गणक, अनुपातिक गणक, प्रस्फुरण गणक, अभ्रकोष्ठ, बंधन ऊर्जा , अल्फा–कण का वेग एवं ऊर्जा, गाइगर–नेटल नियम, बीटा–किरण वर्णक्रम की प्रकृति, न्यूट्रीनों, ऊर्जा स्तर एवं क्षय पद्धति, पोजीट्रान उत्सर्जन एवं इलेक्ट्रॉन प्रग्रहण, चयन (वरण) नियम, बीटा अवशोषण एवं बीटा कण का परास, क्यूरी आरेख, नाभिकीय अभिक्रियाएँ, युग्म उत्पादन, Q– मान एवं नाभिकीय अभिक्रिया की देहली (थ्रेशोल्ड), नाभिकीय अभिक्रिया का अनुप्रस्थ काट, विभिन्न प्रकार की अभिक्रियाओं के उदाहरण एवं अभिलाक्षणिक, यौगिक नाभिक, यौगिक नाभिकीय अभिक्रिया की बोहर अभिकल्पना, अर्धमूलानुपाती सूत्र, द्रव बूंद मॉडल, कोश मॉडल, नाभिकीय विखंडन एवं संलयन।	

References :

1. **Quantum machanics:** V. Devanathan, Narosa Publishing House, New Delhi, 2005
2. **Quantum machanics**: B. H. Bransden, Pearson Education, Singapore, 2005
3. **Quantum Mechanics**: Concepts and Applications, Nouredine Settili. Jacksonville tate University, Jacksonville, USA Johan Wiley and Sons. Ltd. 2009
4. **Physics of Atoms and molecules**: B.H Bransden and C. J. Joachaim. Pearson education. Singapore, 2003

5. **Fundamentals of Molecular Spectroscopy**: C. M. Banwell and M. Mccash. McGraw Hill (U. K. Edition)
6. **Introduction to Atomic Physics**, H. E. White.
7. **Quantum Mechanics: Schaums Outlines**, Y. Peleg, RPnini, E. Zaarur, E. Hecht.

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<tr><td>(हिन्दी)</td><td colspan="2">भौतिक शास्त्र</td></tr>
<tr><td rowspan="2">Title of the paper</td><td>(English)</td><td colspan="3">Solid State Physics and Devices</td></tr>
<tr><td>(हिन्दी)</td><td colspan="3">ठोस अवस्था भौतिकी एवं युक्तियाँ</td></tr>
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Theory

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Crystal Structure and bonding: Crystalline and amorphous solids. Translational Symmetry Lattice and basis. Unit Cell. Reciprocal Lattice. Fundamental Types of Lattices (Bravias Lattice). Miller indices Lattice Planes. Simple Cubic. Face Centered Cubic. Body Centered Cubic Lattices. Laue And Bragg's Equations. Determination of crystal structre with X-ray, X- ray spectrometer. ionic, covalant, metallic, van der Waals and hydrogen bonding. Band theory of solids, Periodic potential and Bloch Theorem. Kronig-Penny model (Qualitative).</td><td rowspan="2"></td></tr>
<tr><td>(हिन्दी)</td><td>ठोस अवस्था भौतिकी–1
क्रिस्टलीय, संरचना एवं आबंधनः क्रिस्टलीय एवं अक्रिस्टलीय ठोस, स्थानांतरण सममिति, जालक व आधार इकाई सेल, व्युत्क्रम जालक, जालकों के मौलिक प्रकार (ब्रेवाइस लेटिस), मिलर सूचकांक, जालक तल। सरल घनाकार, फलक केन्द्रित घनाकार, अन्तः केन्द्रित घनाकार लेटिसेस। लॉवे व ब्रेग का समीकरण, X किरणों से क्रिस्टल की संरचना ज्ञात करना, X किरण स्पेक्ट्रममापी। आयनिक, सह–संयोजक, धात्विक, वॉण्डरवाल एवं हायड्रोजन बंधन। ठोस पदार्थो के कलए बैण्ड सिद्धांत, आवर्ती विभव एवं ब्लॉच प्रमेय। क्रोनिंग–पैनी मॉडल (गुणत्मक विवेचना)</td></tr>
</table>

Unit II	**(English)**	**Solid State Physics-2** Lattice Structure and Properties: Dulong Petit. Einstein and Debye theories of specific heats of solids. Elastic and atomic force constants. Dynamics of a chain of similar atoms and chain of two types of atoms. Optical and acoustic modes. Electrical resistivity. Specific heat of electron. Wiedemann-Franz law. Hall effect. Response of substances in magnetic field, dia-para-and ferromagnetic materials. Classical Langevin theory of dia and paramagnetic domains. Curie's law. Weiss theory of ferromagnetism and ferromagnetic domains. Discussion of B-H hysteresis.	
	(हिन्दी)	**ठोस अवस्था भौतिकी–2** **जालक संरचना एवं गुण:** विशिष्ट उष्मा का ड्यूलोंग–पेटिट, आइन्सटीन डिबाई सिद्धान्त, प्रत्यास्थ एवं परमाण्विक बल नियतांक। एक परमाण्विक व द्विपरमाण्विक कड़ी की गतिकी, प्रकाशकीय व ध्वनिकी विधाएँ, विद्युतीय प्रतिरोधकता, इलेक्ट्रॉन की विशिष्ट उष्मा, वाइडमेन–फ्रेंज नियम। हॉल प्रभाव, चुम्बकीय क्षेत्र में पदार्थों की अनुक्रिया। प्रति, अनु, एवं लौह चुम्बकीय पदार्थ। प्रति एवं अनु चुम्बकीय डोमेन्स का लैंगविन का चिरसम्मत सिद्धान्त। क्यूरी का नियम, लौह चुम्बकत्व एवं लौह चुम्बकीय डोमेन्स के लिए वेस (Weiss) का सिद्धान्त। B-H शैथिल्यता की विवेचना।	
Unit III	**(English)**	**Semiconductor Devices-1** Electronics Devices: Types of Semiconductors (p and n). Formation of energy Bands. Energy level diagram. Conductivity and mobility. Junction formation, Barrier formation in p-n junction diode. Current flow mechanism in forward and reverse biased diode (recombination), drift and saturation of drift velocity, Derivation of mathematical equations for barrier potential, barrier width. Single p-n junction device (physical explanation, current voltage characteristics and one or two applications). Two terminal devices. Rectification. Zener diode. Photo diode. Light emitting diode. Solar cell. Three terminal devices.	

		Junction field effect transistor (JFET). Two junction devices. Transistors as p-n-p and n-p-n. Physical mechanism of current flow. Characteristics of transistor.	
	(हिन्दी)	**अर्ध चालक युक्तियां – 1** इलेक्ट्रानिक युक्तियां: अर्धचालक के प्रकार (P व N)ऊर्जा बैंडो का बनना, ऊर्जा स्तर का डायग्राम, चालकता और गतिशीलता, संधि का बनना, p-n संधि डायोड में रोधिका विभव का बनना, अग्र व पश्च अभिनति डायोड में धारा प्रवाह (पुनः संयोजन), अनुगमन वेग व अनुगमनवेग की संतृप्तता, रोधिका विभव के गणितीय समीकरण की व्युत्पत्ति, रोधिका चौड़ाई, एकल p-n संधि **डायोड** (भौतिकीय विवेचना), धारा–विभव अभिलाक्षणिक (एक–दो अनुप्रयोग), द्वि – टर्मीनल युक्ति, दिष्टकरण, जेनर डायोड, फोटो डायोड, प्रकाश उत्सर्जक डायोड, सोलर सेल, त्रि टर्मिनल युक्ति, संधि क्षेत्र प्रभाव ट्रांजिस्टर (JEFT) द्वि–संधि युक्तियाँ, p-n-p व n-p-n ट्रांजिस्टर, धारा–प्रवाह की भौतिकीय प्रक्रिया, ट्रांजिस्टर के अभिलाक्षणिक वक्र।	
Unit IV	(English)	**Semiconductor Devices-2** Amplifiers (only bipolar junction transistor), CB, CE and CC configurations. Single stage CE amplifier (biasing and stabilization circuits), Q-point, equivalent circuit, input impedance. output impedance, voltage and current gain. Class A, B, C amplifiers (Definitions). RC coupled amplifiers (frequency response) Class B push-pull amplifier. Feedback amplifiers. Voltage feedback and current feedback. Effect of negative voltage series feedback on input impedance. Output impedance and gain, stability, distortion and noise. Principle of an Oscillator, Barkhausen criterion, Colpitts, RC phase shift oscillators. Basic concepts of amplitude, frequency and phase modulation and demodulation.	
	(हिन्दी)	**अर्धचालक युक्तियां – 2** प्रवर्धक (द्वि–ध्रुव संधि ट्रांजिस्टर) CB, CE व CC विद्या, एकल स्टेज (चरण) CE प्रर्वधक (अभिनन व स्थायीकरण परिपथ), Q बिन्दु समतुल्य परिपथ, निवेशी व निर्गत प्रतिबाधा, विभव एवं धारा लाभ। वर्ग A, B, C प्रवर्धक (परिभाषा), RC युग्मित प्रवर्धक (आवृत्ति अनुक्रिया वक्र), वर्ग– B पुश– पुल प्रवर्धक, पुर्ननिवेशन प्रवर्धक,	

		विभव एवं धारा, पुर्निनिवेशन, निवेशी प्रतिबाधा पर **ऋणात्मक** विभव, श्रेणी फीडबैक का प्रभाव, निर्गमन प्रतिबाधा एवं लाभ। स्थायित्व, विकृत व शोर, दोलित्र का सिद्धान्त तथा बार्क – हाउसन का प्रतिबन्ध, कॉलपिट दोलत्र RC कला विस्थापी दौलित्र, आयाम, आवृत्ति एवं कला माडुलेशन एवं संसूचक की मूल अवधारणा।	
Unit V	**(English)**	**Nano Materials** Nanostructures: introduction to nanotechnology, structure and size dependent properties. 3D, 2D, 1D, 0D nanostructure materials and their density of states, surface and interface effects. Modelling of quantum size effect synthesis of nanoparticles- Bottom up and top down approach, wet chemical method. Nanolithography. Metal and semiconducting nanomaterials. Essential differences in structural and properties of bulk and nano materials (Qualitative description). Naturally occurring nano Crystals. Applications of nanomaterials.	
	(हिन्दी)	**नैनो पदार्थ** नैनो संरचनाएं: नैनो टेक्नॉलाजी की प्रस्तावना, संरचना आकार निर्भर गुण। 3D, 2D, 1D, 0D नैनो संरचना पदार्थ एवं उनकी अवस्थाओं का घनत्व, सतह एवं अंतराफलक प्रभाव, क्वांटम आकार प्रभाव का प्रतिरूपण, नैनो कणों का संश्लेषण–नीचे से ऊपर(बॉटम अप) और ऊपर से नीचे (टॉप डाउन) विधियाँ, वेट रासयनिक विधि, नैनो लिथोग्राफी (नैनो मुद्रण), धातु एवं अर्द्ध चालकों के नैनो पदार्थ (गुणात्मक विवरण), विस्तृत (Bulk) और नैनो पदार्थो की संरचना एवं गुणों में अन्तर (गुणात्मक विवरण), प्राकृतिक रूप में पाये जाने वाले नैनो क्रिस्टल। नैनो पदार्थो के अनुप्रयोग।	

References:

1. **Introduction to solid state physics**, C. Kittel. VIIIth Edition, John Wiley and sons, New York, 2005
2. **Intermediate Quantum theory of Crystalline solids**, A.O. E. Animalu. Prentice-Hall of India private Limited, New Delhi 1977.
3. **Soild State electronic Devices**, B. G. Streetman, II Edition Prentice Hall, India.
4. **Microelectronics**, J. Millman and A. Grabel McGraw Hill New York
5. **The Physics and Chemistry of Nanosolids**: Frank J. Owens, and Charles P. Poole Jr.. Wiley Inter Science, 2008
6. **Physics of Low Dimensional Semiconductors**: An introduction: J. H. Davies, Cambridge University Press, U. K.1998.
7. **Electronics Fundamentals and applications**, J. D. Ryder, Prentice Hall, India.

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College,
Shivaji Nagar, Bhopal
Syllabus for Physics
(As Recommended by the Board of Studies)
Session: 2019-2020

Class: B. Sc. III Year
Subject: Physics

For Regular Students

Practical	Sessional	Viva	Total
35	00	15	50

For Ex- Student

Practical	Sessional	Viva	Total
35	00	15	50

List of Practical's

1. Specific resistance and energy gap of a semiconductor.
2. Study of half wave and full wave rectification.
3. Characteristics of Zener diode.
4. Characteristics of tunnel diode.
5. Characteristics of JFET.
6. Characteristic of Transistor.
7. Study of regulated power supply.
8. Study of RC coupled amplifiers
9. Determination of Planck's constant.
10. Determination of e/m usingThomson's method.
11. Determination of e by Millikan's method.
12. Study of spectra of hydrogen and deuterium (Rydberg constant and ratio of masses of electron to proton)
13. Absorption spectrum of iodine vapour.
14. Study of Zeeman Effect for determination of Lande g-factor.
15. Study of Raman spectrum using laser as an excitation source.
16. To draw B-H Curve of ferro –magnetic material with the help of CRO.
17. Hysteresis Curve of a transformer Core.
18. Hall probe method for measurement of resistivity.

Signature of Member of B.O.S. ....

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SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE,

BHOPAL

SYLLABUS FOR

M.Sc (Physics)

SEM I, II, III & IV

SESSION 2019-20

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College,

Shivaji Nagar, Bhopal

As Recommended by the Board of Studies

Session 2019-20

Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : I**
Title of the Paper	**MATHEMATICAL PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - 1 (English)	**<u>Differential equations</u>: Recursion relation, generating functions and orthogonality of Bessel functions of first and second kind, Hermite, Legendre, Associate Legendre and Laguerre Polynomials, Curvilinear coordinate system with specific cases of Cartesian, Cylindrical and Spherical coordinate systems.**	1. L.A. Pipes Mathematics of Engineers and Physicists. 2. Arfken Mathematical Methods for Physicists. 3. P.K. Chattopadhyay Machematical Physics. 4. H.K.Dass Mathematical Physics
Unit - II (English)	**Integral transforms. Fourier integral. Fourier transforms and inverse Fourier transforms.** **Fourier transform of derivatives. Convolution theorem. Elementary Laplace transforms.** **Laplace transform to derivatives. Application to a damped harmonic oscillator.**	

Unit - III (English)	**Green's functions: Non-homogenous boundary value problems, Green's function for one dimensional problems, eigen function expansion of Green's function, Fourier transforms.** **Method of constructing.** **Green's functions, Green's function for electrostatic boundary value. Problems and quantum-mechanical scattering problem.**	5. Ghatak, Goyal & Guha Mathematical Physics 6. M.R. Spiegal (Schaum Series) Complex variable & Laplace Transform.
Unit - IV (English)	**Complex variables: analyticity of complex functions. Cauchy Riemann equations. Cauchy theorem. Cauchy integral formula.** **Taylors, Maclaurin Laurent series and mapping.** **Theorem of residues. Simple cases of contour integration. Jordan's lemma Integrals involving multiple valued function (Branch points)**	
Unit - V (English)	**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.**	

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Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : II**
Title of the Paper	**CLASSICAL MECHANICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**Newtonin mechanics of one and many particles systems: Conservation laws, Constraints their classification, Principle of virtual work; D'Almbert's principle in generalized coordinates, The Lagrange's equitation from D'Almbert's principle. Configuration space, Hamilton's principle deduction from D'Almberts principle, Generalized momenta and Lagragian 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.**	1. H. Goldsetin (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)
Unit - II (English)	**The equitation of canonical transformation and generating functions: The Hamilton-Jacobi Action and Angle 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.**	

Unit - III (English)	**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.**	R.G. Takwale & P.s. Puranik Introduction to Classical Mechanics.
Unit - IV (English)	**Symmetries of space and time.** **Invariance under galilion transformation, Covariant four-dimensional 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 Hamiltonioan, Examples.**	
Unit - V (English)	**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.**	

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Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : III**
Title of the Paper	**QUANTIUM MECAHNICS – I**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**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.**	1. L I Schiff, Quantum Mechanics 2. S Gasiorovvicz. Quantum Physics
Unit - II (English)	**Linear vector space, concept of Hilbert 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).**	3. B.Craseman and J D Powell Quantum Mechanics 4. A.P. Messiah Quantum Mechanics

		5. J.J. Sakurai Modern Quantum Mechanics Mathews and Venkatesan Quantum Mechanics.
Unit - III (Engilish)	**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 (deuteron).**	
Unit - IV (English)	**Angular momentum in quantum mechanics, Eigen values and Eigen function of L_2 and L_z in term of spherical harmonics, commutation relation. Time independent perturbation theory. Non-degenerate and degenerate cases.**	
Unit - V (English)	**This unit will have a short note question covering all the four units.** **The students will have to answer any two questions of the four.**	

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Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : IV**
Title of the Paper	**ELETRONIC DEVICES**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - 1 (English)	**<u>Transistors</u> : JFET, BJT, MOSFET and MOSFET, structure derivations of the equations for I-V characteristics under different conditions, microwave devices, tunnel diode, transfer electron devices (Gunn diode) avalanche transits time devices, Impatt diodes and parametric devices.**	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.
Unit - II (English)	**<u>Photonic devices</u>: 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 (English)	**<u>Memory Devices</u>: Read Only Memory (ROM) and Random Access Memory (RAM). Types of ROM: PROM, EPRON, EEPROM AND EAPROM, Static and dynamic RAMs (SRAM & DRAM), characteristics of SRAM and DRAM.** **<u>Hydbrid Memories</u> : CMOS and NMOS memories, Nonvolatile RAM, ferro-electric memories, charge coupled devices (CCD), storage devices : Geometry and organization of magnetic (FDD and HDD) and Optical (CD-ROM, CD-R, CD-R/W, DVD) Storage Devices.**	Ajoy Ghatak and Thyagrajam Optical Electrics.
Unit - IV (English)	**Eletro-optics, Magneto-optic and Acousto-optic effects, materials properties related to get these effect, important ferro electric, Liquid crystal and polymeric materials for these devices, piezoelectric, electrostrictive and magnetostrictive effects. Important materials for these properties and their applications in sensors and actuator devices, acoustic delay lines, peizoelectric resonators and filters, high frequency piezoelectric devices-surface, acoustic wave devices.**	
Unit - V (English)	**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.**	

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Practial

Class		M.Sc.	Semester : I
Subject		Physics	
Title of Practical		Electronics (Lab-A)	
Medium of instructions ¼Teaching)		English	Question Paper Language : English
Maximum Marks		100	

Syllabus	*Recommended Books*
1. To study Characteristics of "Tunnel Diode". 2. To study Characteristics of "Field Effect Transistor". 3. To study Characteristics of "Unijunction Transistor". 4. To study Characteristics of "MOSFET" 5. To study Characteristics of "Thermister" 6. To study Characteristics of "Triac" 7. To study Characteristics of "Zender Diode". 8. To study Characteristics of :V R Tube" 9. To study Characteristics of "LED & Photo Transistor" 10. To determine hybrid parameters of a transistor	

11. To verify Richardson's Equation.	

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Practial

Class		M.Sc.	Semester : I
Subject		Physics	
Title of Practical		General (Lab-B)	
Medium of instructions ¼Teaching)		English	Question Paper Language : English
Maximum Marks		100	

Syllabus	*Recommended Books*
1. To determine Planck's constant 'h' by photo cell. **2. To determine Planck's constant 'h' by solar cell.** **3. To determine 'e/m' by 'Thomas' method.** **4. To determine 'e/m' by Milliken's Oil Drop method.** **5. To study resolving power of diffraction grating.** **6. To find out thickness of mica sheet by biprism.** **7. To study waveform and frequency by CRO.** **8. To study diffraction at single slit.** **9. To analyze elliptically polarized light by Babinate's Compensator.**	

10. To verify Fresnel's formula & Canchy's formula 11. To find 'electronic charge' 'e' by rectifier. 12. To find energy band gap 13. To determine low resistance by Kelvin's Double Bridge.	

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Theory

<table>
<tr><td>Class</td><td colspan="2">M.Sc.</td><td>Semester: II</td></tr>
<tr><td>Subject</td><td colspan="2">Physics</td><td>Paper No : I</td></tr>
<tr><td>Title of the Paper</td><td colspan="3">QUANTUM MECHANICS –II</td></tr>
<tr><td>Medium of instructions (Teaching)</td><td>English</td><td colspan="2">Question Paper Language: English</td></tr>
<tr><td></td><td colspan="3"></td></tr>
<tr><td>Maximum Marks</td><td>Total :100</td><td>Main Exam:70</td><td>C.C.E.:30</td></tr>
</table>

<table>
<tr><th>Unit</th><th>Syllabus</th><th>Recommended Books</th></tr>
<tr><td>Unit - I (English)</td><td><u>Approximation method for bound states</u>: Rayleigh - Schrodinger Perturbation theory of non-degenerate and degenerate 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.</td><td rowspan="3">1. LI Schiff Quantum Mechanics

2. S Gasirowicaz Quantum Physics

3. B.Craseman and J J Powell Quantum Mechanics (Addison Wessley)

4. A. Messiah Quantum Mechanics

5. J.J. Sakurai Modern</td></tr>
<tr><td>Unit - II (English)</td><td><u>Time dependant perturbation theory</u> : 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.</td></tr>
<tr><td>Unit - III (English)</td><td>Theory of Scattering, Physical concepts, scattering amplitude, scattering cross section.

Born Approximation and partial waves, scattering by perfectly rigid</td></tr>
</table>

	sphere, complex potential and absorption, scattering by spherically symmetric potential, identical practices with spin, Pauli's spin matrices.	Quantum Mechanics 6. Mathews and Venkatessan Quantum Mechanics A.K.Ghatak and Loknathan Quantum Mechanics.
Unit - IV (English)	**Schrodinger.s relativistic equation (Klein-Gordon equation), Probability and current denisity, 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 (English)	**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.**	

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Theory

Class	**M.Sc.**	**Semester: II**	
Subject	**Physics**	**Paper No : II**	
Title of the Paper	**STATISTICAL MECHANICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**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. Micro canonical ensemble, phase space, trajectories and density of states, Liouvelle theorem, canonical and grand canonical ensembles, partition function, calculation of statistical quantities, energy sand density fluctuations.**	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.
Unit - II (English)	**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 (English)	**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 - IV (English)	**Thermodynamics fluctuation spatial correlation Brownian motion, Langevin theory, fluctuation dissipation theorem, the Fokker-Planck equation, Onsager reciprocity relations.**	
Unit - V (English)	**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.**	

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : III**
Title of the Paper	**ELECTRODYNAMICS AND PLASMA PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - I (English)	**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.**	1. Bitteneerort Plasma Physics 2. Chen Plasma Physics 3. Gupta, Kumar, Singh Electro dynamics 4. Sen Plasma state and matter 5. Jackson Classical electrodynamics
Unit - II (English)	**Fields of an 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-demension Maxwell equation, Four Vector current and potential and their invariance under Lortentz transformation, covariance of electro-dynamics.** **Langragian and Hamiltonian for a relativistic charged particle in**	

	External EM field; motion of charged particles in electromagnetic fields, uniform and non-uniform E and B fields.	6. Pamolsky & Philips Classical electricity and Magnetism.
Unit - III (English)	**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 plasma. Debye screening distance. Plasma oscillations: Transverse oscillations and longitudinal oscillations.**	
Unit - IV (English)	**<u>Domain of Magneto hydrodynamics and plasma Physics</u> :** **Magneto hydrodynamic equations, magnetic hydro-static pressure hydrodynamic waves: Magneto-sonic and Alfven waves, particle orbits and drift motion in plasmas. Experimental study of Plasma the theory of single and double probes.**	
Unit - V (English)	**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.**	

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : IV**
Title of the Paper	**ATOMIC AND MOLECULAR PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**Quantum states of one electron atom. Atomic orbitals. Hydrogen spectrum, Pauli's 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).**	1. H.E. White Introduction to atomic spectra 2. C.B. Banwell Fundamental of molecular spectroscopy 3. Walker and Strengthen Spectroscopy Vol. I , II and III 4. G.N. Barrow Introduction of molecular spectroscopy 5. Herzberg Spectra of diatomic molecules
Unit - II (English)	**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 (English)	**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)**	6. Jeanne L and McHale Molecular spectroscopy 7. J.M. Brown Molecular spectroscopy 8. P.F. Benmath Spectra of atoms and molecules J.M. Halian Modern Spectroscopy
Unit - IV (English)	**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 photo acoustic spectroscopy and Moss Bauer spectroscopy (principle).**	
Unit - V (English)	**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.**	

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Practials

Class		**M.Sc.**	**Semester : II**
Subject		**Physics**	
Title of Practical		**General (Lab-B)**	
Medium of instructions ¼Teaching)		**English**	**Question Paper Language : English**
Maximum Marks		**100**	

Syllabus	*Recommended Books*
1. To find Young's modulus of metallic rod by Newton's ring method. **2. To find Poisson's ratio and Young's modulus of glass by Cornu's method** **3. To find capacitance by "Shearing bridge".** **4. To find self and mutual inductance by Anderson's bridge.** **5. To study BH curve for soft iron rod by CRO** **6. To study BH curve for the specimen of iron in form of anchor ring.** **7. To determine resistivity of given material by 'Four Probe**	

Method'. 8. To determine band gap in semiconductor by 'For Probe Method'. 9. To study "Hall Effect". 10. To find "Stefan's Constant". 11. To verify Cauchy's Formula 12. To study thermo emf of a thermo couple 13. To measure drift velocity in semi conductor	

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Practials

Class		**M.Sc.**	**Semester : II**
Subject		**Physics**	
Title of Practical		**Electronics (Lab-A)**	
Medium of instructions ¼Teaching)		**English**	**Question Paper Language : English**
Maximum Marks		**100**	

Syllabus	***Recommended Books***
1. To study Basic Logic Gates **2. To study ''NAND" Gate** **3. To verify De Morgan's Law** **4. To study frequency response of R.C. coupled amplifier.** **5. To study regulated/ unregulated power supply.** **6. To study characteristics of Silicon Controlled Rectifier.** **7. To study Fourier analysis of a complex wave form** **8. To study cathode follower**	

9. **To study emitter follower** **10.** **To study frequency response of passive filters** **11.** **To compare characteristics of Ge & Si Transistor.**	

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Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : I**
Title of paper	**Condensed Matter Physics-I**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional :	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit-1	**Crystal structure:** Bravis lattice in two and three dimension. Simple crystal structures: Hexagonal close packed structure, Diamond structure, zinc blende structure, sodium chloride structure, cesium chloride structure.	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
Unit-2	**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-3	**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.	5. Huong: Theoretical solids state physics
Unit-4	**Lattice vibration and phonons:** Lattice dynamics 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.	6. Weertman and Weertman: Elementary dislocation theory 7. Buerger: Crystal structure physics.
Unit-5	**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.	8. Made Lung: Introduction to solids state physics.

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Theory

Class	**M.Sc.**		**Semester: III**
Subject (English)	**Physics**		**Paper No : II**
Title of Paper	**Nuclear and Particle Physics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional :	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit-1	**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.	1. Introduction of Nuclear physics : H.A. Enge 2. Nuclear radiation detectors : S.S. Kapoor and V.S. Ramamurthy 3. Atomic and Nuclear physic : S.N. Ghoshal
Unit-2	**Acclerators of charged particles:** Study of cyclotron, phase stability, frequency modulated cyclotron (synchorocyclotron) magnetic induction accelerator (Betatron) Electron synchrotron and linear accelerator (Linac)	

<table>
<tr><td>Unit-3</td><td>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.</td><td rowspan="3">4. Nuclear and Particle physics : D.C. Tayal

5. Nuclear physics :
R.C. Sharma

6. Introduction of Nuclear physics: KRANE

7. Nuclear physics Principles & Application
: Lilley</td></tr>
<tr><td>Unit-4</td><td>Nuclear decay and elementary particles:

ß Decay, general features of ß ray spectrum, Fermi theory of ß decay, selection rules, parity in ß decay, multipole radiation, internal conversion, nuclear isomerism.</td></tr>
<tr><td>Unit-5</td><td>Elementary particles:

Classification of elementary particles, fundamental interaction, parameters of elementary particles. Symmetry and conservation laws, symmetry schemes of elementary particles SU(3).</td></tr>
</table>

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Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : III**
Title of Paper	**Digital Electronics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional :	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit-1	Number system (Binary, Octal, Decimal, hexadecimal) and conversion between them. Boolean arithmetic, signed and unsigned binary numbers, I's complement, 2's complement.	1. "Digital principles and applications" by A.P. Malvino and Donald P. Leach, Tata Megraw-Hill Company, New Delhi, 1993. 2. "Microprocessor Architecture, Programming and Applications with 8085/8086 by Rames S.Gaonkar, Wiley-eastern Ltd., 1987 (for unit V)"
Unit-2	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-3	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)	

<table>
<tr><td>Unit-4</td><td>Counters-asynchronous (ripple) counter, synchronous (parallel) counter, MOD-5 counter and MOD-10 counter, BCD counter, Up-Down counter, Shift Register counter (Ring counter)</td><td rowspan="2">3. Digital electronics : S.N. Ali

4. Digital electronics: Morries Mano

5. Microprocessor and Microcomputers : B. Ram-Dhanpat Rai publications V edition.</td></tr>
<tr><td>Unit-5</td><td>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)</td></tr>
</table>

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Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : IV**
Title of Paper	**Atomic and Molecular Physics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional :	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit-1	**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 interation and spin-spin coupling between two and more nuclei (Qualitative)	1. Fundamentals of Molecular Spectroscopy : C.B. Banwell. 2. Spectra of Diatomic Molecules : Herzberg. 3. Mossbauer Spectroscopy : M.R. Bhide
Unit-2	**Electronic spectra of Diatomic Molecules and Fourier transform infrared spectroscopy** Frank Condon principles, dissociation and pre-dissociation, dissociation energy. Born-Oppenheimer-approximation, vibrational coarse structure of electronic spectra (bands progression and sequence). Fourier transform infrared spectroscopy :Theory and application FTIR peaks of common bands and functional groups	

		4. NMR and Chemistry : J.W. Akitt 5. Modern Spectroscopy : J.M. Hollons
Unit-3	**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-4	**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-5	**Electron Spin Resonance Spectroscopy:** Elementary Idea about ESR, Principle of ESR, ESR spectrometer, splitting of electron energy levels by a magnetic field, G-Values, simple experimental set-up of ESR. ESR spectra of free radicals in solution, Anisotropic system.	

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As Recommended by the Board of Studies

Session – 2019-20

Practial

Class		M.Sc.	Semester : III
Subject		Physics	
Title of Paper		Lab-A & Lab-B	
Medium of instructions ¼Teaching)		English	Question Paper Language : English
Maximum Marks		100 +100	

LAB A

Syllabus	*Recommended Books*
1. Find thickness of a wire using LASER 2. To find ' ' of LASER light 3. To find of liquid using LASER 4. To study Wein Bridge Oscillator 5. To study Hartley Oscillator 6. To study Differential Comparator 7. To study Operational Amplifier as :Adder and Sub tractor"	

8.	To study Operational Amplifier as :Diffrentiator"	
9.	To study Operational amplifier as " Integrator".	
10.	To study Operational Amplifier as " Mono stable Multi vibrator"	
11.	To study Operational amplifier as low pass and high pass filter.	
12.	To study Operational Amplifier as square wave generator.	
13.	To study Operational amplifier as current voltage converter.	
14.	To study Operational Amplifier as current gain amplifier.	
15.	To study Operational Amplifier as Schmith Trigger.	

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Session 2019-20

Class / कक्षा	: **M.Sc.**
Semester / सेमेस्टर	: **IV**
Subject / विषय	: **Physics**
Title of Subject Group	: **Condensed Matter Physics-II**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: **I**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: **Compulsory**
Max. Marks अधिकतम अंक	: **CCE : 30, Main Exam : 70 Total - 100**

Particulars / विवरण

Unit-1	Super Conductivity: Concept of super conducting state, persistent current, critical temperature, Meissen 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-2	Magnetism: Weiss theory of ferromagnetic Heisenberg model and molecular field theory, Domain and Bloch wall energy, Spin waves and magnons, Curie Weiss law for susceptibility, Ferri and anti ferrimagnetism.
Unit-3	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-4	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.
Unit-5	Nano structure: Definition and properties of nano structured material, different method of preparation of nano materials, plasma enchanted chemical vapour deposition, electro deposition. structure of single wall carbon nono tubes (classification, chiral vector Cn, Translational vector T, Symmetry vector R, Unit Cell, Brillouin Zone) Electronic, mechanical, thermal and phonon properties.

Suggested Readings:

1. Kittel: Solid State Physics
2. Huang: Theoretical Solid State Physics
3. Weertmon and Weertman: Elementary Dislocation theory
4. Thomes: Multiple Electron microscopy
5. Tolansky: Multiple Beam Interferometer

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Session 2019-20

Class / कक्षा	: **M.Sc.**
Semester / सेमेस्टर	: **IV**
Subject / विषय	: **Physics**
Title of Subject Group	: **Laser Physics**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: **II**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: **Compulsory**
Max. Marks अधिकतम अंक	: **CCE : 30, Main Exam : 70 Total - 100**

Particulars / विवरण

Unit-1	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-2	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-3	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 HCI and HF lasers.
Unit-4	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-5	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.

Suggested Readings:

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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Session (सत्र) – 2019-20

Class / कक्षा	: **M.Sc.**
Semester / सेमेस्टर	: **IV**
Subject / विषय	: **Physics**
Title of Subject Group	: **Computer Programming and Informatics**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: **III**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: **Compulsory**
Max. Marks अधिकतम अंक	: **CCE : 30, Main Exam : 70 Total - 100**

Particulars / विवरण

Unit-1	Conceptual framework of computer languages (Algorithm, Flowcharts) Need of structured programming, Top-down, bottom-up and modular programming design. Introduction to C languages-basic structure of C programme. Character set, keyword and identifiers, C data types, variable and data type declaration. Various operators like arithmetic, relational, logical assignment, conditional, increment and decrement operators. Evaluation of expression and operator precedence.
Unit-2	Input and output statement, control statement (If, If-else, If nested If-else statements switch, while, Do... while and for statements) Simple C programmes like search of prime number between given range of numbers, finding the smallest and largest of three numbers, sume of algebraic series, factorial of given number, roots of a quadratic equation, binary of decimal and decimal to binary conversion etc.
Unit-3	Functions: need of functions, calling the function by value and by reference, category of functions: no argument no return, argument but not return, argument with return. Recursion. One and two dimensional arrays. String and string handling functions like sprinf (), strepy (), sscanf (), strlen(), sizeorf () strcmp ()etc. Simple programs using user define functions, arrays and string functions.
Unit-4	Network: Terminals-Dumb terminals, smart terminals, intelligent tgerminals. Types of network: • According to range: LAN,MAN,WAN, Client server • According to topologies: BUS, RING, STAR, Mesh Network.

	Internet: History of Internet Service Provider (ISP), introduction to type of internet account-shell/Ac, TCP/IP A/c. types of connectivity-Dialup, Leased lines, Satellite. IP Address-Class A, Class B, Class C Domain Name address. URL-absolute and relative
Unit-5	Web enabled technology (Email and HTML): Web Browser: Internet Explorer, Netscape Navigator, Station and Dynamic web page Introduction to HTML. HTML tags: • <HTML>, <TITLE>, <HEAD>, <BODY> • <P>, , (ALIGN>, <I>, <B>, <DIV>, <PRE>, and their attributers • <IMG> <a> and their attributes • Ordered and unordered list tages • Tabes and associated tags and its properties Creation of simple forms using text, Password, text area, radio, submit, Rest and Hidden. Brief idea about HTTP. Search engine, its working, types of search engines: sub directories meta search engines, search function-AND and OR. Population search engines.

Suggested Readings:

1. Let us C : Yashwat Kanetkar

2. Programming with C : Balaguruswami

3. Internet and Web Page : V. K Jain

   'O' level module M1.2

4. Internet and Web Page design : Dr. P.D Murarka

   'O' level module M1.2

5. Internet and web page design : Pearl Software

   'O' level module M1.2

6. C# 2008 in simple step

   Dreamtech press

7. C# 2008 programming block book

   Dreamtech press

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Session (सत्र) – **2019-20**

Class / कक्षा	: **M.Sc.**
Semester / सेमेस्टर	: **IV**
Subject / विषय	: **Physics**
Title of Subject Group	: **Digital Electronics**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: **IV-E**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: **Optional**

Max. Marks अधिकतम अंक : CCE : 30, Main Exam : 70 Total - 100

Particulars / विवरण

Unit-1	**OP-AMP:-** Differential amplifier circuit configurations: dual input balanced output dual input, single input unbalanced output (ac analysis) only, block diagram of a typical op amp analysis, schematic symbol of an op-amp. IC 555 timer Introduction, Architecture, Application as astable and monostable multivibraters.
Unit-2	**OP-AMP Parameters:-** Ideal op-amp parameters; input offset voltage, input offset current, input bias current, CMRR, SVRR, large signal voltage gain, Slew rate, Gain band width product, output resistance, supply currents power consumption, inverting and non-inverting inputs.
Unit-3	**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, L-C tunable oscillator, square wave generator.
Unit-4	**Microprocessors and Micro Computers:** Microprocessor and Architecture: Intel 8086, Microprocessor architecture modes of memory addressing, 8086/8088 Hardware specification: Pin-outs and pin functions, clock generator (8284A) Bus buffering and latching, Bus timing, Ready and wait State, Minimum mode versus maximum mode.
Unit-5	**Programming the Microprocessors:** Addressing modes: Data addressing modes, program memory addressing modes, stack memory-addressing modes. Instruction set: data movement Instructions, Arithmetic and login instructions, program control instructions. Programming example: Simple Assembly language programs table handling direct table addressing, searching a table sorting a table using pseudo ops.

Suggested Readings :

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

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Theory

Class	**M.Sc.**		**Semester: IV**
Subject	**Physics**		**Paper No : I**
Title of the Paper	**Condensed Matter Physics-II**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit-1	Super Conductivity: Concept of super conducting state, persistent current, critical temperature, Meissen 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-2	Magnetism: Weiss theory of ferromagnetic Heisenberg model and molecular field theory, Domain and Bloch wall energy, Spin waves and magnons, Curie Weiss law for susceptibility, Ferri and anti ferrimagnetism.
Unit-3	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-4	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.
Unit-5	Nano structure: Definition and properties of nano structured material, different method of preparation of nano materials, plasma enchanted chemical vapour deposition, electro deposition. structure of single wall carbon nono tubes (classification, chiral vector Cn, Translational vector T, Symmetry vector R, Unit Cell, Brillouin Zone) Electronic, mechanical, thermal and phonon properties.

Suggested Readings:

1. Kittel: Solid State Physics
2. Huang: Theoretical Solid State Physics
3. Weertmon and Weertman: Elementary Dislocation theory
4. Thomes: Multiple Electron microscopy
5. Tolansky: Multiple Beam Interferometer

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Theory

Class	**M.Sc.**		**Semester: IV**
Subject	**Physics**		**Paper No : II**
Title of the Paper	**Laser Physics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit-1	**Basic principles of laser:** Introduction to laser, spontaneous and stimulated emission. Einstein coefficients, Idea of light amplification. Population inversion, laser pumping schemes for two and three level system with threshold condition for laser oscillation.
Unit-2	**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-3	**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 HCI and HF lasers.
Unit-4	**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-5	**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.

Suggested Readings:

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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Theory

Class	**M.Sc.**		**Semester: IV**
Subject	**Physics**		**Paper No : III**
Title of the Paper	**Computer Programming & Informatics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit-1	Conceptual framework of computer languages (Algorithm, Flowcharts) Need of structured programming, Top-down, bottom-up and modular programming design. Introduction to C languages-basic structure of C programme. Character set, keyword and identifiers, C data types, variable and data type declaration. Various operators like arithmetic, relational, logical assignment, conditional, increment and decrement operators. Evaluation of expression and operator precedence.
Unit-2	Input and output statement, control statement (If, If-else, If nested If-else statements switch, while, Do... while and for statements) Simple C programmes like search of prime number between given range of numbers, finding the smallest and largest of three numbers, sume of algebraic series, factorial of given number, roots of a quadratic equation, binary of decimal and decimal to binary conversion etc.
Unit-3	Functions: need of functions, calling the function by value and by reference, category of functions: no argument no return, argument but not return, argument with return. Recursion. One and two dimensional arrays. String and string handling functions like sprinf (), strepy (), sscanf (), strlen(), sizeorf () strcmp ()etc. Simple programs using user define functions, arrays and string functions.
Unit-4	Network:

	Terminals-Dumb terminals, smart terminals, intelligent tgerminals. Types of network: • According to range: LAN,MAN,WAN, Client server • According to topologies: BUS, RING, STAR, Mesh Network. Internet: History of Internet Service Provider (ISP), introduction to type of internet account-shell/Ac, TCP/IP A/c. types of connectivity-Dialup, Leased lines, Satellite. IP Address-Class A, Class B, Class C Domain Name address. URL-absolute and relative
Unit-5	Web enabled technology (Email and HTML): Web Browser: Internet Explorer, Netscape Navigator, Station and Dynamic web page Introduction to HTML. HTML tags: • <HTML>, <TITLE>, <HEAD>, <BODY> • <P>, , (ALIGN>, <I>, <B>, <DIV>, <PRE>, and their attributers • <IMG> <a> and their attributes • Ordered and unordered list tages • Tabes and associated tags and its properties Creation of simple forms using text, Password, text area, radio, submit, Rest and Hidden. Brief idea about HTTP. Search engine, its working, types of search engines: sub directories meta search engines, search function-AND and OR. Population search engines.

Suggested Readings:

1.	Let us C	: Yashwat Kanetkar
2.	Programming with C	: Balaguruswami
3.	Internet and Web Page 'O' level module M1.2	: V. K Jain
4.	Internet and Web Page design 'O' level module M1.2	: Dr. P.D Murarka
5.	Internet and web page design 'O' level module M1.2	: Pearl Software

6. C# 2008 in simple step Dreamtech press

7. C# 2008 programming block book
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Session – 2019-20

Theory

Class	**M.Sc.**		**Semester: IV**
Subject	**Physics**		**Paper No : IV**
Title of the Paper	**Digital Electronics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit-1	**OP-AMP:-** Differential amplifier circuit configurations: dual input balanced output dual input, single input unbalanced output (ac analysis) only, block diagram of a typical op amp analysis, schematic symbol of an op-amp. IC 555 timer Introduction, Architecture, Application as astable and monostable multivibraters.
Unit-2	**OP-AMP Parameters:-** Ideal op-amp parameters; input offset voltage, input offset current, input bias current, CMRR, SVRR, large signal voltage gain, Slew rate, Gain band width product, output resistance, supply currents power consumption, inverting and non-inverting inputs.
Unit-3	**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, L-C tunable oscillator, square wave generator.
Unit-4	**Microprocessors and Micro Computers:** Microprocessor and Architecture: Intel 8086, Microprocessor architecture modes of memory addressing, 8086/8088 Hardware specification: Pin-outs and pin functions, clock generator (8284A) Bus buffering and latching, Bus timing, Ready and wait State, Minimum mode versus maximum mode.

Unit-5	**Programming the Microprocessors:** Addressing modes: Data addressing modes, program memory addressing modes, stack memory-addressing modes. Instruction set: data movement Instructions, Arithmetic and login instructions, program control instructions. Programming example: Simple Assembly language programs table handling direct table addressing, searching a table sorting a table using pseudo ops.

Suggested Readings :

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

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Theory

Class	**M.Sc.**		**Semester: IV**
Subject	**Physics**		**Paper No : I**
Title of the Paper	**Condensed Matter Physics-II**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit-1	Super Conductivity: Concept of super conducting state, persistent current, critical temperature, Meissen 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-2	Magnetism: Weiss theory of ferromagnetic Heisenberg model and molecular field theory, Domain and Bloch wall energy, Spin waves and magnons, Curie Weiss law for susceptibility, Ferri and anti ferrimagnetism.
Unit-3	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-4	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.
Unit-5	Nano structure: Definition and properties of nano structured material, different method of preparation of nano materials, plasma enchanted chemical vapour deposition, electro deposition. structure of single wall carbon nono tubes (classification, chiral vector Cn, Translational vector T, Symmetry vector R, Unit Cell, Brillouin Zone) Electronic, mechanical, thermal and phonon properties.

Suggested Readings:

1. Kittel: Solid State Physics
2. Huang: Theoretical Solid State Physics
3. Weertmon and Weertman: Elementary Dislocation theory
4. Thomes: Multiple Electron microscopy
5. Tolansky: Multiple Beam Interferometer

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Theory

Class	**M.Sc.**	**Semester: IV**	
Subject	**Physics**	**Paper No : II**	
Title of the Paper	**Laser Physics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit-1	**Basic principles of laser:** Introduction to laser, spontaneous and stimulated emission. Einstein coefficients, Idea of light amplification. Population inversion, laser pumping schemes for two and three level system with threshold condition for laser oscillation.
Unit-2	**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-3	**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 HCI and HF lasers.
Unit-4	**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-5	**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.

Suggested Readings:

1. Laser-syelto
2. Optical electronics-Yarive
3. Laser spectra scopy-demtroder
4. Laser spectroscopy and instrumentation demotroder
5. Molecular spectra scopy-King
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Theory

Class	**M.Sc.**		**Semester: IV**
Subject	**Physics**		**Paper No : III**
Title of the Paper	**Computer Programming & Informatics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit-1	Conceptual framework of computer languages (Algorithm, Flowcharts) Need of structured programming, Top-down, bottom-up and modular programming design. Introduction to C languages-basic structure of C programme. Character set, keyword and identifiers, C data types, variable and data type declaration. Various operators like arithmetic, relational, logical assignment, conditional, increment and decrement operators. Evaluation of expression and operator precedence.
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Unit-4	Network:

	Terminals-Dumb terminals, smart terminals, intelligent tgerminals. Types of network: • According to range: LAN,MAN,WAN, Client server • According to topologies: BUS, RING, STAR, Mesh Network. Internet: History of Internet Service Provider (ISP), introduction to type of internet account-shell/Ac, TCP/IP A/c. types of connectivity-Dialup, Leased lines, Satellite. IP Address-Class A, Class B, Class C Domain Name address. URL-absolute and relative
Unit-5	Web enabled technology (Email and HTML): Web Browser: Internet Explorer, Netscape Navigator, Station and Dynamic web page Introduction to HTML. HTML tags: • <HTML>, <TITLE>, <HEAD>, <BODY> • <P>, , (ALIGN>, <I>, <B>, <DIV>, <PRE>, and their attributers • <IMG> <a> and their attributes • Ordered and unordered list tages • Tabes and associated tags and its properties Creation of simple forms using text, Password, text area, radio, submit, Rest and Hidden. Brief idea about HTTP. Search engine, its working, types of search engines: sub directories meta search engines, search function-AND and OR. Population search engines.

Suggested Readings:

1. Let us C : Yashwat Kanetkar

2. Programming with C : Balaguruswami

3. Internet and Web Page : V. K Jain

   'O' level module M1.2

4. Internet and Web Page design : Dr. P.D Murarka

   'O' level module M1.2

5. Internet and web page design : Pearl Software

   'O' level module M1.2

6.	C# 2008 in simple step	Dreamtech press
7.	C# 2008	programming block book Dreamtech press

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As Recommended by the Board of Studies

Session – 2019-20

Theory

Class	**M.Sc.**		**Semester: IV**
Subject	**Physics**		**Paper No : IV**
Title of the Paper	**Digital Electronics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit-1	**OP-AMP:-** Differential amplifier circuit configurations: dual input balanced output dual input, single input unbalanced output (ac analysis) only, block diagram of a typical op amp analysis, schematic symbol of an op-amp. IC 555 timer Introduction, Architecture, Application as astable and monostable multivibraters.
Unit-2	**OP-AMP Parameters:-** Ideal op-amp parameters; input offset voltage, input offset current, input bias current, CMRR, SVRR, large signal voltage gain, Slew rate, Gain band width product, output resistance, supply currents power consumption, inverting and non-inverting inputs.
Unit-3	**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, L-C tunable oscillator, square wave generator.
Unit-4	**Microprocessors and Micro Computers:** Microprocessor and Architecture: Intel 8086, Microprocessor architecture modes of memory addressing, 8086/8088 Hardware specification: Pin-outs and pin functions, clock generator (8284A) Bus buffering and latching, Bus timing, Ready and wait State, Minimum mode versus maximum mode.

Unit-5	**Programming the Microprocessors:** Addressing modes: Data addressing modes, program memory addressing modes, stack memory-addressing modes. Instruction set: data movement Instructions, Arithmetic and login instructions, program control instructions. Programming example: Simple Assembly language programs table handling direct table addressing, searching a table sorting a table using pseudo ops.

Suggested Readings :

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

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As Recommended by the Board of Studies

Theory

<table>
<tr><td colspan="2">Session</td><td colspan="3">2018-19</td></tr>
<tr><td colspan="2">Class</td><td colspan="2">Bsc. I Year</td><td>Paper I</td></tr>
<tr><td rowspan="2">Subject</td><td>(English)</td><td colspan="3">Physics</td></tr>
<tr><td>हिन्दी</td><td colspan="3">भौतिक शास्त्र</td></tr>
<tr><td rowspan="2">Title of the Paper</td><td>(English)</td><td colspan="3">Math Physics, Mechanics and Properties of Matter</td></tr>
<tr><td>(हिन्दी)</td><td colspan="3">गणितीय भौतिकी यांत्रिकी तथा द्रव्य के गुण</td></tr>
<tr><td colspan="2">Medium of instruction (Teaching)</td><td>Both (दोनो)</td><td colspan="2">Question Paper Language - Both</td></tr>
<tr><td colspan="2">Max. Marks</td><td>(Theory) 40 + (CCE) 10</td><td colspan="2">=50</td></tr>
</table>

Subject : **Physics**

Paper : **I**

Title of the Paper : **Mathematical Physics, Mechanics and Properties of Matter**

Unit-I Mathematical Physics [15 Lectures]

Addition, subtraction and product of two vectors: Polar and axial vectors and their examples from physics: Triple and quadruple product (without geometrical application): Scalar and vector fields: Differentiation of a vector: Repeated integral of a function of more than one variable: Unit tangent and unit normal vector Gradient. Divergence and Curl: Laplacian operator; Idea of line surface and volume integrals; Gauss; Stokes and Green's Theorems.

इकाई–1: गणितीय भौतिकी **[15 Lectures]**

दो सदिशो का योग अंतर व गुणनफल, ध्रुवीय एवं अक्षीय सदिश एवं उनके भौतिकी उदाहरण तीन व चार सदिशों का गुणन (ज्यामितीय अनुप्रयोग के बिना), अदिश व सदिश क्षेत्र सदिश का अवकलन एक से अधिक चरों के फलन का बरम्बार समाकलन, इकाई स्पर्श सदिश, व इकाई नार्मल सदिश, सदिश का ग्रेडियन्ट, डायवर्जेस एवं कर्ल, लाप्लासीयन आपरेटर, रेखीय, पृष्ठीय, आयतन समाकलन गॉस, स्टोक व ग्रीन प्रमेय।

Unit-II Mechanics [15 Lectures]

Position, velocity, and acceleration vectors, Vectors. Components of velocity and acceleration in different coordinate systems Newton's Laws of motion and its explanation with problems various types of forces in nature (explanation). Pseudo Forces (e.g. Centrifugal Force), coriolis force and its applications. Motions under a central force. Derivation of Kepler's laws. Gravitational law and field, Potential due to a spherical body. Gauss & Poisson'sequation of

Gravitational self-energy. System of particles. Centre of mass and reduced Mass. Elastic and inelastic collisions.

इकाई—2: यांत्रिकी **[15 Lectures]**

स्थिति, वेग एंव त्वरण सदिश, गति व त्वरण के विभिन्न निर्देशांक पद्धतियों में घटक। न्यूटन के गति के नियम व इसकी व्याख्या, प्रकृति में विभिन्न बल व व्याख्या छद्म बल (उदाहरण, अभिकेन्द्रीय बल) कोरियालिस बल व इसके उदाहरण, केन्द्रीय बल के अन्तर्गत गति केप्लर के नियमों की निष्पति, गुरूत्वाकर्षण का नियम व क्षेत्र, गोलाकार पिण्ड का गुरूत्वीय विभव, गॉस व पायसन की गुरूत्वीय स्व उर्जा की समीकरण कणों का निकाय द्रव्यमान केन्द्र व समानीत द्रव्यमान, प्रत्यास्थ व अप्रत्यास्थ टक्कर।

Unit-III General Properties of Matter [15 Lectures]

Elastic moduli and their relations, Determination of Y of rectangular thin bar loaded at the centre: Torsional oscillations. Torsional rigidity of a wire, to determine n by torsional oscillations. Surface Tension. Angle to Contact, Capillary Rise Method; Energy required to raise a liquid in capillary tube; Factors affecting surface tension; Jeager's method for Determination of surface tension: Applications of Surface Tension. Concept of Viscous Forces and Viscosity. Steady and Turbulent Flow. Reynolds's number: Equation of continuity: Bernoulli's Principle: Application of Bernoulli's equation-(i) Speed of Efflux (ii) Venturimeter (iii) Aspirator Pump (iv) Change of Plane of motion of a spinning ball.

इकाई—3: द्रव्य के सामान्य गुण **[15 Lectures]**

प्रत्यास्थता गुणांक एवं उनके संबंध, मध्य में भारितपतली आयताकार छड (केन्टीलीवर) के Y का निर्धारण, ऐठन, दोलन, किसी तार की ऐंठन दृढ़ता व इसका ऐंठन दोलन विधि से निर्धारण। पृष्ठ तनाव, स्पर्श कोण, केशिका, उन्नयन विधि, केशिका में द्रव चढ़ाने में आवश्यक उर्जा, पृष्ठ, तनाव को प्रभावित करने वाले कारक जेगर, की विधि से पृष्ठ तनाव का निर्धारण, पृष्ठ तनाव के अनुप्रयोग। श्यानबल की संकल्पना व श्यानता गुणांक, धारोरेखीय व विक्षुब्ध प्रावह, रेनॉल्ड संख्या, सातत्य समीकरण बरनॉली का सिद्धांत बरनॉली प्रमेय के अनुप्रयोग : 1 एफ्लक्स की चाल 2. वेन्चुरीमीटर 3. एस्पिरेटर पम्प 4. स्पिनिंग बॉल के तल का परिवर्तन।

Unit-IV Oscillations [15 Lectures]

Concept of Simple, Periodic & Harmonic Oscillation with illustrations; Differential equation of harmonic oscillator; Kinetic and potential energy of Harmonic Oscillator; Oscillations of two masses connected by a spring; Translational and Rotational motion, Moment of Inertia and their Product, Principal moments and axes, Motion of Rigid Body, Euler's equation.

इकाई—4 : दोलन **[15 Lectures]**

सरल, आवर्ती व हार्मोनिक गति की सचित्र संकल्पना, आवर्ती दोलित्र का समीकरण, आवर्ती, दोलित्र की गतिज व स्थितिज उर्जा, स्प्रिंग से जुडे दो पिंड़ो का दोलन, स्थानांतरणीय व

घूर्णीय गति, जड़त्व आघूर्ण व उनका गुणन, मुख्य आघूर्ण एवं अक्ष, दृढ पिण्ड की गति, यूलर समीकरण।

Unit-V **[15 Lectures]**

Relativistic Mechanics: Michelson-Morley experiment and its outcome; Postulates of Special Theory of Relativity: Lorentz Transformation Simultaneity and order of events; Lorentz contraction; time dilation; Relativistic, transformation of velocity. Frequency and wave number Relativistic addition of velocities; Variation of mass with velocity.

Earlier Developments in physics up to 18th Century Contributions of Aryabhatt. Archimedes, Nicolas Copernicus, Galileo galilei, Huygens. Rebert Hooke. Torricelli, Vernier, Pascal, Kepler, Newton, Boyle, Young, Thompson, Coulomb. Amperes. Gauss. Biot-Savarts. Cavendish. Galvani. Franklin and Bernoulli.

इकाई–5 : **[15 Lectures]**

सापेक्षकीय यांत्रिकीः माइकल्सन व मोरले का प्रयोग एवं इसके निष्कर्ष, विशिष्ट सापेक्षिकता के सिद्धांत की अवधारणाएं, लॉरेंज, रूपांतरण समकालिक घटना एवं घटनाओं के क्रम, लॉरेंज संकुचन समय विस्तारण वेग, आवृत्ति तथा वेव नम्बर का सापेक्षकीय रूपान्तरण, वेगों का सापेक्षकीय योग, वेग के साथ द्रव्यमान परिवर्तन।

भौतिकी का प्रारंभिक विकास 18वीं सदी तकः आर्यभट्ट, आर्कमिडिज निकोलस कोपरनिकस, गेलिलीओ गैलिली, हॉयग्न, राबर्टहुक, टॉरसेली, वर्नियर, पॉस्कल, केप्लर, न्यूटन, बॉयल यंग, थॉमसन, कुलॉम्ब, एम्पीयर, गॉस, बॉयो–सेवर्ट, केवनडिश, गेलवानी, फ्रेंकलीन और बरनॉली।

Reference Books:

1. University Physics Sears and Zeeman sky. XIth edition. Pearson Education.
2. Concepts of Physics: H.C. Verma. Bharti Bhavan Publishers
3. Problems in Physics P.K. Srivastava. Wiley Eastern Ltd.
4. Berkley Physics Course. Vol I. Mechanics: E.M Purcell. McGraw hill
5. Properties. of Matter. D.S. Mathur Shamlal Chritable Trust, New Delhi
6. Mechnics: D.S. Mathur, S. Chand and Company new Delhi - 5
7. The Feymman Lectures in Physics Vol. I: R.P. Feymman. R.B. Lighton and M. Sands

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As Recommended by the Board of Studies

Theory

<table>
<tr><th colspan="2">Session</th><th colspan="2">2018-19</th></tr>
<tr><th colspan="2">Class</th><th>Bsc. I Year</th><th>Paper 2</th></tr>
<tr><th rowspan="2">Subject</th><th>(English)</th><th colspan="2">Physics</th></tr>
<tr><th>हिन्दी</th><th colspan="2">भौतिक शास्त्र</th></tr>
<tr><th rowspan="2">Title of the Paper</th><th>(English)</th><th colspan="2">Thermodynamics and Statistical Physics</th></tr>
<tr><th>(हिन्दी)</th><th colspan="2">उष्मागतिकी तथा सांख्यिकी भौतिकी</th></tr>
<tr><th colspan="2">Medium of instruction (Teaching)</th><th>Both (दोनो)</th><th>Question Paper Language - Both</th></tr>
<tr><th colspan="2">Max. Marks</th><th>(Theory) 40 + (CCE) 10</th><th>=50</th></tr>
</table>

Subject : **Physics**

Paper : **II**

Title of the Paper : **Thermodynamics and Statistical Physics**

Unit-I Thermodynamics-I [15 Lectures]

Reversible and irreversible process, Heat engines Definition of efficiency Carnot's ideal heat engine, Carnot's cycle, Effective way to increase efficiency, Carnot's engines and refrigerator, Coefficient of performance, Second law of thermodynamics, Various statements of second law of thermodynamics, Carnot's theorem, Chaperon's latent . heat equation, Carnot's cycle and its applications, Steam engine Otto engine. Petrol engine. Diesel engine.

इकाई–1: उष्मागतिकी–। **[15 Lectures]**

उत्क्रमणीय एवं अनुत्क्रमणीय प्रक्रम, कार्नो का आदर्श चक्र, इसकी दक्षता बढ़ाने के प्रभावी तरीकें कानों का उष्मीय इंजन व प्रशीतक, दक्षता गुणांक, उष्मागतिकी का द्वितीय नियम व इसके विभिन्न कथन, कानों का प्रमेय, क्लेपरियॉन की गुप्त उष्मा समीकरण कार्नोचक्र एवं उसके अनुप्रयोग। उष्मीय इंजिन, ऑटो इंजिन, पेंट्रोल इंजिन, डीजल इंजिन।

Unit-II Thermodynamics-II [15 Lectures]

Concept of entropy, Change in entropy in adiabatic process, Change in entropy in reversible cycle, Principle of increase of entropy, Change in entropy in irreversible process. T-S diagram. Physical signification of Entropy, Entropy of a perfect gas. Kelvin's thermodynamic scale of temperature. The size of a degree. Zero of absolute scale, Identity of a perfect gas scale and absolute scale. Third law of thermodynamics. Zero point energy, Negative temperatures (not

possible), Heart death of the universe, Relation between thermodynamic variable (Maxwell's Relations).

इकाई–2: उष्मागतिकी–II **[15 Lectures]**

एन्ट्रापी की संकल्पना, रूद्धोष्म प्रक्रम में एन्ट्रीपी का परिवर्तन चक्रय प्रक्रम में एन्ट्रापी का परिवर्तन, एन्ट्रापी के वृद्धि का सिद्धांत, उत्क्रमणीय व अनुत्क्रमणीय प्रक्रम में एन्ट्रापी का परिवर्तन–T-S आरेख, एन्ट्रापी का भौतिक महत्व, आदर्श गैस की एन्ट्रापी, केल्विन का उष्मागतिक ताप पैमाना, परम पैमाने का शून्य ताप, आदर्श गैस व परम ताम पैमाने में साम्यता। उष्मागतिकी का तृतीय नियम, शून्य बिन्दू उर्जा, ऋणात्मक तापक्रम (सम्भव नहीं) ब्रहमाण्ड की उष्मीय समाप्ति। उष्मागिकी चरों में संबंध (मेक्सवेल के समीकरण)

Unit-III Statistical Physics-I [15 Lectures]

Description of a system: Significance of statistical approach, Particle-states, System-states. Microstate and Macro-states of a system. Equlibrium States, Fluctuation Classical & Statistical Probability the equi-probability postulate, Statistical ensemble, Number of states accessible to a system. Phase space. Micro Canonical Ensemble, Canonical Ensemble. Helmholtz freee energy, Enthalpy, First law of thermodynamics, Gibbs free energy. Grand Canonical Ensemble.

इकाई–3: सांख्यिकीय भौतिकी–1 **[15 Lectures]**

निकाय का वर्णन: सांख्यिकीय अवधारणा का महत्व, कण एवं निकाय की अवस्थाऐं, निकाय की सूक्ष्म एवं स्थूल अवस्थाएं साम्य अवस्थाऐं विचलन, चिरसम्मत व सांख्यिकी प्रायिकता, पूर्व प्रायिकता सिद्धान्त सांख्यिकी एन्सेम्बल, किसी निकास के लिये अभिगम्य अवस्थाऐं, कला आकाश, माईक्रो केनोनीकल एन्सेम्बल, केनोनीकल एन्सेम्बल, हेल्मोल्टज मुक्त उर्जा, एन्थलपी, उष्मागतिकी का प्रथम नियम, गिब्स, मुक्त उर्जा, ग्रेंड केनोनीकल एन्सेम्बल.

Unit-IV Statistical Physics-II [15 Lectures]

Statistical Physics: Phase space, The Probability of a distribution. The most probable distribution and its narrowing with increase in number of particles. Maxwll-Boltzmnn statistics Molecular speeds. Distribution and mean. r.m.s and most probable velocity. Constraints of accessible state. and maccessible states Quantum Statistics: Partition Function, Relation between Partition Function and Entropy, Bose-Eistein statistics. Black-Body radiation, The Rayleigh-Jeans formula, The Planck radiation formula, Fermi-Dirac Statistics. Comparison of results. Concept of Phase transitions.

इकाई–4: सांख्यिकीय भौतिकी–II **[15 Lectures]**

सांख्यिकीय यांत्रिकी: कला आकाश, वितरण की प्रायिकता, अधिकतम, संभाव्य वितरण व इसका कणों की संख्या बढ़ने पर संकुचन, मेक्सवेल, बोल्टजमैन सांख्यिकी, आणविक चाल का वितरण, औसत चाल, वर्ग–माध्य–मूल चाल और अधिकतम प्रसम्भाव वेग, प्रतिबंध अभिगम्य, एवं अनअभिगम्य अवस्थाओं के प्रतिबंध। क्वांटम सांख्यिकी: पार्टीशन फलन, एंट्रापी व पार्टीशन

फलन में संबंध, बोस आइन्सटीन सांख्यिकी, कृष्ण पिण्ड विकिरण, रेले जीन्स सूत्र, प्लांक विकिरण सूत्र, फर्मी–डिराक सांख्यिकी परिणामों की तुलना फेस संक्रमण की संल्पना।

Unit-V Contributions of Physicists [15 Lectures]

S.N. Bose, M.N. Saha, Maxwell, Clausois. Boltzmaan. Joule, Wien, Einstein, Plank Bohr. Heiesnberg. Fermi, Dirac, Max Born Bardeen.

इकाई–5: भौतिकविदों का योगदान **[15 Lectures]**

एस.एन. बोस, एम.एन. साहा, मैक्सवेल, क्लासियस, बोल्टमैन, जूल, वीन, आइन्सटीन, प्लाक बोहर, हाईजनबर्ग फर्मी, डिराक, मेस्कबार्न वार्डीन।

Text and Reference Books:

1. Heat and Thermodynamics: Mark W. Zemansky. Richard H.Ditman. Sventh Edition. McGraw-Hill International Editions.
2. Thermal Physics (Heat and Thermodynamics) A.B. Gupta, H.P. Roy, Books and Allied (P) Ltd. Calcutta.
3. Heat and Thermodynamics: Brijlal and N. Subrahmanyam. S. Chand & Company Ltd. New Delhi.
4. Berkley Physics Course, Vol 3, Thermodynamics: F, Reif, Mergraw Hill
5. Thermodynamics and Statistical Physics, D.P. Khandelwal and A.K. Pandey, Himalaya Publication.
6. Laboratory manual of Physics for undergraduate classes, D.P. Khandelwal Vani Publication house. New Delhi.

Class: B.Sc. First Year

Max. Marks: 50

Subject : **Physics**

For Regular Students

Practical	Sessional	Viva	Total
25	10	15	50

For Ex-Student

Practical	Sessional	Viva	Total
35	00	15	50

List of Practical's

1. To verify laws of parallel and perpendicular axes for moment of inertia.
2. To determine acceleration due to gravity using compound pendulum.
3. To determine damping coefficient using a bar pendulum.
4. To determine Young's Modulus by bending of beam Method.
5. To determine Young's Modulus using Cantilever method.
6. To determine coefficient of rigidity by static method.
7. To determine Coefficient of rigidity by dynamic method.
8. To determine Surface Tension by Jaegar's method.
9. To determine Surface Tension of a liquid by capillary rise method.
10. To determine Viscosity of fluid using Poisellie's methods.
11. To study conversion of mechanical energy into heat using Calender & Barne's Method.
12. To determine heating efficiency of electrical Kettle with various voltages.
13. To determine heating temperature coefficient of resistance using platinum resistance thermometer.
14. To determine thermo electromotive force by a thermocouple method.
15. To determine heat conductivity of bad conductors of different geometry by Lee's method.
16. To verify Newton's Laws of cooling.

17. To determine specific heat of Coefficient of thermal conductivity by Searl's Method.

18. To determine Specific heat of a liquid.

19. To compare Maxwell-Boltzmann, Bose Einstein and Fermi-Dirac Distribution function vs temperature using M.S. Excel/C++

20. To plot equation of state and Vander-Wall equation with temperature using M.S. Excel/C++

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE,

BHOPAL

SYLLABUS FOR

M.Sc (Physics)

SEM I, II, III & IV

SESSION 2018-19

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College,

Shivaji Nagar, Bhopal

As Recommended by the Board of Studies

Session 2018-19

Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : I**
Title of the Paper	**MATHEMATICAL PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - 1 (English)	**<u>Differential equations</u>: Recursion relation, generating functions and orthogonality of Bessel functions of first and second kind, Hermite, Legendre, Associate Legendre and Laguerre Polynomials, Curvilinear coordinate system with specific cases of Cartesian, Cylindrical and Spherical coordinate systems.**	1. L.A. Pipes Mathematics of Engineers and Physicists. 2. Arfken Mathematical Methods for Physicists. 3. P.K. Chattopadhyay Machematical Physics. 4. H.K.Dass Mathematical Physics
Unit - II (English)	**Integral transforms. Fourier integral. Fourier transforms and inverse Fourier transforms.** **Fourier transform of derivatives. Convolution theorem. Elementary Laplace transforms.** **Laplace transform to derivatives. Application to a damped harmonic oscillator.**	

Unit - III (English)	**Green's functions: Non-homogenous boundary value problems, Green's function for one dimensional problems, eigen function expansion of Green's function, Fourier transforms.** **Method of constructing.** **Green's functions, Green's function for electrostatic boundary value. Problems and quantum-mechanical scattering problem.**	5. Ghatak, Goyal & Guha Mathematical Physics 6. M.R. Spiegal (Schaum Series) Complex variable & Laplace Transform.
Unit - IV (English)	**Complex variables: analyticity of complex functions. Cauchy Riemann equations. Cauchy theorem. Cauchy integral formula.** **Taylors, Maclaurin Laurent series and mapping.** **Theorem of residues. Simple cases of contour integration. Jordan's lemma Integrals involving multiple valued function (Branch points)**	
Unit - V (English)	**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.**	

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Session 2018-19

Theory

Class	**M.Sc.**	**Semester: I**	
Subject	**Physics**	**Paper No : II**	
Title of the Paper	**CLASSICAL MECHANICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**<u>Newtonin mechanics of one and many particles systems</u>: Conservation laws, Constraints their classification, Principle of virtual work; D'Almbert's principle in generalized coordinates, The Lagrange's equitation from D'Almbert's principle. Configuration space, Hamilton's principle deduction from D'Almberts principle, Generalized momenta and Lagragian 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.**	1. H. Goldsetin (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)
Unit - II (English)	**<u>The equitation of canonical transformation and generating functions</u>: The Hamilton-Jacobi Action and Angle 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.**	

Unit - III (English)	**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.**	R.G. Takwale & P.s. Puranik Introduction to Classical Mechanics.
Unit - IV (English)	**Symmetries of space and time.** **Invariance under galilion transformation, Covariant four-dimensional 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 Hamiltonioan, Examples.**	
Unit - V (English)	**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.**	

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Session 2018-19

Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : III**
Title of the Paper	**QUANTIUM MECAHNICS – I**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**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.**	1. L I Schiff, Quantum Mechanics 2. S Gasiorovvicz. Quantum Physics
Unit - II (English)	**Linear vector space, concept of Hilbert 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).**	3. B.Craseman and J D Powell Quantum Mechanics 4. A.P. Messiah Quantum Mechanics

Unit - III (Engilish)	**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 (deuteron).**	5. J.J. Sakurai Modern Quantum Mechanics Mathews and Venkatesan Quantum Mechanics.
Unit - IV (English)	**Angular momentum in quantum mechanics, Eigen values and Eigen function of L_2 and L_z in term of spherical harmonics, commutation relation. Time independent perturbation theory. Non-degenerate and degenerate cases.**	
Unit - V (English)	**This unit will have a short note question covering all the four units.** **The students will have to answer any two questions of the four.**	

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As Recommended by the Board of Studies

Session 2018-19

Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : IV**
Title of the Paper	**ELETRONIC DEVICES**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - 1 (English)	**<u>Transistors</u> : JFET, BJT, MOSFET and MOSFET, structure derivations of the equations for I-V characteristics under different conditions, microwave devices, tunnel diode, transfer electron devices (Gunn diode) avalanche transits time devices, Impatt diodes and parametric devices.**	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.
Unit - II (English)	**<u>Photonic devices</u>: 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 (English)	**<u>Memory Devices</u>: Read Only Memory (ROM) and Random Access Memory (RAM). Types of ROM: PROM, EPRON, EEPROM AND EAPROM, Static and dynamic RAMs (SRAM & DRAM), characteristics of SRAM and DRAM.** **<u>Hydbrid Memories</u> : CMOS and NMOS memories, Nonvolatile RAM, ferro-electric memories, charge coupled devices (CCD), storage devices : Geometry and organization of magnetic (FDD and HDD) and Optical (CD-ROM, CD-R, CD-R/W, DVD) Storage Devices.**	Ajoy Ghatak and Thyagrajam Optical Electrics.
Unit - IV (English)	**Eletro-optics, Magneto-optic and Acousto-optic effects, materials properties related to get these effect, important ferro electric, Liquid crystal and polymeric materials for these devices, piezoelectric, electrostrictive and magnetostrictive effects. Important materials for these properties and their applications in sensors and actuator devices, acoustic delay lines, peizoelectric resonators and filters, high frequency piezoelectric devices-surface, acoustic wave devices.**	
Unit - V (English)	**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.**	

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As Recommended by the Board of Studies

Session 2018-19

Practial

Class		**M.Sc.**	**Semester : I**
Subject		**Physics**	
Title of Practical		**Electronics (Lab-A)**	
Medium of instructions ¼Teaching)		**English**	**Question Paper Language : English**
Maximum Marks		**100**	

Syllabus	*Recommended Books*
1. To study Characteristics of "Tunnel Diode". **2. To study Characteristics of "Field Effect Transistor".** **3. To study Characteristics of "Unijunction Transistor".** **4. To study Characteristics of "MOSFET"** **5. To study Characteristics of "Thermister"** **6. To study Characteristics of "Triac"** **7. To study Characteristics of "Zender Diode".** **8. To study Characteristics of :V R Tube"** **9. To study Characteristics of "LED & Photo Transistor"** **10. To determine hybrid parameters of a transistor**	

11. To verify Richardson's Equation.	

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Session – 2018-19

Practial

Class		M.Sc.	Semester : I
Subject		Physics	
Title of Practical		General (Lab-B)	
Medium of instructions ¼Teaching)		English	Question Paper Language : English
Maximum Marks		100	

Syllabus	*Recommended Books*
1. To determine Planck's constant 'h' by photo cell. **2. To determine Planck's constant 'h' by solar cell.** **3. To determine 'e/m' by 'Thomas' method.** **4. To determine 'e/m' by Milliken's Oil Drop method.** **5. To study resolving power of diffraction grating.** **6. To find out thickness of mica sheet by biprism.** **7. To study waveform and frequency by CRO.** **8. To study diffraction at single slit.** **9. To analyze elliptically polarized light by Babinate's Compensator.**	

10. To verify Fresnel's formula & Canchy's formula 11. To find 'electronic charge' 'e' by rectifier. 12. To find energy band gap 13. To determine low resistance by Kelvin's Double Bridge.	

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Session – 2018-19

Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : I**
Title of the Paper	**QUANTUM MECHANICS –II**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - I (English)	**<u>Approximation method for bound states</u>: Rayleigh - Schrodinger Perturbation theory of non-degenerate and degenerate 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.**	1. LI Schiff Quantum Mechanics 2. S Gasirowicaz Quantum Physics 3. B.Craseman and J J Powell Quantum Mechanics (Addison Wessley) 4. A. Messiah Quantum Mechanics 5. J.J. Sakurai Modern
Unit - II (English)	**<u>Time dependant perturbation theory</u> : 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 (English)	**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 practices with spin, Pauli's spin matrices.	Quantum Mechanics 6. Mathews and Venkatessan Quantum Mechanics
Unit - IV (English)	**Schrodinger.s relativistic equation (Klein-Gordon equation), Probability and current denisity, 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.**	A.K.Ghatak and Loknathan Quantum Mechanics.
Unit - V (English)	**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.**	

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : II**
Title of the Paper	**STATISTICAL MECHANICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**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. Micro canonical ensemble, phase space, trajectories and density of states, Liouvelle theorem, canonical and grand canonical ensembles, partition function, calculation of statistical quantities, energy sand density fluctuations.**	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.
Unit - II (English)	**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 (English)	**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 - IV (English)	**Thermodynamics fluctuation spatial correlation Brownian motion, Langevin theory, fluctuation dissipation theorem, the Fokker-Planck equation, Onsager reciprocity relations.**	
Unit - V (English)	**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.**	

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : III**
Title of the Paper	**ELECTRODYNAMICS AND PLASMA PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - I (English)	**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.**	1. Bitteneerort Plasma Physics 2. Chen Plasma Physics 3. Gupta, Kumar, Singh Electro dynamics 4. Sen Plasma state and matter 5. Jackson Classical electrodynamics
Unit - II (English)	**Fields of an 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-demension Maxwell equation, Four Vector current and potential and their invariance under Lortentz transformation, covariance of electro-dynamics.** **Langragian and Hamiltonian for a relativistic charged particle in**	

	External EM field; motion of charged particles in electromagnetic fields, uniform and non-uniform E and B fields.	6. Pamolsky & Philips Classical electricity and Magnetism.
Unit - III (English)	**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 plasma. Debye screening distance. Plasma oscillations: Transverse oscillations and longitudinal oscillations.**	
Unit - IV (English)	**<u>Domain of Magneto hydrodynamics and plasma Physics</u> :** **Magneto hydrodynamic equations, magnetic hydro-static pressure hydrodynamic waves: Magneto-sonic and Alfven waves, particle orbits and drift motion in plasmas. Experimental study of Plasma the theory of single and double probes.**	
Unit - V (English)	**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.**	

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Theory

Class	M.Sc.		Semester: II
Subject	Physics		Paper No : IV
Title of the Paper	ATOMIC AND MOLECULAR PHYSICS		
Medium of instructions (Teaching)	English	Question Paper Language: English	
Maximum Marks	Total :100	Main Exam:70	C.C.E.:30

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**Quantum states of one electron atom. Atomic orbitals. Hydrogen spectrum, Pauli's 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).**	1. H.E. White Introduction to atomic spectra 2. C.B. Banwell Fundamental of molecular spectroscopy 3. Walker and Strengthen Spectroscopy Vol. I , II and III 4. G.N. Barrow Introduction of molecular spectroscopy 5. Herzberg Spectra of diatomic molecules
Unit - II (English)	**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 (English)	**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)**	6. Jeanne L and McHale Molecular spectroscopy 7. J.M. Brown Molecular spectroscopy
Unit - IV (English)	**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 photo acoustic spectroscopy and Moss Bauer spectroscopy (principle).**	8. P.F. Benmath Spectra of atoms and molecules J.M. Halian Modern Spectroscopy
Unit - V (English)	**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.**	

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Practials

Class		**M.Sc.**	**Semester : II**
Subject		**Physics**	
Title of Practical		**General (Lab-B)**	
Medium of instructions ¼Teaching)		**English**	**Question Paper Language : English**
Maximum Marks		**100**	

Syllabus	***Recommended Books***
1. To find Young's modulus of metallic rod by Newton's ring method. **2. To find Poisson's ratio and Young's modulus of glass by Cornu's method** **3. To find capacitance by "Shearing bridge".** **4. To find self and mutual inductance by Anderson's bridge.** **5. To study BH curve for soft iron rod by CRO** **6. To study BH curve for the specimen of iron in form of anchor ring.** **7. To determine resistivity of given material by 'Four Probe**	

Method'. 8. To determine band gap in semiconductor by 'For Probe Method'. 9. To study "Hall Effect". 10. To find "Stefan's Constant". 11. To verify Cauchy's Formula 12. To study thermo emf of a thermo couple 13. To measure drift velocity in semi conductor	

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Practials

Class		**M.Sc.**	**Semester : II**
Subject		**Physics**	
Title of Practical		**Electronics (Lab-A)**	
Medium of instructions ¼Teaching)		**English**	**Question Paper Language : English**
Maximum Marks		**100**	

Syllabus	***Recommended Books***
1. To study Basic Logic Gates **2. To study ''NAND" Gate** **3. To verify De Morgan's Law** **4. To study frequency response of R.C. coupled amplifier.** **5. To study regulated/ unregulated power supply.** **6. To study characteristics of Silicon Controlled Rectifier.** **7. To study Fourier analysis of a complex wave form** **8. To study cathode follower**	

9. To study emitter follower **10. To study frequency response of passive filters** **11. To compare characteristics of Ge & Si Transistor.**	

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Session – 2018-19

Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : I**
Title of paper	**Condensed Matter Physics-I**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional :	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit-1	**Crystal structure:** Bravis lattice in two and three dimension. Simple crystal structures: Hexagonal close packed structure, Diamond structure, zinc blende structure, sodium chloride structure, cesium chloride structure.	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
Unit-2	**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-3	**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.	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.
Unit-4	**Lattice vibration and phonons:** Lattice dynamics 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-5	**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.	

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Theory

Class	**M.Sc.**		**Semester: III**
Subject (English)	**Physics**		**Paper No : II**
Title of Paper	**Nuclear and Particle Physics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional :	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit-1	**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.	1. Introduction of Nuclear physics : H.A. Enge 2. Nuclear radiation detectors : S.S. Kapoor and V.S. Ramamurthy 3. Atomic and Nuclear physic : S.N. Ghoshal
Unit-2	**Acclerators of charged particles:** Study of cyclotron, phase stability, frequency modulated cyclotron (synchorocyclotron) magnetic induction accelerator (Betatron) Electron synchrotron and linear accelerator (Linac)	

<table>
<tr>
<td>Unit-3</td>
<td>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.</td>
<td rowspan="3">4. Nuclear and Particle physics : D.C. Tayal

5. Nuclear physics :
R.C. Sharma

6. Introduction of Nuclear physics: KRANE

7. Nuclear physics Principles & Application
: Lilley</td>
</tr>
<tr>
<td>Unit-4</td>
<td>Nuclear decay and elementary particles:

ß Decay, general features of ß ray spectrum, Fermi theory of ß decay, selection rules, parity in ß decay, multipole radiation, internal conversion, nuclear isomerism.</td>
</tr>
<tr>
<td>Unit-5</td>
<td>Elementary particles:

Classification of elementary particles, fundamental interaction, parameters of elementary particles. Symmetry and conservation laws, symmetry schemes of elementary particles SU(3).</td>
</tr>
</table>

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Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : III**
Title of Paper	**Digital Electronics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional :	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit-1	Number system (Binary, Octal, Decimal, hexadecimal) and conversion between them. Boolean arithmetic, signed and unsigned binary numbers, I's complement, 2's complement.	1. "Digital principles and applications" by A.P. Malvino and Donald P. Leach, Tata Megraw-Hill Company, New Delhi, 1993. 2. "Microprocessor Architecture, Programming and Applications with 8085/8086 by Rames S.Gaonkar, Wiley-eastern Ltd., 1987 (for unit V)"
Unit-2	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-3	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)	

<table>
<tr><td>Unit-4</td><td>Counters-asynchronous (ripple) counter, synchronous (parallel) counter, MOD-5 counter and MOD-10 counter, BCD counter, Up-Down counter, Shift Register counter (Ring counter)</td><td rowspan="2">3. Digital electronics : S.N. Ali

4. Digital electronics: Morries Mano

5. Microprocessor and Microcomputers : B. Ram- Dhanpat Rai publications V edition.</td></tr>
<tr><td>Unit-5</td><td>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)</td></tr>
</table>

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College,

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As Recommended by the Board of Studies

Session – 2018-19

Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : IV**
Title of Paper	**Atomic and Molecular Physics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional :	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit-1	**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 interation and spin-spin coupling between two and more nuclei (Qualitative)	1. Fundamentals of Molecular Spectroscopy : C.B. Banwell.
Unit-2	**Electronic spectra of Diatomic Molecules and Fourier transform infrared spectroscopy** Frank Condon principles, dissociation and pre-dissociation, dissociation energy. Born-Oppenheimer-approximation, vibrational coarse structure of electronic spectra (bands progression and sequence). Fourier transform infrared spectroscopy :Theory and application FTIR peaks of common bands and functional groups	2. Spectra of Diatomic Molecules : Herzberg. 3. Mossbauer Spectroscopy : M.R. Bhide

		4. NMR and Chemistry : J.W. Akitt
Unit-3	**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.	5. Modern Spectroscopy : J.M. Hollons
Unit-4	**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-5	**Electron Spin Resonance Spectroscopy:** Elementary Idea about ESR, Principle of ESR, ESR spectrometer, splitting of electron energy levels by a magnetic field, G-Values, simple experimental set-up of ESR. ESR spectra of free radicals in solution, Anisotropic system.	

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As Recommended by the Board of Studies

Session – 2018-19

Practial

Class		**M.Sc.**	**Semester : III**
Subject		**Physics**	
Title of Paper		**Lab-A & Lab-B**	
Medium of instructions ¼Teaching)		**English**	**Question Paper Language : English**
Maximum Marks		**100 +100**	

LAB A

Syllabus	*Recommended Books*
1. Find thickness of a wire using LASER **2. To find ' ' of LASER light** **3. To find of liquid using LASER** **4. To study Wein Bridge Oscillator** **5. To study Hartley Oscillator** **6. To study Differential Comparator** **7. To study Operational Amplifier as :Adder and Sub tractor"**	

8.	To study Operational Amplifier as :Diffrentiator"	
9.	To study Operational amplifier as " Integrator".	
10.	To study Operational Amplifier as " Mono stable Multi vibrator"	
11.	To study Operational amplifier as low pass and high pass filter.	
12.	To study Operational Amplifier as square wave generator.	
13.	To study Operational amplifier as current voltage converter.	
14.	To study Operational Amplifier as current gain amplifier.	
15.	To study Operational Amplifier as Schmith Trigger.	

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Session 2018-19

Class / कक्षा	: **M.Sc.**
Semester / सेमेस्टर	: **IV**
Subject / विषय	: **Physics**
Title of Subject Group	: **Condensed Matter Physics-II**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: **I**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: **Compulsory**
Max. Marks अधिकतम अंक	: **CCE : 30, Main Exam : 70 Total - 100**

Particulars / विवरण

Unit-1	Super Conductivity: Concept of super conducting state, persistent current, critical temperature, Meissen 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-2	Magnetism: Weiss theory of ferromagnetic Heisenberg model and molecular field theory, Domain and Bloch wall energy, Spin waves and magnons, Curie Weiss law for susceptibility, Ferri and anti ferrimagnetism.
Unit-3	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-4	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.
Unit-5	Nano structure: Definition and properties of nano structured material, different method of preparation of nano materials, plasma enchanted chemical vapour deposition, electro deposition. structure of single wall carbon nono tubes (classification, chiral vector Cn, Translational vector T, Symmetry vector R, Unit Cell, Brillouin Zone) Electronic, mechanical, thermal and phonon properties.

Suggested Readings:

1. Kittel: Solid State Physics
2. Huang: Theoretical Solid State Physics
3. Weertmon and Weertman: Elementary Dislocation theory
4. Thomes: Multiple Electron microscopy
5. Tolansky: Multiple Beam Interferometer

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Session 2018-19

Class / कक्षा	:	**M.Sc.**
Semester / सेमेस्टर	:	**IV**
Subject / विषय	:	**Physics**
Title of Subject Group	:	**Laser Physics**
विषय समूह का शीर्षक	:	
Paper No. / प्रश्नपत्र क्रमांक	:	**II**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	:	**Compulsory**
Max. Marks अधिकतम अंक	:	**CCE : 30, Main Exam : 70 Total - 100**

Particulars / विवरण

Unit-1	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-2	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-3	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 HCI and HF lasers.
Unit-4	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-5	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.

Suggested Readings:

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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Session (सत्र) – 2018-19

Class / कक्षा	: **M.Sc.**
Semester / सेमेस्टर	: **IV**
Subject / विषय	: **Physics**
Title of Subject Group	: **Computer Programming and Informatics**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: **III**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: **Compulsory**
Max. Marks अधिकतम अंक	: **CCE : 30, Main Exam : 70 Total - 100**

Particulars / विवरण

Unit-1	Conceptual framework of computer languages (Algorithm, Flowcharts) Need of structured programming, Top-down, bottom-up and modular programming design. Introduction to C languages-basic structure of C programme. Character set, keyword and identifiers, C data types, variable and data type declaration. Various operators like arithmetic, relational, logical assignment, conditional, increment and decrement operators. Evaluation of expression and operator precedence.
Unit-2	Input and output statement, control statement (If, If-else, If nested If-else statements switch, while, Do... while and for statements) Simple C programmes like search of prime number between given range of numbers, finding the smallest and largest of three numbers, sume of algebraic series, factorial of given number, roots of a quadratic equation, binary of decimal and decimal to binary conversion etc.
Unit-3	Functions: need of functions, calling the function by value and by reference, category of functions: no argument no return, argument but not return, argument with return. Recursion. One and two dimensional arrays. String and string handling functions like sprinf (), strepy (), sscanf (), strlen(), sizeorf () strcmp ()etc. Simple programs using user define functions, arrays and string functions.
Unit-4	Network: Terminals-Dumb terminals, smart terminals, intelligent tgerminals. Types of network: • According to range: LAN,MAN,WAN, Client server • According to topologies: BUS, RING, STAR, Mesh Network.

	Internet: History of Internet Service Provider (ISP), introduction to type of internet account-shell/Ac, TCP/IP A/c. types of connectivity-Dialup, Leased lines, Satellite. IP Address-Class A, Class B, Class C Domain Name address. URL-absolute and relative
Unit-5	Web enabled technology (Email and HTML): Web Browser: Internet Explorer, Netscape Navigator, Station and Dynamic web page Introduction to HTML. HTML tags: • <HTML>, <TITLE>, <HEAD>, <BODY> • <P>, , (ALIGN>, <I>, <B>, <DIV>, <PRE>, and their attributers • <IMG> <a> and their attributes • Ordered and unordered list tages • Tabes and associated tags and its properties Creation of simple forms using text, Password, text area, radio, submit, Rest and Hidden. Brief idea about HTTP. Search engine, its working, types of search engines: sub directories meta search engines, search function-AND and OR. Population search engines.

Suggested Readings:

1. Let us C : Yashwat Kanetkar
2. Programming with C : Balaguruswami
3. Internet and Web Page : V. K Jain

   'O' level module M1.2
4. Internet and Web Page design : Dr. P.D Murarka

   'O' level module M1.2
5. Internet and web page design : Pearl Software

   'O' level module M1.2
6. C# 2008 in simple step

   Dreamtech press
7. C# 2008 programming block book

   Dreamtech press

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Session (सत्र) – **2018-19**

Class / कक्षा	: **M.Sc.**
Semester / सेमेस्टर	: **IV**
Subject / विषय	: **Physics**
Title of Subject Group	: **Digital Electronics**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: **IV-E**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: **Optional**

Max. Marks अधिकतम अंक : CCE : 30, Main Exam : 70 Total - 100

Particulars / विवरण

Unit-1	**OP-AMP:-** Differential amplifier circuit configurations: dual input balanced output dual input, single input unbalanced output (ac analysis) only, block diagram of a typical op amp analysis, schematic symbol of an op-amp. IC 555 timer Introduction, Architecture, Application as astable and monostable multivibraters.
Unit-2	**OP-AMP Parameters:-** Ideal op-amp parameters; input offset voltage, input offset current, input bias current, CMRR, SVRR, large signal voltage gain, Slew rate, Gain band width product, output resistance, supply currents power consumption, inverting and non-inverting inputs.
Unit-3	**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, L-C tunable oscillator, square wave generator.
Unit-4	**Microprocessors and Micro Computers:** Microprocessor and Architecture: Intel 8086, Microprocessor architecture modes of memory addressing, 8086/8088 Hardware specification: Pin-outs and pin functions, clock generator (8284A) Bus buffering and latching, Bus timing, Ready and wait State, Minimum mode versus maximum mode.
Unit-5	**Programming the Microprocessors:** Addressing modes: Data addressing modes, program memory addressing modes, stack memory-addressing modes. Instruction set: data movement Instructions, Arithmetic and login instructions, program control instructions. Programming example: Simple Assembly language programs table handling direct table addressing, searching a table sorting a table using pseudo ops.

Suggested Readings :

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

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As Recommended by the Board of Studies

Session – 2018-19

Theory

Class	**M.Sc.**		**Semester: IV**
Subject	**Physics**		**Paper No : I**
Title of the Paper	**Condensed Matter Physics-II**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit-1	Super Conductivity: Concept of super conducting state, persistent current, critical temperature, Meissen 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-2	Magnetism: Weiss theory of ferromagnetic Heisenberg model and molecular field theory, Domain and Bloch wall energy, Spin waves and magnons, Curie Weiss law for susceptibility, Ferri and anti ferrimagnetism.
Unit-3	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-4	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.
Unit-5	Nano structure: Definition and properties of nano structured material, different method of preparation of nano materials, plasma enchanted chemical vapour deposition, electro deposition. structure of single wall carbon nono tubes (classification, chiral vector Cn, Translational vector T, Symmetry vector R, Unit Cell, Brillouin Zone) Electronic, mechanical, thermal and phonon properties.

Suggested Readings:

1. Kittel: Solid State Physics
2. Huang: Theoretical Solid State Physics
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Session – 2018-19

Theory

Class	**M.Sc.**		**Semester: IV**
Subject	**Physics**		**Paper No : II**
Title of the Paper	**Laser Physics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit-1	**Basic principles of laser:** Introduction to laser, spontaneous and stimulated emission. Einstein coefficients, Idea of light amplification. Population inversion, laser pumping schemes for two and three level system with threshold condition for laser oscillation.
Unit-2	**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-3	**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-4	**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-5	**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.

Suggested Readings:

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

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Theory

Class	**M.Sc.**		**Semester: IV**
Subject	**Physics**		**Paper No : III**
Title of the Paper	**Computer Programming & Informatics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit-1	Conceptual framework of computer languages (Algorithm, Flowcharts) Need of structured programming, Top-down, bottom-up and modular programming design. Introduction to C languages-basic structure of C programme. Character set, keyword and identifiers, C data types, variable and data type declaration. Various operators like arithmetic, relational, logical assignment, conditional, increment and decrement operators. Evaluation of expression and operator precedence.
Unit-2	Input and output statement, control statement (If, If-else, If nested If-else statements switch, while, Do... while and for statements) Simple C programmes like search of prime number between given range of numbers, finding the smallest and largest of three numbers, sume of algebraic series, factorial of given number, roots of a quadratic equation, binary of decimal and decimal to binary conversion etc.
Unit-3	Functions: need of functions, calling the function by value and by reference, category of functions: no argument no return, argument but not return, argument with return. Recursion. One and two dimensional arrays. String and string handling functions like sprinf (), strepy (), sscanf (), strlen(), sizeorf () strcmp ()etc. Simple programs using user define functions, arrays and string functions.

Unit-4	Network: Terminals-Dumb terminals, smart terminals, intelligent tgerminals. Types of network: • According to range: LAN,MAN,WAN, Client server • According to topologies: BUS, RING, STAR, Mesh Network. Internet: History of Internet Service Provider (ISP), introduction to type of internet account-shell/Ac, TCP/IP A/c. types of connectivity-Dialup, Leased lines, Satellite. IP Address-Class A, Class B, Class C Domain Name address. URL-absolute and relative
Unit-5	Web enabled technology (Email and HTML): Web Browser: Internet Explorer, Netscape Navigator, Station and Dynamic web page Introduction to HTML. HTML tags: • <HTML>, <TITLE>, <HEAD>, <BODY> • <P>, , (ALIGN>, <I>, <B>, <DIV>, <PRE>, and their attributers • <IMG> <a> and their attributes • Ordered and unordered list tages • Tabes and associated tags and its properties Creation of simple forms using text, Password, text area, radio, submit, Rest and Hidden. Brief idea about HTTP. Search engine, its working, types of search engines: sub directories meta search engines, search function-AND and OR. Population search engines.

Suggested Readings:

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4. Internet and Web Page design : Dr. P.D Murarka

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6.	C# 2008 in simple step	Dreamtech press
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Session – 2018-19

Theory

Class	**M.Sc.**		**Semester: IV**
Subject	**Physics**		**Paper No : IV**
Title of the Paper	**Digital Electronics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit-1	**OP-AMP:-** Differential amplifier circuit configurations: dual input balanced output dual input, single input unbalanced output (ac analysis) only, block diagram of a typical op amp analysis, schematic symbol of an op-amp. IC 555 timer Introduction, Architecture, Application as astable and monostable multivibraters.
Unit-2	**OP-AMP Parameters:-** Ideal op-amp parameters; input offset voltage, input offset current, input bias current, CMRR, SVRR, large signal voltage gain, Slew rate, Gain band width product, output resistance, supply currents power consumption, inverting and non-inverting inputs.
Unit-3	**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, L-C tunable oscillator, square wave generator.
Unit-4	**Microprocessors and Micro Computers:** Microprocessor and Architecture: Intel 8086, Microprocessor architecture modes of memory addressing, 8086/8088 Hardware specification:

	Pin-outs and pin functions, clock generator (8284A) Bus buffering and latching, Bus timing, Ready and wait State, Minimum mode versus maximum mode.
Unit-5	**Programming the Microprocessors:** Addressing modes: Data addressing modes, program memory addressing modes, stack memory-addressing modes. Instruction set: data movement Instructions, Arithmetic and login instructions, program control instructions. Programming example: Simple Assembly language programs table handling direct table addressing, searching a table sorting a table using pseudo ops.

Suggested Readings :

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

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Session 2017-18

Theory

Class	B.Sc.	Semester IV
Subject	Physics	
Title of Paper	Electrostatics, Magnetostatics and Electrodynamics	
Medium of Teaching	English/Hindi	
Compulsory/Optional	Compulsory	
Maximum Marks :100	70 + (C.C.E.) 30 = 100	

Unit-1 Electrostatics [15 Lectures]

Coulombs law in vacuum expressed in vector forms, calculations of electric field **E** for simple distributions of charge at rest, dipole and quadruple fields. Work done on a charge in an electrostatic field expressed as a line integral, conservative nature of the electrostatic field. Relation between electric field & electric potential ($\mathbf{E} = -\nabla V$), torque on a dipole in a uniform electric field and its energy, flux of the electric field, Gauss's law and its application for finding **E** for symmetric charge distributions, Gaussian pillbox, fields at a surface of a conductor, screening of **E** field by a conductor. Capacitors, electrostatic field energy, force per unit area of the surface of a conductor in an electric field, conducting sphere in a uniform electric field, point charge in front of a grounded
infinite conductor. Dielectrics, parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector **P**, relation between displacement vector **D**, **E** and **P**. Molecular interpretation of Claussius-Mossotti equation, boundary conditions satisfied by **E** and **D** at the interface between two homogenous dielectrics, illustration through a simple example.

Unit-2 Magnetostatics [15 Lectures]

Force on a moving charge, Lorentz force equation and definition of **B**, force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment, angular momentum and gyromagnetic ratio, Biot and Savart's law, calculation of **H** for simple geometrical situations such as Solenoid, Anchor ring. Ampere's Law, $\nabla\times\mathbf{B} = \mu_0\mathbf{J}$, $\nabla.\mathbf{B} = 0$. Field due to a magnetic dipole, free and bound currents, magnetization vector (**M**), relationship between **B**, **H** and **M**. Derivation of the relation $\nabla\times\mathbf{M} = \mathbf{J}$ for nonuniform magnetization.

Unit-3 Current Electricity and Bio electricity [**15 Lectures**]

Current Electricity: Steady current, current density **J**, non-steady currents and continuity equation, Kirchoff's laws and analysis of multiloop circuits, growth and decay of current in LR and CR circuits, decay constants, LCR circuits. AC circuits, complex numbers and their applications in solving AC circuits problems, complex impedance and reactance, series and parallel resonance. Q-factor, power consumed by an A.C. circuit, power factor, Y and Δ networks and transmission of electric power.

Bioelectricity: Electricity observed in living systems, Origin of bioelectricity, Sodium and potassium transport, Resting potential and action potential, Nernst's equation, Conduction velocity, Origin of compound action potential, Neuron structure and function, An axon as cable, Membrane resistance and capacitance.

Unit-4 Motion of Charged Particles in Electric and Magnetic Fields [**15 Lectures**]

(Note: The emphasis here should be on the mechanical aspects and not on the details of the apparatus mentioned which are indicated as applications of principles involved.)

E as an accelerating field, electron gun, discharge tube, linear accelerator. **E** as deflecting field - CRO, Sensitivity of CRO. Transverse **B** field; 180° deflection, Mass spectrograph and velocity selector, Curvatures of tracks for energy determination for nuclear particles; Principle and working of Cyclotron. Mutually perpendicular and parallel **E** & **B** fields; Positive ray parabolas, Discovery of isotopes, Elements of Mass Spectrographs, Principle of magnetic focusing **(**lenses**).**

Unit-5 Electrodynamics [**15 Lectures**]

Electromagnetic induction, Faraday's Laws, Electromotive force, Integral and differential forms of Faraday's laws, Self and mutual inductance, Transformers, Energy in a static magnetic field, Maxwell's displacement current, Derivations of Maxwell's equations, Electromagnetic field energy density. Poynting vector, Electromagnetic wave equation, Plane electromagnetic waves in vacuum and dielectric media, Reflection at a plane boundary of dielectrics, Fresnel's Laws, Polarization by reflection and total internal reflection, Waves in a conducting medium, Reflection and refraction by the ionosphere.

References:

1. **Introduction to Electrodynamics:** David J. Griffiths, 4th Edition, Printice Hall.
2. **Classical Electrodynamics:** Jhon David Jackson, Jhon Wiley & Sons.
3. **Electrodynamics:** Emi Cossor & Bassin Lorraine, Asahi Shimbunsha Publishing Ltd.
4. **From Neuron to Brain:** Kuffler and Nicholas, Sinauer Associates, Inc Pub. Sunderland, Masschuetts *(Reference for topics of Bioelectricity)*

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College
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As Recommended by the Board of Studies
Session 2017-18

Class	B.Sc.	Semester V
Subject	Physics	
Title of Paper	Quantum Mechanics and Spectroscopy	
Medium of Teaching	English/Hindi	
Compulsory/Optional	Compulsory	
Maximum Marks :100	70 + (C.C.E.)30 =100	

Theory

Unit-I: QUANTUM MECHANICS-1 15 Lectures

Particles and Waves: Photoelectric effect. Black body radiation. Compton effect. De Broglie hypothesis. Wave particle duality. Davisson-Germer experiment. Wave packets. Concept of phase and group velocity. Two slit experiment with electrons. Probability. Wave amplitude and wave functions. Heisenberg's uncertainty principle with illustrations. Basic postulates and formalism of Schrodinger's equation. Eigenvalues. Probabilistic interpretation of wave function. Equation of continuity. Probability current density. Boundary conditions on the wave function. Normalization of wave function.

Unit-II: QUANTUM MECHANICS-2 15 Lectures

Time independent Schrodinger equation: One dimensional potential well and barrier.
Boundary conditions. Bound and unbound states. Reflection and transmission coefficients for a rectangular barrier in one dimension. Explanation of alpha decay. Quantum phenomenon of tunneling. Free particle in one-dimensional box, eigen functions and eigen values of a free particle. One-dimensional simple harmonic oscillator, energy eigenvalues from Hermite differential equation, wave function for ground state. Particle in a spherically symmetric potential. Rigid rotator. Orbital angular momentum, azimuthal quantum numbers and space quantization. Radial solutions and principle quantum number. Hydrogen atom.

Unit-III: ATOMIC SPECTROSCOPY 15 Lectures

Atoms in electric and magnetic fields: Quantum numbers, Bohr model and selection rules. Stern-Gerlach experiment. Spin as an intrinsic quantum number. Incompatibility of spin with classical ideas. Orbital angular momentum. Fine structure. Total angular momentum. Pauli exclusion principle. Many particles in one dimensional box. Symmetric and anti-symmetric wave functions. Atomic shell model. Spectral notations for atomic states. Spin-orbit coupling, Vector model L-S and J-J coupling. Doublet structure of alkali spectra. Zeeman effect. Continuous and characteristic X-rays. Mossley's law.

Unit-IV: MOLECULAR SPECTROSCOPY 15 Lectures

Spectra: Various types of spectra. Rotational spectra. Intensity of spectral lines and determination of bond distance of diatomic molecules. Isotope effect. Vibrational energies of diatomic molecules. Zero point energy. Anharmonicity. Morse potential. Raman effect,Rotational Raman spectra and Vibrational Raman spectra. Stokes and anti-Stokes lines and their intensity difference. Electronic spectra. Born-Oppenheimer approximation. Frank-Condon principle, singlet and triplet states. Fluorescence and phosphorescence.

Unit-V:
NUCLEAR PHYSICS 15 Lectures

Interaction of charged particles and neutrons with matter, working of nuclear detectors, G-M counter, proportional counter, Scintillation counter, Cloud chamber.

Basic properties of nucleus: Shape, Size, Mass and Charge of the nucleus. Stability of the nucleus and Binding energy. Alpha particle spectra – velocity and energy of alpha particles. Geiger-Nuttal law. Nature of beta ray spectra. The neutrino. Energy levels and decay schemes. Positron emission and electron capture. Selection rules. Beta absorption and range of beta particles. Kurie plot. Nuclear reactions, pair production. Q-values and threshold of nuclear reactions. Nuclear reaction cross-sections. Examples of different types of reactions and their characteristics. Compound nucleus, Bohr's postulate of compound nuclear reaction, Semi empirical mass formula, Shell model, Liquid drop model, Nuclear fission and fusion (concepts).

References:

1 Quantum Mechanics: V. Devanathan, Narosa Publishing House, New Delhi, 2005.
2 Quantum Mechanics: B. H. Bransden, Pearson Education, Singapore, 2005.
3 Quantum Mechanics: Concepts and Applications, Nouredine Zettili, Jacksonville State University, Jacksonville, USA, John Wiley and Sons, Ltd, 2009.
4 Introductory Quantum Mechanics & Spectroscopy: K.M. Jain, South Asian Publications.
5 Physics of Atoms & molecules: B.H. Bransden & C.J. Joachaim, Pearson Education, Singapore, 2003
6 Fundamentals of Molecular Spectroscopy: C.M. Banwell & M. McCash, McGraw Hill (U.K. edition)

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College
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As Recommended by the Board of Studies

Session 2017-18

Theory

Class	B.Sc.	Semester VI
Subject	Physics	
Title of Paper	SOLID STATE PHYSICS AND DEVICES	
Medium of Teaching	English/Hindi	
Compulsory/Optional	Compulsory	
Maximum Marks :100	70 + (C.C.E.) 30 = 100	

Unit-1 SOLID STATE PHYSICS-1 15 Lectures

Crystal Structure and bonding: Crystalline and amorphous solids. Translational symmetry. Lattice and basis. Unit cell. Reciprocal lattice. Fundamental types of lattices (Bravias Lattice). Miller indices Lattice planes. Simple cubic. Face centered cubic. Body centered cubic lattices. Laue and Bragg's equations. Determination of crystal structure with X-rays, X-ray spectrometer. Ionic, covalent, metallic, van der Waals and hydrogen bonding. Band theory of solids. Periodic potential and Bloch theorem. Kronig-Penny model (Qualitative).

Unit-II: SOLID STATE PHYSICS-2 15 Lectures

Lattice structure and properties: Dulong Petit, Einstein and Debye theories of specific heats of solids. Elastic and atomic force constants. Dynamics of a chain of similar atoms and chain of two types of atoms. Optical and acoustic modes. Electrical resistivity. Specific heat of electron. Wiedemann-Franz law. Hall effect. Response of substances in magnetic field, dia-, para- and ferromagnetic materials. Classical Langevin theory of dia and paramagnetic domains. Curie's law. Weiss' theory of ferromagnetism and ferromagnetic domains. Discussion of BH hysteresis.

Unit-III: SEMICONDUCTOR DEVICES-1 15 Lectures

Electronic devices: Types of Semiconductors (p and n). Formation of Energy Bands, Energy level diagram. Conductivity and mobility. Junction formation, Barrier formation in p-n junction diode. Current flow mechanism in forward and reverse biased diode (recombination), drift and saturation of drift velocity. Derivation of mathematical equations for barrier potential, barrier width. Single p-n junction device (physical explanation, current voltage characteristics and one or two applications). Two terminal devices. Rectification. Zener diode. Photo diode. Light emitting diode. Solar cell. Three terminal devices. Junction field effect transistor (JFET). Two junction devices. Transistors as p-n-p and n-p-n. Physical mechanism of current flow. Characteristics of transistor.

Unit-IV: SEMICONDUCTOR DEVICES-2 15 Lectures

Amplifiers (only bipolar junction transistor). CB, CE and CC configurations. Single stage CE amplifier (biasing and stabilization circuits), Q-point, equivalent circuit, input impedance, output impedance, voltage and current gain. Class A, B, C amplifiers (definitions). RC coupled amplifiers (frequency response). Class B push-pull amplifier. Feedback amplifiers. Voltage feedback and current feedback. Effect of negative voltage series feedback on input impedance. Output impedance and gain. Stability, distortion and noise. Principle of an Oscillator, Barkhausen criterion, Colpitts, RC phase shift oscillators. Basic concepts of amplitude, frequency and phase modulations and demodulation.

Unit-V: NANO MATERIALS 15 Lectures

Nanostructures: Introduction to nanotechnology, structure and size dependent properties. 3D, 2D, 1D, 0D nanostructure materials and their density of states, Surface and Interface effects. Modelling of quantum size effect. Synthesis of nanoparticles - Bottom Up and Top Down approach, Wet Chemical Method. Nanolithography. Metal and Semiconducting nanomaterials. Essential differences in structural and properties of bulk and nano materials (qualitative description). Naturally occurring nano crystals. Applications of nanomaterials.

References:

1 Introduction to Solid State Physics, C. Kittel, VIIIth Edition, John Wiley and Sons, New York, 2005.

2 Intermediate Quantum theory of Crystalline Solids, A. O. E. Animalu, Prentice Hall of India private Limited, New Delhi 1977

3 Solid State Physics, N. W. Ashcroft, and N. D. Mermin, Harcourt Asia (P) Ltd. 2001

4 The Physics and Chemistry of Nanosolids: Frank J. Owens, and Charles P. Poole Jr., Wiley Inter Science, 2008

5 Physics of Low Dimensional Semiconductors: An introduction; J.H. Davies, Cambridge University Press, U.K., 1998

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As Recommended by the Board of Studies

Theory

Session		2017-18		
Class		Bsc. I Year		Paper I
Subject	(English)	Physics		
	हिन्दी	भौतिक शास्त्र		
Title of the Paper	(English)	Math Physics, Mechanics and Properties of Matter		
	(हिन्दी)	गणितीय भौतिकी यांत्रिकी तथा द्रव्य के गुण		
Medium of instruction (Teaching)		Both (दोनों)	Question Paper Language - Both	
Max. Marks		(Theory) 40 + (CCE) 10	=50	

Subject : **Physics**

Paper : **I**

Title of the Paper : **Mathematical Physics, Mechanics and Properties of Matter**

Unit-I Mathematical Physics [15 Lectures]

Addition, subtraction and product of two vectors: Polar and axial vectors and their examples from physics: Triple and quadruple product (without geometrical application): Scalar and vector fields: Differentiation of a vector: Repeated integral of a function of more than one variable: Unit tangent and unit normal vector Gradient. Divergence and Curl: Laplacian operator; Idea of line surface and volume integrals; Gauss; Stokes and Green's Theorems.

इकाई–1: गणितीय भौतिकी **[15 Lectures]**

दो सदिशो का योग अंतर व गुणनफल, ध्रुवीय एवं अक्षीय सदिश एवं उनके भौतिकी उदाहरण तीन व चार सदिशों का गुणन (ज्यामितीय अनुप्रयोग के बिना), अदिश व सदिश क्षेत्र सदिश का अवकलन एक से अधिक चरों के फलन का बरम्बार समाकलन, इकाई स्पर्श सदिश, व इकाई नार्मल सदिश, सदिश का ग्रेडियन्ट, डायवर्जेस एवं कर्ल, लाप्लासीयन आपरेटर, रेखीय, पृष्ठीय, आयतन समाकलन गॉस, स्टोक व ग्रीन प्रमेय।

Unit-II Mechanics [15 Lectures]

Position, velocity, and acceleration vectors, Vectors. Components of velocity and acceleration in different coordinate systems Newton's Laws of motion and its explanation with problems various types of forces in nature (explanation). Pseudo Forces (e.g. Centrifugal Force), coriolis force and its applications. Motions under a central force. Derivation of Kepler's laws. Gravitational law and field, Potential due to a spherical body. Gauss & Poisson'sequation of

Gravitational self-energy. System of particles. Centre of mass and reduced Mass. Elastic and inelastic collisions.

इकाई–2: यांत्रिकी **[15 Lectures]**

स्थिति, वेग एंव त्वरण सदिश, गति व त्वरण के विभिन्न निर्देशांक पद्धतियों में घटक। न्यूटन के गति के नियम व इसकी व्याख्या, प्रकृति में विभिन्न बल व व्याख्या छद्म बल (उदाहरण, अभिकेन्द्रीय बल) कोरियालिस बल व इसके उदाहरण, केन्द्रीय बल के अन्तर्गत गति केप्लर के नियमों की निष्पति, गुरूत्वाकर्षण का नियम व क्षेत्र, गोलाकार पिण्ड का गुरूत्वीय विभव, गॉस व पायसन की गुरूत्वीय स्व उर्जा की समीकरण कणों का निकाय द्रव्यमान केन्द्र व समानीत द्रव्यमान, प्रत्यास्थ व अप्रत्यास्थ टक्कर।

Unit-III General Properties of Matter [15 Lectures]

Elastic moduli and their relations, Determination of Y of rectangular thin bar loaded at the centre: Torsional oscillations. Torsional rigidity of a wire, to determine n by torsional oscillations. Surface Tension. Angle to Contact, Capillary Rise Method; Energy required to raise a liquid in capillary tube; Factors affecting surface tension; Jeager's method for Determination of surface tension: Applications of Surface Tension. Concept of Viscous Forces and Viscosity. Steady and Turbulent Flow. Reynolds's number: Equation of continuity: Bernoulli's Principle: Application of Bernoulli's equation-(i) Speed of Efflux (ii) Venturimeter (iii) Aspirator Pump (iv) Change of Plane of motion of a spinning ball.

इकाई–3: द्रव्य के सामान्य गुण **[15 Lectures]**

प्रत्यास्थता गुणांक एवं उनके संबंध, मध्य में भारितपतली आयताकार छड (केन्टीलीवर) के Y का निर्धारण, ऐठन, दोलन, किसी तार की ऐंठन दृढ़ता व इसका ऐंठन दोलन विधि से निर्धारण। पृष्ठ तनाव, स्पर्श कोण, केशिका, उन्नयन विधि, केशिका में द्रव चढ़ाने में आवश्यक उर्जा, पृष्ठ, तनाव को प्रभावित करने वाले कारक जेगर, की विधि से पृष्ठ तनाव का निर्धारण, पृष्ठ तनाव के अनुप्रयोग। श्यानबल की संकल्पना व श्यानता गुणांक, धारोरेखीय व विक्षुब्ध प्रावह, रेनॉल्ड संख्या, सातत्य समीकरण बरनॉली का सिद्धांत बरनॉली प्रमेय के अनुप्रयोग : 1 एफ्लक्स की चाल 2. वेन्चुरीमीटर 3. एस्पिरेटर पम्प 4. स्पिनिंग बॉल के तल का परिवर्तन।

Unit-IV Oscillations [15 Lectures]

Concept of Simple, Periodic & Harmonic Oscillation with illustrations; Differential equation of harmonic oscillator; Kinetic and potential energy of Harmonic Oscillator; Oscillations of two masses connected by a spring; Translational and Rotational motion, Moment of Inertia and their Product, Principal moments and axes, Motion of Rigid Body, Euler's equation.

इकाई–4 : दोलन **[15 Lectures]**

सरल, आवर्ती व हार्मोनिक गति की सचित्र संकल्पना, आवर्ती दोलित्र का समीकरण, आवर्ती, दोलित्र की गतिज व स्थितिज उर्जा, स्प्रिंग से जुडे दो पिंड़ो का दोलन, स्थानांतरणीय व

घूर्णीय गति, जड़त्व आघूर्ण व उनका गुणन, मुख्य आघूर्ण एवं अक्ष, दृढ पिण्ड की गति, यूलर समीकरण।

Unit-V **[15 Lectures]**

Relativistic Mechanics: Michelson-Morley experiment and its outcome; Postulates of Special Theory of Relativity: Lorentz Transformation Simultaneity and order of events; Lorentz contraction; time dilation; Relativistic, transformation of velocity. Frequency and wave number Relativistic addition of velocities; Variation of mass with velocity.

Earlier Developments in physics up to 18th Century Contributions of Aryabhatt. Archimedes, Nicolas Copernicus, Galileo galilei, Huygens. Rebert Hooke. Torricelli, Vernier, Pascal, Kepler, Newton, Boyle, Young, Thompson, Coulomb. Amperes. Gauss. Biot-Savarts. Cavendish. Galvani. Franklin and Bernoulli.

इकाई–5 : **[15 Lectures]**

सापेक्षकीय यांत्रिकीः माइकल्सन व मोरले का प्रयोग एवं इसके निष्कर्ष, विशिष्ट सापेक्षिकता के सिद्धांत की अवधारणाएं, लॉरेंज, रूपांतरण समकालिक घटना एवं घटनाओं के क्रम, लॉरेंज संकुचन समय विस्तारण वेग, आवृत्ति तथा वेव नम्बर का सापेक्षकीय रूपान्तरण, वेगों का सापेक्षकीय योग, वेग के साथ द्रव्यमान परिवर्तन।

भौतिकी का प्रारंभिक विकास 18वीं सदी तकः आर्यभट्ट, आर्कमिडिज निकोलस कोपरनिकस, गेलिलीओ गैलिली, हॉयग्न, राबर्टहुक, टॉरसेली, वर्नियर, पॉस्कल, केप्लर, न्यूटन, बॉयल यंग, थॉमसन, कुलॉम्ब, एम्पीयर, गॉस, बॉयो–सेवर्ट, केवनडिश, गेलवानी, फ्रेंकलीन और बरनॉली।

Reference Books:

1. University Physics Sears and Zeeman sky. XIth edition. Pearson Education.
2. Concepts of Physics: H.C. Verma. Bharti Bhavan Publishers
3. Problems in Physics P.K. Srivastava. Wiley Eastern Ltd.
4. Berkley Physics Course. Vol I. Mechanics: E.M Purcell. McGraw hill
5. Properties. of Matter. D.S. Mathur Shamlal Chritable Trust, New Delhi
6. Mechnics: D.S. Mathur, S. Chand and Company new Delhi - 5
7. The Feymman Lectures in Physics Vol. I: R.P. Feymman. R.B. Lighton and M. Sands

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As Recommended by the Board of Studies

Theory

Session		**2017-18**	
Class		**Bsc. I Year**	**Paper 2**
Subject	**(English)**	**Physics**	
	हिन्दी	**भौतिक शास्त्र**	
Title of the Paper	**(English)**	**Thermodynamics and Statistical Physics**	
	(हिन्दी)	**उष्मागतिकी तथा सांख्यिकी भौतिकी**	
Medium of instruction (Teaching)		**Both (दोनो)**	**Question Paper Language - Both**
Max. Marks		**(Theory) 40 + (CCE) 10**	**=50**

Subject : **Physics**

Paper : **II**

Title of the Paper : **Thermodynamics and Statistical Physics**

Unit-I Thermodynamics-I [15 Lectures]

Reversible and irreversible process, Heat engines Definition of efficiency Carnot's ideal heat engine, Carnot's cycle, Effective way to increase efficiency, Carnot's engines and refrigerator, Coefficient of performance, Second law of thermodynamics, Various statements of second law of thermodynamics, Carnot's theorem, Chaperon's latent . heat equation, Carnot's cycle and its applications, Steam engine Otto engine. Petrol engine. Diesel engine.

इकाई–1: उष्मागतिकी–I **[15 Lectures]**

उत्क्रमणीय एवं अनुत्क्रमणीय प्रक्रम, कार्नो का आदर्श चक्र, इसकी दक्षता बढ़ाने के प्रभावी तरीकें कानों का उष्मीय इंजन व प्रशीतक, दक्षता गुणांक, उष्मागतिकी का द्वितीय नियम व इसके विभिन्न कथन, कानों का प्रमेय, क्लेपरियॉन की गुप्त उष्मा समीकरण कार्नोचक्र एवं उसके अनुप्रयोग। उष्मीय इंजिन, ऑटो इंजिन, पेंट्रोल इंजिन, डीजल इंजिन।

Unit-II Thermodynamics-II [15 Lectures]

Concept of entropy, Change in entropy in adiabatic process, Change in entropy in reversible cycle, Principle of increase of entropy, Change in entropy in irreversible process. T-S diagram. Physical signification of Entropy, Entropy of a perfect gas. Kelvin's thermodynamic scale of temperature. The size of a degree. Zero of absolute scale, Identity of a perfect gas scale and absolute scale. Third law of thermodynamics. Zero point energy, Negative temperatures (not

possible), Heart death of the universe, Relation between thermodynamic variable (Maxwell's Relations).

इकाई–2: उष्मागतिकी–II **[15 Lectures]**

एन्ट्रापी की संकल्पना, रूद्धोष्म प्रक्रम में एन्ट्रीपी का परिवर्तन चक्रय प्रक्रम में एन्ट्रापी का परिवर्तन, एन्ट्रापी के वृद्धि का सिद्धांत, उत्क्रमणीय व अनुत्क्रमणीय प्रक्रम में एन्ट्रापी का परिवर्तन–T-S आरेख, एन्ट्रापी का भौतिक महत्व, आदर्श गैस की एन्ट्रापी, केल्विन का उष्मागतिक ताप पैमाना, परम पैमाने का शून्य ताप, आदर्श गैस व परम ताम पैमाने में साम्यता। उष्मागतिकी का तृतीय नियम, शून्य बिन्दू उर्जा, ऋणात्मक तापक्रम (सम्भव नहीं) ब्रहमाण्ड की उष्मीय समाप्ति। उष्मागिकी चरों में संबंध (मेक्सवेल के समीकरण)

Unit-III Statistical Physics-I [15 Lectures]

Description of a system: Significance of statistical approach, Particle-states, System-states. Microstate and Macro-states of a system. Equlibrium States, Fluctuation Classical & Statistical Probability the equi-probability postulate, Statistical ensemble, Number of states accessible to a system. Phase space. Micro Canonical Ensemble, Canonical Ensemble. Helmholtz freee energy, Enthalpy, First law of thermodynamics, Gibbs free energy. Grand Canonical Ensemble.

इकाई–3: सांख्यिकीय भौतिकी–1 **[15 Lectures]**

निकाय का वर्णन: सांख्यिकीय अवधारणा का महत्व, कण एवं निकाय की अवस्थाऐं, निकाय की सूक्ष्म एवं स्थूल अवस्थाएं साम्य अवस्थाऐं विचलन, चिरसम्मत व सांख्यिकी प्रायिकता, पूर्व प्रायिकता सिद्धान्त सांख्यिकी एन्सेम्बल, किसी निकास के लिये अभिगम्य अवस्थाऐं, कला आकाश, माईक्रो केनोनीकल एन्सेम्बल, केनोनीकल एन्सेम्बल, हेल्मोल्टज मुक्त उर्जा, एन्थलपी, उष्मागतिकी का प्रथम नियम, गिब्स, मुक्त उर्जा, ग्रेंड केनोनीकल एन्सेम्बल.

Unit-IV Statistical Physics-II [15 Lectures]

Statistical Physics: Phase space, The Probability of a distribution. The most probable distribution and its narrowing with increase in number of particles. Maxwll-Boltzmnn statistics Molecular speeds. Distribution and mean. r.m.s and most probable velocity. Constraints of accessible state. and maccessible states Quantum Statistics: Partition Function, Relation between Partition Function and Entropy, Bose-Eistein statistics. Black-Body radiation, The Rayleigh-Jeans formula, The Planck radiation formula, Fermi-Dirac Statistics. Comparison of results. Concept of Phase transitions.

इकाई–4: सांख्यिकीय भौतिकी–II **[15 Lectures]**

सांख्यिकीय यांत्रिकी: कला आकाश, वितरण की प्रायिकता, अधिकतम, संभाव्य वितरण व इसका कणों की संख्या बढ़ने पर संकुचन, मेक्सवेल, बोल्टजमैन सांख्यिकी, आणविक चाल का वितरण, औसत चाल, वर्ग–माध्य–मूल चाल और अधिकतम प्रसम्भाव वेग, प्रतिबंध अभिगम्य, एवं अनअभिगम्य अवस्थाओं के प्रतिबंध। क्वांटम सांख्यिकी: पार्टीशन फलन, एंट्रापी व पार्टीशन

फलन में संबंध, बोस आइन्सटीन सांख्यिकी, कृष्ण पिण्ड विकिरण, रेले जीन्स सूत्र, प्लांक विकिरण सूत्र, फर्मी–डिराक सांख्यिकी परिणामों की तुलना फेस संक्रमण की संल्पना।

Unit-V **Contributions of Physicists** **[15 Lectures]**

S.N. Bose, M.N. Saha, Maxwell, Clausois. Boltzmaan. Joule, Wien, Einstein, Plank Bohr. Heiesnberg. Fermi, Dirac, Max Born Bardeen.

इकाई–5: भौतिकविदों का योगदान **[15 Lectures]**

एस.एन. बोस, एम.एन. साहा, मैक्सवेल, क्लासियस, बोल्टमैन, जूल, वीन, आइन्सटीन, प्लाक बोहर, हाईजनबर्ग फर्मी, डिराक, मेस्कबार्न वार्डीन।

Text and Reference Books:

1. Heat and Thermodynamics: Mark W. Zemansky. Richard H.Ditman. Sventh Edition. McGraw-Hill International Editions.
2. Thermal Physics (Heat and Thermodynamics) A.B. Gupta, H.P. Roy, Books and Allied (P) Ltd. Calcutta.
3. Heat and Thermodynamics: Brijlal and N. Subrahmanyam. S. Chand & Company Ltd. New Delhi.
4. Berkley Physics Course, Vol 3, Thermodynamics: F, Reif, Mergraw Hill
5. Thermodynamics and Statistical Physics, D.P. Khandelwal and A.K. Pandey, Himalaya Publication.
6. Laboratory manual of Physics for undergraduate classes, D.P. Khandelwal Vani Publication house. New Delhi.

Class: B.Sc. First Year

Max. Marks: 50

Subject : **Physics**

For Regular Students

Practical	Sessional	Viva	Total
25	10	15	50

For Ex-Student

Practical	Sessional	Viva	Total
35	00	15	50

List of Practical's

1. To verify laws of parallel and perpendicular axes for moment of inertia.
2. To determine acceleration due to gravity using compound pendulum.
3. To determine damping coefficient using a bar pendulum.
4. To determine Young's Modulus by bending of beam Method.
5. To determine Young's Modulus using Cantilever method.
6. To determine coefficient of rigidity by static method.
7. To determine Coefficient of rigidity by dynamic method.
8. To determine Surface Tension by Jaegar's method.
9. To determine Surface Tension of a liquid by capillary rise method.
10. To determine Viscosity of fluid using Poisellie's methods.
11. To study conversion of mechanical energy into heat using Calender & Barne's Method.
12. To determine heating efficiency of electrical Kettle with various voltages.
13. To determine heating temperature coefficient of resistance using platinum resistance thermometer.
14. To determine thermo electromotive force by a thermocouple method.
15. To determine heat conductivity of bad conductors of different geometry by Lee's method.
16. To verify Newton's Laws of cooling.

17. To determine specific heat of Coefficient of thermal conductivity by Searl's Method.

18. To determine Specific heat of a liquid.

19. To compare Maxwell-Boltzmann, Bose Einstein and Fermi-Dirac Distribution function vs temperature using M.S. Excel/C++

20. To plot equation of state and Vander-Wall equation with temperature using M.S. Excel/C++

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE,

BHOPAL

SYLLABUS FOR

M.Sc (Physics)

SEM ; I, II, III & IV

SESSION ; 2017-18

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College,

Shivaji Nagar, Bhopal

As Recommended by the Board of Studies

Session 2017-18

Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : I**
Title of the Paper	**MATHEMATICAL PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - 1 (English)	**<u>Differential equations</u>: Recursion relation, generating functions and orthogonality of Bessel functions of first and second kind, Hermite, Legendre, Associate Legendre and Laguerre Polynomials, Curvilinear coordinate system with specific cases of Cartesian, Cylindrical and Spherical coordinate systems.**	1. L.A. Pipes Mathematics of Engineers and Physicists. 2. Arfken Mathematical Methods for Physicists. 3. P.K. Chattopadhyay Machematical Physics. 4. H.K.Dass Mathematical Physics
Unit - II (English)	**Integral transforms. Fourier integral. Fourier transforms and inverse Fourier transforms.** **Fourier transform of derivatives. Convolution theorem. Elementary Laplace transforms.** **Laplace transform to derivatives. Application to a damped harmonic oscillator.**	

Unit - III (English)	**<u>Green's functions</u>: Non-homogenous boundary value problems, Green's function for one dimensional problems, eigen function expansion of Green's function, Fourier transforms.** **Method of constructing.** **Green's functions, Green's function for electrostatic boundary value. Problems and quantum-mechanical scattering problem.**	5. Ghatak, Goyal & Guha Mathematical Physics 6. M.R. Spiegal (Schaum Series) Complex variable & Laplace Transform.
Unit - IV (English)	**<u>Complex variables</u>: analyticity of complex functions. Cauchy Riemann equations. Cauchy theorem. Cauchy integral formula.** **Taylors, Maclaurin Laurent series and mapping.** **Theorem of residues. Simple cases of contour integration. Jordan's lemma Integrals involving multiple valued function (Branch points)**	
Unit - V (English)	**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.**	

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Session 2017-18

Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : II**
Title of the Paper	**CLASSICAL MECHANICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - 1 (English)	**Newtonin mechanics of one and many particles systems: Conservation laws, Constraints their classification, Principle of virtual work; D'Almbert's principle in generalized coordinates, The Lagrange's equitation from D'Almbert's principle. Configuration space, Hamilton's principle deduction from D'Almberts principle, Generalized momenta and Lagragian 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.**	1. H. Goldsetin (Addison Wesley) Classical Mechanics 2. N.C. Rana & P.S. Jog Classical Mechanics
Unit - II (English)	**The equitation of canonical transformation and generating functions: The Hamilton-Jacobi Action and Angle 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.**	3. Landu & Lifshitz (Pergamann Press) Classical Mechanics 4. A Sommarfield (Academic Press)

Unit - III (English)	**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.**	R.G. Takwale & P.s. Puranik Introduction to Classical Mechanics.
Unit - IV (English)	**Symmetries of space and time.** **Invariance under galilion transformation, Covariant four-dimensional 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 Hamiltonioan, Examples.**	
Unit - V (English)	**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.**	

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Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : III**
Title of the Paper	**QUANTIUM MECAHNICS – I**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**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.**	1. L I Schiff, Quantum Mechanics 2. S Gasiorovvicz. Quantum Physics
Unit - II (English)	**Linear vector space, concept of Hilbert 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).**	3. B.Craseman and J D Powell Quantum Mechanics 4. A.P. Messiah Quantum Mechanics

		5. J.J. Sakurai Modern Quantum Mechanics Mathews and Venkatesan Quantum Mechanics.
Unit - III (Engilish)	**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 (deuteron).**	
Unit - IV (English)	**Angular momentum in quantum mechanics, Eigen values and Eigen function of L_2 and L_z in term of spherical harmonics, commutation relation. Time independent perturbation theory. Non-degenerate and degenerate cases.**	
Unit - V (English)	**This unit will have a short note question covering all the four units.** **The students will have to answer any two questions of the four.**	

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Theory

Class	**M.Sc.**		**Semester: I**
Subject	**Physics**		**Paper No : IV**
Title of the Paper	**ELETRONIC DEVICES**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - 1 (English)	**Transistors : JFET, BJT, MOSFET and MOSFET, structure derivations of the equations for I-V characteristics under different conditions, microwave devices, tunnel diode, transfer electron devices (Gunn diode) avalanche transits time devices, Impatt diodes and parametric devices.**	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.
Unit - II (English)	**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.**	

		Ajoy Ghatak and Thyagrajam Optical Electrics.
Unit - III (English)	**<u>Memory Devices</u>: Read Only Memory (ROM) and Random Access Memory (RAM). Types of ROM: PROM, EPRON, EEPROM AND EAPROM, Static and dynamic RAMs (SRAM & DRAM), characteristics of SRAM and DRAM.** **<u>Hydbrid Memories</u> : CMOS and NMOS memories, Nonvolatile RAM, ferro-electric memories, charge coupled devices (CCD), storage devices : Geometry and organization of magnetic (FDD and HDD) and Optical (CD-ROM, CD-R, CD-R/W, DVD) Storage Devices.**	
Unit - IV (English)	**Eletro-optics, Magneto-optic and Acousto-optic effects, materials properties related to get these effect, important ferro electric, Liquid crystal and polymeric materials for these devices, piezoelectric, electrostrictive and magnetostrictive effects. Important materials for these properties and their applications in sensors and actuator devices, acoustic delay lines, peizoelectric resonators and filters, high frequency piezoelectric devices-surface, acoustic wave devices.**	
Unit - V (English)	**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.**	

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Session 2017-18

Practial

Class		**M.Sc.**	**Semester : I**
Subject		**Physics**	
Title of Practical		**Electronics (Lab-A)**	
Medium of instructions ¼Teaching)		**English**	**Question Paper Language : English**
Maximum Marks		**100**	

Syllabus	*Recommended Books*
1. To study Characteristics of "Tunnel Diode". 2. To study Characteristics of "Field Effect Transistor". 3. To study Characteristics of "Unijunction Transistor". 4. To study Characteristics of "MOSFET" 5. To study Characteristics of "Thermister" 6. To study Characteristics of "Triac" 7. To study Characteristics of "Zender Diode". 8. To study Characteristics of :V R Tube" 9. To study Characteristics of "LED & Photo Transistor" 10. To determine hybrid parameters of a transistor	

11. To verify Richardson's Equation.	

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As Recommended by the Board of Studies

Session – 2017-18

Practial

Class		M.Sc.	Semester : I
Subject		Physics	
Title of Practical		General(Lab-B)	
Medium of instructions ¼Teaching)		English	Question Paper Language : English
Maximum Marks		100	

Syllabus	*Recommended Books*
1. To determine Planck's constant 'h' by photo cell. 2. To determine Planck's constant 'h' by solar cell. 3. To determine 'e/m' by 'Thomas' method. 4. To determine 'e/m' by Milliken's Oil Drop method. 5. To study resolving power of diffraction grating. 6. To find out thickness of mica sheet by biprism. 7. To study waveform and frequency by CRO. 8. To study diffraction at single slit. 9. To analyze elliptically polarized light by Babinate's Compensator.	

10. To verify Fresnel's formula & Canchy's formula 11. To find 'electronic charge' 'e' by rectifier. 12. To find energy band gap 13. To determine low resistance by Kelvin's Double Bridge.	

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Session – 2017-18

Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : I**
Title of the Paper	**QUANTUM MECHANICS -II**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - I (English)	<u>Approximation method for bound states</u>: **Rayleigh - Schrodinger Perturbation theory of non-degenerate and degenerate 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.**	1. LI Schiff Quantum Mechanics 2. S Gasirowicaz Quantum Physics 3. B.Craseman and J J Powell Quantum Mechanics (Addison Wessley) 4. A. Messiah Quantum
Unit - II (English)	<u>Time dependant perturbation theory</u> **: 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 (English)	**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 practices with spin, Pauli's spin matrices.**	Mechanics 5. J.J. Sakurai Modern Quantum Mechanics 6. Mathews and Venkatessan Quantum Mechanics
Unit - IV (English)	**Schrodinger.s relativistic equation (Klein-Gordon equation), Probability and current denisity, 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.**	A.K.Ghatak and Loknathan Quantum Mechanics.
Unit - V (English)	**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.**	

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : II**
Title of the Paper	**STATISTICAL MECHANICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - 1 (English)	**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. Micro canonical ensemble, phase space, trajectories and density of states, Liouvelle theorem, canonical and grand canonical ensembles, partition function, calculation of statistical quantities, energy sand density fluctuations.**	1. F Reif Statistical and thermal Physics 2. K Huang Statistical Mechanics 3. R K Pathria Statistical Mechanics 4. R Kubo Statistical Mechanics
Unit - II (English)	**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 (English)	**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.**	5. Tandan Statistical Physics.
Unit - IV (English)	**Thermodynamics fluctuation spatial correlation Brownian motion, Langevin theory, fluctuation dissipation theorem, the Fokker-Planck equation, Onsager reciprocity relations.**	
Unit - V (English)	**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.**	

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : III**
Title of the Paper	**ELECTRODYNAMICS AND PLASMA PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit - I (English)	**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.**	1. Bitteneerort Plasma Physics 2. Chen Plasma Physics 3. Gupta, Kumar, Singh Electro dynamics 4. Sen Plasma state and matter 5. Jackson Classical electrodynamics
Unit - II (English)	**Fields of an 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-demension Maxwell equation, Four Vector current and potential and their invariance under Lortentz transformation, covariance of electro-dynamics.**	

	Langragian and Hamiltonian for a relativistic charged particle in External EM field; motion of charged particles in electromagnetic fields, uniform and non-uniform E and B fields.	6. Pamolsky & Philips Classical electricity and Magnetism.
Unit - III (English)	**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 plasma. Debye screening distance. Plasma oscillations: Transverse oscillations and longitudinal oscillations.**	
Unit - IV (English)	**Domain of Magneto hydrodynamics and plasma Physics :** **Magneto hydrodynamic equations, magnetic hydro-static pressure hydrodynamic waves: Magneto-sonic and Alfven waves, particle orbits and drift motion in plasmas. Experimental study of Plasma the theory of single and double probes.**	
Unit - V (English)	**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.**	

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Theory

Class	**M.Sc.**		**Semester: II**
Subject	**Physics**		**Paper No : IV**
Title of the Paper	**ATOMIC AND MOLECULAR PHYSICS**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit - 1 (English)	**Quantum states of one electron atom. Atomic orbitals. Hydrogen spectrum, Pauli's 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).**	1. H.E. White Introduction to atomic spectra 2. C.B. Banwell Fundamental of molecular spectroscopy 3. Walker and Strengthen Spectroscopy Vol. I , II and III 4. G.N. Barrow Introduction of molecular spectroscopy
Unit - II (English)	**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.**	

		5. Herzberg Spectra of diatomic molecules 6. Jeanne L and McHale Molecular spectroscopy 7. J.M. Brown Molecular spectroscopy 8. P.F. Benmath Spectra of atoms and molecules J.M. Halian Modern Spectroscopy
Unit - III (English)	**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 (English)	**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 photo acoustic spectroscopy and Moss Bauer spectroscopy (principle).**	
Unit - V (English)	**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.**	

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Session – 2017-18

Practial

Class		M.Sc.	Semester : II
Subject		Physics	
Title of Practical		General (Lab-B)	
Medium of instructions ¼Teaching)		English	Question Paper Language : English
Maximum Marks		100	

Syllabus	*Recommended Books*
1. To find Young's modulus of metallic rod by Newton's ring method. 2. To find Poisson's ratio and Young's modulus of glass by Cornu's method 3. To find capacitance by "Shearing bridge". 4. To find self and mutual inductance by Anderson's bridge. 5. To study BH curve for soft iron rod by CRO 6. To study BH curve for the specimen of iron in form of anchor ring.	

7.	To determine resistivity of given material by 'Four Probe Method'.	
8.	To determine band gap in semiconductor by 'For Probe Method'.	
9.	To study "Hall Effect".	
10.	To find "Stefan's Constant".	
11.	To verify Cauchy's Formula	
12.	To study thermo emf of a thermo couple	
13.	To measure drift velocity in semi conductor	

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Session – 2017-18

Practial

Class		**M.Sc.**	**Semester : II**
Subject		**Physics**	
Title of Practical		**Electronics (Lab-A)**	
Medium of instructions ¼Teaching)		**English**	**Question Paper Language : English**
Maximum Marks		**100**	

Syllabus	***Recommended Books***
1. To study Basic Logic Gates **2. To study ''NAND" Gate** **3. To verify De Morgan's Law** **4. To study frequency response of R.C. coupled amplifier.** **5. To study regulated/ unregulated power supply.** **6. To study characteristics of Silicon Controlled Rectifier.** **7. To study Fourier analysis of a complex wave form**	

8. To study cathode follower **9. To study emitter follower** **10. To study frequency response of passive filters** **11. To compare characteristics of Ge & Si Transistor.**	

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Session – 2017-18

Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : I**
Title of paper	**Condensed Matter Physics-I**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional :	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	**Syllabus**	**Recommended Books**
Unit-1	**Crystal structure:** Bravis lattice in two and three dimension. Simple crystal structures: Hexagonal close packed structure, Diamond structure, zinc blende structure, sodium chloride structure, cesium chloride structure.	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
Unit-2	**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-3	**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.	5. Huong: Theoretical solids state physics
Unit-4	**Lattice vibration and phonons:** Lattice dynamics 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.	6. Weertman and Weertman: Elementary dislocation theory
Unit-5	**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.	7. Buerger: Crystal structure physics. 8. Made Lung: Introduction to solids state physics.

Sarojini Naidu Govt. Girls' P.G. (Autonomous) College,

Shivaji Nagar, Bhopal

As Recommended by the Board of Studies

Session – 2017-18

Theory

Class	**M.Sc.**		**Semester: III**
Subject (English)	**Physics**		**Paper No : II**
Title of Paper	**Nuclear and Particle Physics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional :	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit-1	**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.	1. Introduction of Nuclear physics : H.A. Enge 2. Nuclear radiation detectors : S.S. Kapoor and V.S. Ramamurthy 3. Atomic and Nuclear physic : S.N. Ghoshal
Unit-2	**Acclerators of charged particles:** Study of cyclotron, phase stability, frequency modulated cyclotron (synchorocyclotron) magnetic induction accelerator (Betatron) Electron synchrotron and linear accelerator (Linac)	
Unit-3	**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.	4. Nuclear and Particle physics : D.C. Tayal
Unit-4	**Nuclear decay and elementary particles:** ß Decay, general features of ß ray spectrum, Fermi theory of ß decay, selection rules, parity in ß decay, multipole radiation, internal conversion, nuclear isomerism.	5. Nuclear physics : R.C. Sharma
Unit-5	**Elementary particles:** Classification of elementary particles, fundamental interaction, parameters of elementary particles. Symmetry and conservation laws, symmetry schemes of elementary particles SU(3).	6. Introduction of Nuclear physics: KRANE 7. Nuclear physics Principles & Application : Lilley

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Session – 2017-18

Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : III**
Title of Paper	**Digital Electronics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional :	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit-1	Number system (Binary, Octal, Decimal, hexadecimal) and conversion between them. Boolean arithmetic, signed and unsigned binary numbers, I's complement, 2's complement.	1. "Digital principles and applications" by A.P. Malvino and Donald P. Leach, Tata Megraw-Hill Company, New Delhi, 1993. 2. "Microprocessor Architecture, Programming and Applications with 8085/8086 by Rames S.Gaonkar, Wiley-eastern Ltd., 1987 (for unit V)"
Unit-2	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-3	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-4	Counters-asynchronous (ripple) counter, synchronous (parallel) counter, MOD-5 counter and MOD-10 counter, BCD counter, Up-Down counter, Shift Register counter (Ring counter)	3. Digital electronics : S.N. Ali 4. Digital electronics: Morries Mano 5. Microprocessor and Microcomputers : B. Ram-Dhanpat Rai publications V edition.
Unit-5	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)	

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Session – 2017-18

Theory

Class	**M.Sc.**		**Semester: III**
Subject	**Physics**		**Paper No : IV**
Title of Paper	**Atomic and Molecular Physics**		
Medium of instructions (Teaching)	**English**	**Question Paper Language: English**	
Compulsory / Optional :	**Compulsory**		
Maximum Marks	**Total :100**	**Main Exam:70**	**C.C.E.:30**

Unit	Syllabus	Recommended Books
Unit-1	**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 interation and spin-spin coupling between two and more nuclei (Qualitative)	1. Fundamentals of Molecular Spectroscopy : C.B. Banwell. 2. Spectra of Diatomic Molecules : Herzberg. 3. Mossbauer Spectroscopy : M.R. Bhide
Unit-2	**Electronic spectra of Diatomic Molecules and fourier transform infrared spectoscopy** Frank Condon principles, dissociation and pre-dissociation, dissociation energy. Born-Oppenheimer-approximation, vibrational coarse structure of electronic spectra (bands progression and sequence). fourier transform infrared spectroscopy :Theory and application FTIR peaks of common bands and functional groups	

		4. NMR and Chemistry : J.W. Akitt 5. Modern Spectroscopy : J.M. Hollons
Unit-3	**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-4	**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-5	**Electron Spin Resonance Spectroscopy:** Elementary Idea about ESR, Principle of ESR, ESR spectrometer, spliting of electron energy levels by a magnetic field, G-Values, simple experimental set-up of ESR. ESR spectra of free radicals in solution, Anisotropic system.	

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Session – 2017-18

Practial

Class		M.Sc.	Semester : III
Subject		Physics	
Title of Paper		Lab-A & Lab-B	
Medium of instructions ¼Teaching)		English	Question Paper Language : English
Maximum Marks		100 +100	

LAB A

Syllabus	*Recommended Books*
1. Find thickness of a wire using LASER 2. To find ' ' of LASER light 3. To find of liquid using LASER 4. To study Wein Bridge Oscillator 5. To study Hartley Oscillator 6. To study Differential Comparator 7. To study Operational Amplifier as :Adder and Sub tractor"	

8. To study Operational Amplifier as :Diffrentiator" 9. To study Operational amplifier as " Integrator". 10. To study Operational Amplifier as " Mono stable Multi vibrator" 11. To study Operational amplifier as low pass and high pass filter. 12. To study Operational Amplifier as square wave generator. 13. To study Operational amplifier as current voltage converter. 14. To study Operational Amplifier as current gain amplifier. 15. To study Operational Amplifier as Schmith Trigger.	

**Signature of Member of B.O.S. ------------- ------------ ------------- ---------------- --------
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Session 2017-18

Class / कक्षा	: **M.Sc.**
Semester / सेमेस्टर	: **IV**
Subject / विषय	: **Physics**
Title of Subject Group	: **Condensed Matter Physics-II**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: **I**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: **Compulsory**
Max. Marks अधिकतम अंक	: **CCE : 30, Main Exam : 70 Total - 100**

Particulars / विवरण

Unit-1	Super Conductivity: Concept of super conducting state, persistent current, critical temperature, Meissen 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-2	Magnetism: Weiss theory of ferromagnetic Heisenberg model and molecular field theory, Domain and Bloch wall energy, Spin waves and magnons, Curie Weiss law for susceptibility, Ferri and anti ferrimagnetism.
Unit-3	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-4	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.
Unit-5	Nano structure: Definition and properties of nano structured material, different method of preparation of nano materials, plasma enchanted chemical vapour deposition, electro deposition. structure of single wall carbon nono tubes (classification, chiral vector Cn, Translational vector T, Symmetry vector R, Unit Cell, Brillouin Zone) Electronic, mechanical, thermal and phonon properties.

Suggested Readings:

1. Kittel: Solid State Physics
2. Huang: Theoretical Solid State Physics
3. Weertmon and Weertman: Elementary Dislocation theory
4. Thomes: Multiple Electron microscopy
5. Tolansky: Multiple Beam Interferometer

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Session 2017-18

Class / कक्षा	: **M.Sc.**
Semester / सेमेस्टर	: **IV**
Subject / विषय	: **Physics**
Title of Subject Group	: **Laser Physics**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: **II**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: **Compulsory**
Max. Marks अधिकतम अंक	: **CCE : 30, Main Exam : 70 Total - 100**

Particulars / विवरण

Unit-1	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-2	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-3	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 HCI and HF lasers.
Unit-4	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-5	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.

Suggested Readings:

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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Session (सत्र) – **2017-18**

Class / कक्षा	: **M.Sc.**
Semester / सेमेस्टर	: **IV**
Subject / विषय	: **Physics**
Title of Subject Group	: **Computer Programming and Informatics**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: **III**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: **Compulsory**
Max. Marks अधिकतम अंक	: **CCE : 30, Main Exam : 70 Total - 100**

Particulars / विवरण

Unit-1	Conceptual framework of computer languages (Algorithm, Flowcharts) Need of structured programming, Top-down, bottom-up and modular programming design. Introduction to C languages-basic structure of C programme. Character set, keyword and identifiers, C data types, variable and data type declaration. Various operators like arithmetic, relational, logical assignment, conditional, increment and decrement operators. Evaluation of expression and operator precedence.
Unit-2	Input and output statement, control statement (If, If-else, If nested If-else statements switch, while, Do... while and for statements) Simple C programmes like search of prime number between given range of numbers, finding the smallest and largest of three numbers, sume of algebraic series, factorial of given number, roots of a quadratic equation, binary of decimal and decimal to binary conversion etc.
Unit-3	Functions: need of functions, calling the function by value and by reference, category of functions: no argument no return, argument but not return, argument with return. Recursion. One and two dimensional arrays. String and string handling functions like sprinf (), strepy (), sscanf (), strlen(), sizeorf () strcmp ()etc. Simple programs using user define functions, arrays and string functions.
Unit-4	Network: Terminals-Dumb terminals, smart terminals, intelligent tgerminals. Types of network: • According to range: LAN,MAN,WAN, Client server • According to topologies: BUS, RING, STAR, Mesh Network.

	Internet: History of Internet Service Provider (ISP), introduction to type of internet account-shell/Ac, TCP/IP A/c. types of connectivity-Dialup, Leased lines, Satellite. IP Address-Class A, Class B, Class C Domain Name address. URL-absolute and relative
Unit-5	Web enabled technology (Email and HTML): Web Browser: Internet Explorer, Netscape Navigator, Station and Dynamic web page Introduction to HTML. HTML tags: • <HTML>, <TITLE>, <HEAD>, <BODY> • <P>, , (ALIGN>, <I>, <B>, <DIV>, <PRE>, and their attributers • <IMG> <a> and their attributes • Ordered and unordered list tages • Tabes and associated tags and its properties Creation of simple forms using text, Password, text area, radio, submit, Rest and Hidden. Brief idea about HTTP. Search engine, its working, types of search engines: sub directories meta search engines, search function-AND and OR. Population search engines.

Suggested Readings:

1. Let us C : Yashwat Kanetkar
2. Programming with C : Balaguruswami
3. Internet and Web Page : V. K Jain

   'O' level module M1.2
4. Internet and Web Page design : Dr. P.D Murarka

   'O' level module M1.2
5. Internet and web page design : Pearl Software

   'O' level module M1.2
6. C# 2008 in simple step

   Dreamtech press
7. C# 2008 programming block book

   Dreamtech press

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Session (सत्र) – 2017-18

Class / कक्षा	: **M.Sc.**
Semester / सेमेस्टर	: **IV**
Subject / विषय	: **Physics**
Title of Subject Group	: **Digital Electronics**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: **IV-E**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: **Optional**

Max. Marks अधिकतम अंक : CCE : 30, Main Exam : 70 Total - 100

Particulars / विवरण

Unit-1	**OP-AMP:-** Differential amplifier circuit configurations: dual input balanced output dual input, single input unbalanced output (ac analysis) only, block diagram of a typical op amp analysis, schematic symbol of an op-amp. IC 555 timer Introduction, Architecture, Application as astable and monostable multivibraters.
Unit-2	**OP-AMP Parameters:-** Ideal op-amp parameters; input offset voltage, input offset current, input bias current, CMRR, SVRR, large signal voltage gain, Slew rate, Gain band width product, output resistance, supply currents power consumption, inverting and non-inverting inputs.
Unit-3	**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, L-C tunable oscillator, square wave generator.
Unit-4	**Microprocessors and Micro Computers:** Microprocessor and Architecture: Intel 8086, Microprocessor architecture modes of memory addressing, 8086/8088 Hardware specification: Pin-outs and pin functions, clock generator (8284A) Bus buffering and latching, Bus timing, Ready and wait State, Minimum mode versus maximum mode.
Unit-5	**Programming the Microprocessors:** Addressing modes: Data addressing modes, program memory addressing modes, stack memory-addressing modes. Instruction set: data movement Instructions, Arithmetic and login instructions, program control instructions. Programming example: Simple Assembly language programs table handling direct table addressing, searching a table sorting a table using pseudo ops.

Suggested Readings :

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