EWING CHRISTIAN COLLEGE

(An Autonomous Constituent College of Allahabad University)

LECTURE LIST B. Sc.-I

FIRST SEMESTER

PHYSICS DEPARTMENT

2014-2015

SEMESTER 1 : PAPER I

Mechanics and Relativity **Max. Marks : 75**

Unit I : Vector and Gravitation

- Polar and axial vectors, Dot and Cross product of vectors; gradient of scalars, divergence and curl of vectors.
- Integral (line, surface and volume) of vectors, Gauss and Stoke's theorem, Solenoid and Lamellar Vectors, Conservative and non-conservative forces.
- Hydro dynamical Equations (Conservation of mass, momentum and energy)
- Central Force and its chracteristics, reduction of two body problem to one body problem, reduced mass.
- Gravitational self energy of a solid sphere, motion under inverse square force, Communication Satellites.

Unit II : Fundamental of Dynamics

- Centre of mass and centre of gravity, centre of mass and laboratory frame of references.
- Linear momentum, angular momentum, Kinetic energy, potential energy, mechanical energy & their conservation laws for a system of particles.
- Equation of rotational motion, moment and product of inertia, Inertia Tensor.

Unit III : Elasticity:

- Behaviors of loaded wire, Load & extension graph.
- Hook's Law, Elastic constants (Y,n, K & σ) and relations among them.
- Torsion of cylinder, Angle of Twist and angle of Shear, Torsion regidity.
- Bending of light beams, bending moment, Geometrical moment of Inertia, Cantilever.

Unit IV : Relativity

- Frame of Reference (Inertial and Non-inertial Frames of Reference) Events (Co-local, Smultaneous & Coincident) PseudoForce and Coriolis force.
- Galilean Transformation, Galilean Variant and Invariant, Michelson Morley Experiment and its significance.
- Postulates of special theory of relativity, Lorentz transformation, Length contraction, Time Dilation, Relativity of Simultaneity, Relativistic Velocity addition Theorem, Einstein's mass-energy equivalence relation Variation of mass with velocity (qualitative) Aberration of stars, Relativistic Doppler effects.
- Fundamental equation of Relativistic Motion, Longitudinal and Transverse masses.

Books Recommended :

1. Mechanics - Saxena, Prasad Singh
2. Mechanics - J. K. Ghosh
3. Mechanics D. S. Mathur
4. Elements of Mechanics J.C. Upadhyay
5. An Introduction to Mechanics-R. B. Singh

6. Introduction to special Relativity - Robert Resnick
7. Introduction to special Relativity-Bergmann
8. Relativistic Mechanicds-Guta & Prakash'
9. Theory of Relativity - Ugarov

SEMESTER 1 : PAPER II

Thermal Physics **Max. Marks : 75**

Unit I : Fundamentals of Thermodynamics

- Thermodynamical Systems and Variables, Macroscopic, Microscopic, extensive and intensive variables.
- Theromodynamic equilibrium, equation of state and constraints, Zeroth law of thermodynamics and concept of Temperature.
- Point functions and path functions, Quasi-state and non-quasistatic processes, reversible and irreversible processes, Internal Energy.
- First law of thermodynamics (Statement Limitations and its application), degree of freedom, Atomic Heat Ratio, P-V indicator diagram.

Unit II : Second law of Thermodynamics :

- Need of Second Law, Carnot Cycle P-V and T-S Diagram), Carnot heat engine and refrigerators, Thermal Efficiency and coefficient of performance.
- Carnot theorem, Statement of Second law of thermodynamics, Absolute scale of temperature.
- Entropy (Need and Characteristics), Clausius Theorem and inequality, entropy change (Mixture, change of state and perfect gas).
- Available and non available energy, the principle of increase of entropy, Nernst heat Theorem.

Unit III : Thermodynamical Relations

- Thermodynamical Potentials, Maxwell's thermodynamical relations, TdS equations and their applications.
- Phase changes (First and Second order), Clausius-Calpeyron latent heat equations, Differences and ratio of specific heat capacities.
- Joule Expansion, Joule-Thomson Expansion and Comparison with adiabatic expansion.
- Energy equation, Joule Coefficients, Enthalpy equations, Joule-Kelvin Coefficient, Inversion Temperature.

Unit IV : Transfer of heat

- Steady and Variable states, Thermal Conductivity and Thermal Diffusivity, Temperature gradients.
- Formation of ice-layer, Fourier equation of heat, Periodic flow of heat (qualitative).
- Natural and forced convection (qualitative).
- Radiant energy, Kirchhoff law, Black body radiation and its Characteristics (qualitative).

Books Recommended :

1. Thermal Physics : B. K. Agarwal
2. Heat and Themodyamics - M.W. Zemansky
3. Tratise on Heat -M.N. Saha and B.N. Srivastava
4. Heat and Thermodynamics-B.L. Kulshrestha and R.P. Goyal
5. Heat - D.S. Mathur
6. Heat andThermodynamics-Brijlal & N. Subrahmanyam
7. Termodynamics - Singhal, Prasad,Agarwal
8. Thermal Physics - Singh Prasad, Saxena
9. Thermal Physics-Garg, Bansal, S. Ghosh
10. Thermodynamics - A. K. Saxena

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LECTURE LIST B. Sc.-I
SECOND SEMESTER
PHYSICS DEPARTMENT
2014-2015

SEMESTER 2 : PAPER I

Oscillations and **Max. Marks : 75**

Unit I : Mechanical Oscillator

- Undamped oscillations and its characteristics, Electrical analogue of mechanical vibration, derivation of differential equation using energy consideration and its solution, motion of extended spring.
- Damped oscillatioins and its Characteristics. Derivation of differential equation using energy consideration and its solution, logarithmic decrement, Q factor and relaxation time.
- Forced vibrations and its examples, Differential equation and steady state solution, amplitude & velocity resonance, mechanical impedance.
- Power absorption & power dissipation, Quality factor and band width. Sharpness of resonance.

Unit II : Transient Phenomenon :

- Transient state and steady state, transient response of LR, CR, LCR and LC circuits.
- Theory of moving coil galvanometers (dead beat and ballistic), Critical resistance, Current and charge sensitivity, Applications to measurement of high resistance byleakage method.

Unit III : Alternative Current

- j-operator and phasor notation, Reactance, Impednace, Susceptance, Admittance, Instantaneous, peak, RMS, Average value of voltage and current Form Facotr.
- Wattful and Wattless current, Average power (active, reactive and apparent), Power Factor.
- Phasor and vector diagram of CR, LR, LCR series and LCR parallel, LR in series and C in parallel circuit.
- Parallel and series resonance, Sharpness of resonance, Q-factor and bandwidth.

Unit IV : Network Analysis (For both AC & DC)

- T and π network and their equivalence.
- Kirchhoff's law, mesh and nodal analysis of electrical circuits (matrix and determinant method).
- Concept of constant current and constant Voltage sources, Thevenin theorem, Norton theorem, Maximum power transfer theorem.
- Balance and sensitivity conditions of DC and AC bridges, Maxwell, Wien's and Schering bridges.

Books Recommended :

1. Physics of Vibrations and waves - H. J. Pain
2. Physics of oscillations and waves - R. B. Singh
3. Waves and Oscillations - D. N. Tripthi
4. Waves and Oscillations - Dangre & Bhattacharya
5. Electricla Circuits and Introductory Eletronics-Vinod Prakas
6. Electricity and Magnetism-K. K. Tiwari
7. Electricity and Magnetism - D. C. Tayal
8. Fundamentals of Electricity and Magnetism-R. B. Singh & A. K. Shukla

SEMESTER 2 : PAPER II

Analog and Digital Electronics **Max. Marks : 75**

Unit I : Semi conducting devices I

- P-N Jucntion formation, Drift and diffusion motion in semi-conductor, charge depletion region and potential barrier. Forward and Reverse biasing, Diode equation and diode characteristics, Breakdown, mechanisms (Zener & Avalanche), Transition and storages capacitances.

- Zener diode and its characteristics, Regulated and non-regulated power supply. Half wave, full wave and bridge rectifier and their mathematical analysis. Filtering by RL, RC and LC circuits (only qualitative).

- NPN and PNP transistors and their action. Thermal runways Characteristics and parameters in CE, CB and CC configuration of transistor.

- Hybrid parameters and their inter-relationship. Small Signal hybird equivalent circuits, Voltage divider baising of transistor. AC and DC load lines.

Unit II : Semi Conduciting devices II

- FET (construction, principle of operation, characteristics, parameters and applications), External and internal baising.

- MOSEFT (enhancement and depletion) modes. MOS and CMOS as switches.

- Storage and transition time. BJT as switch, Schottky diode and schottky transistor.

- Eber's moll model for PNP and NPN transistors, saturation parameter condition for cutt off, saturation and active mode.

Unit III : Number system and Logic Gates

- Number Systems : (Decimal, binary, octal and hexadecimal numbers) and their interconversion, 1's and 2's Copmplements,
- Different types of codes (Excess-3 code, Grey code, ASCII code, EBCDIC code, Error code and BCD code)
- Primary gates (AND, OR, NOT), Universal gates (NAND, NOR) and Exclusive gate (XOR, XNOR).
- Truth Table, Venn diagram, Boolean function and Switching Circuits.

Unit IV : Combinational logic circuits

- De-Morgan's laws, Commutative laws associative laws, distribution laws, Absorptive laws, Dual and complement of Boolean functions.
- SOP and POS, Minterms and Maxterm, Karnaugh's Mapping (For 2, 3 and 4 variables)
- Simplifaction of Boolean expression by Boolean laws and K mapping.
- Combinational logic circuits (Half adder, Full adder, Half subtractor, Full subtractor).

Books Recommended :

1. Integrated Electronics : J. Millman and C. Halkias
2. Electronic Principles - Albert Paul Malvino
3. Hand book of Electronics-Gupta and kumar
4. Principals of Electronics - V. K. Metha
5. Solid State Devices and Circuits-Kshitiz and Singhals
6. Electronic Devices and Circuits - Allen Mottershead
7. Introductory circuit Analysis - Bolyested
8. Basic Electronics -Bhargava Kulshreshta & Gupta.
9. Electronics - B. L. Thereja
10. Principles of Modern Physics-A.K. Saxena

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SEMESTER 3 : PAPER I

WAVE MOTION AND WAVE OPTICS (M.M. 75)

Unit 1 : Wave Motion

- Differential equation of wave motion, wave front, Plane progressive wave in fluid and stretched string, Displacement wave and pressure wave.
- Intensity and energy transport in wave. Specific and acoustic impendence. Characteristic impedance. Reflection and transmission coefficient of amplitude and energy at joint of two media/strings.
- Principle of superposition. Sationary wave and its characteristics. SWR, Fundamental freqeuncy, harmonics and overtones. Mode of natural oscillation of stretched string.

Unit 2 : Interference

- Essential conditions for observation. Shape and visibilities of fringes, Division of Wavefront (Fresnel's Biprism, Lloyd's Single Mirror and Fresnel's Bimirror), achromatic Fringes.
- Division of Amplitude (Colour of thin Film, Newton's Rings, Michelson's Interferometer).
- Multiple Beam Interferometry (Fabry Perot Interferometer, L G Plate).

Unit 3 : Diffraction

- Fresnel class of Diffraction (Half Period Zones, Zone Plaste, Diffraction at a Straight Edge, Carnu's Spiral, Circular aperture).
- Fraunhofer Class of Diffraction [Single Slit, Double Slit & Grating (Plane and Concave].
- Rayleigh Criteria for Resolution, Resolving Power of Grating, Prism, Telescope and Microscope.

Unit 4 : Polarization

- Basics of Polarisation, Polarisation by refletion and refraction, Brewster's law, Double refraction (E & O rays) by uniaxial crystals, Huygens theory of double refraciton, Law of Malus. Nicol Prism and dichroism.
- Retardation plate (Quarter and Half wave plates), Production and detection of plane, circularly and elliptically polarized light, Babinet Compensator.
- Optical rotation and Optical activity, Fresnel's theory of optical rotation, Half-Shade and Biquartz Polarimeters.

SEMESTER 3 : PAPER II

GEOMETRICAL AND QUANTUM OPTICS (M.M. 75)

Unit 1 : Co-axial system of lenses

- Cardinal Points of Coaxial System of Lenses (The matrix method for its analysis), Problems of Combination of thin Lenses.
- Eye-pieces (Ramsden and Huygen's), Aplanatic Points & its applications.

Unit 2 : Laser and Holography

- Coherence (Temporal and Spatial), stimulated and spontaneous emission, Einstein coefficient and their inter relationship.
- Pumping and population inversion, basic idea about laser, characteristics of laster light, Ruby, He-Ne laser & semiconductor laser and its applications.
- Theory of Holography (recording and reconstruction of hologram) & applications.

Unit 3 : Fiber Optics

- Principle of Fiber Optics, construction and material used in Fiber, Propagation of light in fibers, Advantages and Disadvantages, numerical aperature and acceptance angle, Meridional and skew rays.
- Type of fibers (SIF, GIF, single and multimode), Fiber profile, Attenuation and Dispersion. Qualitative discussion of Coupler, Splices and connectors.

Unit 4 : Photonics

- LED & LCD display, optical sources (Laser and LED)
- Photodiode,photo transistors and their characteristics, Detectors (PIN and Avalanche)
- Photo conductivity, solar cell (Principle, construction, characteristics, parameters and its applications).

EWING CHRISTIAN COLLEGE, ALLAHABAD

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Lecture List of B.Sc. Part I

SECOND SEMESTER

Department of Physics

2015-2016

Electromagnetism **Max. Mark : 60**

Semester 4 : Paper -I

Unit I : Electrostatics

- Gauss law (Integral & differential form) and its application for linear cylindrical and spherical charge distributions. Electric flux, Laws of electrostatic.
- Electric field and potential gradient and their relationship. Electric field and potential due to a spherical charge distribution, Electrostatic potential energy and self energy.
- Dipole in uniform and non-uniform electric field, Electric field and potential due to an electric dipole at a point in Cartesian and polar coordinates.
- Capacity and Principle of Capacitor, Capacity of Partially filled parallel plate, spherical plate and cylindrical plate capacitors.

Unit II : Magnetostatics

- Magnetic field due to current, magnetic torce between current elements, Definition of B & H, Biot Savart law and its applications to straight, circular, solenoidal & Toroidal current carrying conductors.
- Lorentz force, cyclotron (Principle, construction, working, limitations and modifications)

- Lorentz force, Cyełotron (Principle, construction, working, limitations and modifications)
- Ampero's circuital law and its applications (hollow and solid rods), Laws in magnetostatics.
- Vector potential and its expression due to a straight conductor and current loop.

Unit III : Electromagnetic induction

- Magnetic flux, Faraday's law of electromagnetic induction (integral and differential form) induced voltage, current, charge and power.
- Self and mutual inductions, Reciprocity theorem and Neumaum relation.
- Relation between self and mutual induction between two coils, Energy coupled circuits
- Transformer and its equivalent circuit, efficiency and voltage gain of ideal transformer, translators losses.

Unit IV : Dielectrics and Magnetic Materials

- Electric susceptibility dielectric constants, dielectric strength, the electric vectors (P, E & D).
- Polarization, surface and volume charge density, Gauss' law in dielectrics.
- Magnetizations and megnetization currents, magnetic susceptibilities, relative and absolute permeability
- Three magnetic vectors (M, H & B), Curl of M.

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SEMESTER 2: PAPER - II

Atomic Physics **Max. Marks: 60**

Unit I : Optical and X-ray spectra

- Spectrum of hydrogen atom and effect of Nuclear Motion Ground, excited and ionized energy states. Bohr's correspondence principle and Rydberg's constant, Excitation, resonance and ionization potentials, Binding energy and ionization energy.

- Continuous and characteristic X-ray, Duane-Haunt law, Emission and absorption spectra, Hydrogen like atoms, Comparisons of optical spectra and X-ray spectra

Unit II : Atomic Structure

- Need and statement of Vector atom model, Space quantization and concept of electron spin. Quantum Numbers, Stern & Gerlach experiment, Magnetic moment of atom, Bohrs magneton, Larmour precession and frequency.

- Spectral terms, Na D1 and D2 lines. Fine structure of Hα, L-S and J-J coupling schemes for two valence electron, spectra of alkali and alkaline earth elements.

Unit III: Dualism in Nature :

- Planck's quantum theory of radiation, and Einstein's Modifications. Photoelectric effect, Compton Effect, Non-relativestic particles and relativistic particles.

- de-Broglie hypothesis, wave-particle duality, comparisons of matters wave, electromagnetic wave and mechanical wave, Davisson Germer experiment, wave packets, uncertainty principle phase and group velocity.

Unit IV : Wave mechanics

- Need of Quantum mechanics, Schrodingers equation for wave mechanics, Max Born and schrondiger interpretation of wave function, Separation of variables Probability density and equation of continuity, Stationery states, Probability current density.

- Normalization, orthogonality, orthonormality and completeness of wave function, Dirac-Delta functions, Kronecker delta function. Applications of Schrodinger equation to Free particle, particle in a box, potential step, potential barrier (tunneling), potential well.