PHYSICS
II and III Yr Syllabus

(To be implemented w.e.f 2009-10 & 2010-11 respectively)

(UG courses)

(For the Batch of the students admitted in 2008)

STRUCTURE OF MODEL CURRICULUM

PHYSICS

YEAR	THEORY/ PRACTICAL	TITLE	WORKLOAD HRS/ WEEK
FIRST	Theory – I	Mechanics and Waves and Oscillations	4
	Practical - I	---	3
SECOND	Theory - II	Thermodynamics and Optics	4
	Practical - II	---	3
THIRD	Theory – III	Electricity, Magnetism and Electronics	3
	Theory - IV	Modern Physics	3
	Practical - III	---	3
	Practical - IV	---	3

B.Sc. (Physics)
(For the Batch of students admitted in 2008)
Theory Paper – II
Thermodynamics and Optics

120 hrs
(4 hrs / week)

Unit – I **30 hrs**

1. **Kinetic theory of gases: (8)**

   Introduction – Deduction of Maxwell's law of distribution of molecular speeds, Experimental verification Toothed Wheel Experiment, Transport Phenomena – Viscosity of gases – thermal conductivity – diffusion of gases.

2. **Thermodynamics: (12)**

   Introduction – Reversible and irreversible processes – Carnot's engine and its efficiency – Carnot's theorem – Second law of thermodynamics, Kelvin's and Claussius statements – Thermodynamic scale of temperature – Entropy, physical significance – Change in entropy in reversible and irreversible processes – Entropy and disorder – Entropy of universe – Temperature- Entropy (T-S) diagram – Change of entropy of a perfect gas-change of entropy when ice changes into steam.

3. **Thermodynamic potentials and Maxwell's equations: (10)**

   Thermodynamic potentials – Derivation of Maxwell's thermodynamic relations – Clausius-Clayperon's equation – Derivation for ratio of specific heats – Derivation for difference of two specific heats for perfect gas. Joule Kelvin effect – expression for Joule Kelvin coefficient for perfect and Vanderwaal's gas.

Unit – II **30 hrs**

4. **Low temperature Physics: (10)**

   Introduction – Joule Kelvin effect – liquefaction of gas using porous plug experiment. Joule expansion – Distinction between adiabatic and Joule Thomson expansion – Expression for Joule Thomson cooling – Liquefaction of helium, Kapitza's method – Adiabatic demagnetization – Production of low temperatures – Principle of refrigeration, vapour compression type. Working of refrigerator and Air conditioning machines. Effects of Chloro and Fluro Carbons on Ozone layer;

5. **Quantum theory of radiation: (10)**

   Black body-Ferry's black body – distribution of energy in the spectrum of Black body – Wein's displacement law, Wein's law, Rayleigh-Jean's law – Quantum theory of radiation - Planck's law – deduction of Wein's law, Rayleigh-Jeans law, from Planck's law - Measurement of radiation – Types of pyrometers – Disappearing filament optical pyrometer – Angstrom pyroheliometer - determination of solar constant, estimation of temperature of sun.

6. Statistical Mechanics: (10)

Introduction to statistical mechanics, concept of ensembles, Phase space, Maxwell-Boltzmann's distribution law, Molecular energies in an ideal gas, Bose-Einstein Distribution law, Fermi-Dirac Distribution law, comparison of three distribution laws, Black Body Radiation, Rayleigh-Jean's formula, Planck's radiation law, Weins Displacement, Stefan's Boltzmann's law from Plancks formula.

Unit III **30 hrs**

7 The Matrix methods in paraxial optics: (8)

Introduction, the matrix method, effect of translation, effect of refraction, imaging by a spherical refracting surface. Imaging by a co-axial optical system. Unit planes. Nodal planes. A system of two thin lenses.

8 Aberrations: (7)

Introduction – Monochromatic aberrations, spherical aberration, methods of minimizing spherical aberration, coma, astigmatism and curvature of field, distortion. Chromatic aberration – the achromatic doublet – Removal of chromatic aberration of a separated doublet.

9 Interference: (15)

Principle of superposition – coherence – temporal coherence and spatial coherence – conditions for Interference of light

Interference by division of wave front: Fresnel's biprism – determination of wave length of light. Determination of thickness of a transparent material using Biprism – change of phase on reflection – Lloyd's mirror experiment.

Interference by division of amplitude: Oblique incidence of a plane wave on a thin film due to reflected and transmitted light (Cosine law) – Colours of thin films – Non reflecting films – interference by a plane parallel film illuminated by a point source – Interference by a film with two non-parallel reflecting surfaces (Wedge shaped film) – Determination of diameter of wire-Newton's rings in reflected light with and without contact between lens and glass plate, Newton's rings in transmitted light (Haidinger Fringes) – Determination of wave length of monochromatic light – Michelson Interferometer – types of fringes – Determination of wavelength of monochromatic light, Difference in wavelength of sodium D_1,D_2 lines and thickness of a thin transparent plate.

Unit IV: **30 hrs**

10 Diffraction: (10)

Introduction – Distinction between Fresnel and Fraunhoffer diffraction Fraunhoffer diffraction:- Diffraction due to single slit and circular aperture – Limit of resolution – Fraunhoffer diffraction due to double slit – Fraunhoffer diffraction pattern with N slits (diffraction grating)

Resolving Power of grating – Determination of wave length of light in normal and oblique incidence methods using diffraction grating.

Fresnel diffraction:-

Fresnel's half period zones – area of the half period zones –zone plate – Comparison of zone plate with convex lens – Phase reversal zone plate – diffraction at a straight edge – difference between interference and diffraction.

11 Polarization (10)

Polarized light : Methods of Polarization, Polarizatioin by reflection, refraction, Double refraction, selective absorption , scattering of light – Brewsters law – Malus law – Nicol prism polarizer and analyzer – Refraction of plane wave incident on negative and positive crystals (Huygen's explanation) – Quarter wave plate, Half wave plate – Babinet's compensator – Optical activity, analysis of light by Laurent's half shade polarimeter.

12 Laser, Fiber Optics and Holography: (10)

Lasers: Introduction – Spontaneous emission – Stimulated emission – Population inversion . Laser principle – Einstein coefficients – Types of Lasers – He-Ne laser – Ruby laser – Applications of lasers.

Fiber Optics : Introduction – Optical fibers – Types of optical fibers – Step and graded index fibers – Rays and modes in an optical fiber – Fiber material – Principles of fiber communication (qualitative treatment only) and advantages of fiber communication.

Holography: Basic Principle of Holography – Gabor hologram and its limitations, Holography applications.

NOTE: Problems should be solved at the end of every chapter of all units.

Textbooks

1. **Optics** by Ajoy Ghatak. *The McGraw-Hill companies*.
2. **Optics** by Subramaniyam and Brijlal. *S. Chand & Co*.
3. **Fundamentals of Physics**. Halliday/Resnick/Walker.*C. Wiley India Edition 2007*.
4. **Optics and Spectroscopy**. R. Murugeshan and Kiruthiga Siva Prasath. *S. Chand & Co*.

5. **Second Year Physics** – *Telugu Academy.*
6. **Modern Physics** by R. Murugeshan and Kiruthiga Siva Prasath (for statistical Mechanics) *S. Chand & Co*.
7. **Thermodynamics** by R.C. Srivastava, Subit K. Saha & Abhay K. *Jain Eastern Economy Edition*.
8. **Heat and thermodynamics** – Brijlala and Subrahamanyam (S.Chand)

Reference Books

1. **Modern Physics** by G. Aruldhas and P. Rajagopal, *Eastern Economy Education*.
2. Berkeley Physics Course. Volume-5. **Statistical Physics** by F. Reif. *The McGraw-Hill Companies*.
3. **An Introduction to Thermal Physics** by Daniel V. Schroeder.*Pearson Education Low Price Edition*.
4. **Modern Engineering Physics** by A.S. Vasudeva. *S.Chand & Co. Publications*.
5. **Feyman's Lectures on Physics** Vol. 1,2,3 & 4. *Narosa Publications*.
6. **Fundamentals of Optics** by Jenkins A. Francis and White E. Harvey, *McGraw Hill Inc.*

B.Sc (Physics)

(For the Batch of students admitted in 2008)

Theory Paper – III **90 hrs**

(3 hrs / week)

Electricity, Magnetism and Electronics

Unit – I **23 hrs**

1. **Electrostatics (10 periods)**

   Gauss law and its applications-Uniformly charged sphere, charged cylindrical conductor and an infinite conducting sheet of charge. Deduction of Coulmb's law from Gauss law Mechanical force on a charged conductor Electric potential – Potential due to a charged spherical conductor, , electric field strength from the electric dipole and an infinite line of charge. Potential of a uniformly charged circular disc.

2. **Dielectrics (5 periods)**

   An atomic view of dielectrics, potential energy of a dipole in an electric field. Polarization and charge density, Gauss's law for dielectric medium– Relation between D,E, and P. Dielectric constant, susceptibility and relation between them. Boundary conditions at the dielectric surface. Electric fields in cavities of a dielectric-needle shaped cavity and disc shaped cavity.

3. **Capacitance (8 periods)**

   Capacitance of concentric spheres and cylindrical condenser, capacitance of parallel plate condenser with and without dielectric. Electric energy stored in a charged condenser – force between plates of condenser, construction and working of attracted disc electrometer, measurement of dielectric constant and potential difference.

Unit – II **24 hrs**

1. **Magnetostatics (6 periods)**

   Magnetic shell – potential due to magnetic shell – field due to magnetic shell – equivalent of electric circuit and magnetic shell – Magnetic induction (B) and field (H) – permeability and susceptibility – Hysteresis loop.

2. **Moving charge in electric and magnetic field (8 periods)**

   Motion of charged particles in electric and magnetic fields. Hall effect, cyclotron, synchrocyclotron and synchrotron – force on a current carrying conductor placed in a magnetic field, force and torque on a current loop, Biot –Savart's law and calculation of B due to long straight wire, a circular current loop and solenoid.

3. **Electromagnetic induction (10 periods)**

   Faraday's law –Lenz's law – expression for induced emf – time varying magnetic fields – Betatron –Ballistic galvanometer – theory – damping correction – self and

mutual inductance, coefficient of coupling, calculation of self inductance of a long solenoid – toroid – energy stored in magnetic field – transformer – Construction, working, energy losses and efficiency.

Unit – III **20 hrs**

1. **Varying and alternating currents (10 periods)**

   Growth and decay of currents in LR, CR and LCR circuits – Critical damping. Alternating current relation between current and voltage in pure R,C and L-vector diagrams – Power in ac circuits. LCR series and parallel resonant circuit – Q-factor. AC & DC motors-single phase, three phase (basics only).

2. **Maxwell's equations and electromagnetic waves (10 periods)**

   A review of basic laws of electricity and magnetism – displacement current – Maxwell's equations in differential form – Maxwell's wave equation, plane electromagnetic waves – Transverse nature of electromagnetic waves, Poynting theorem, production of electromagnetic waves (Hertz experiment)

Unit – IV **23 hrs**

1. **Basic Electronics (15 periods)**

   Formation of energy bands in solids, classification of solids in terms of forbidden energy gap. Intrinsic and extrinsic semiconductors, Fermi level, continuity equation – p-n junction diode, half wave and full wave rectifiers and filters, ripple factor (quantitative), Characteristics of Zener diode and its application as voltage regulator. – p n p and n p n transistors, current components in transistors, CB,CE and CC configurations – concept of transistor biasing, operating point, fixed bias and self bias (Qualitative only), transistor as an amplifier — concept of negative feed back and positive feed back – Barkhausen criterion, RC coupled amplifier and phase shift oscillator (qualitative).

2. **Digital Principles (8 periods)**

   Binary number system, converting Binary to Decimal and vice versa. Binary addition and subtraction (1's and 2's complement methods). Hexadecimal number system. Conversion from Binary to Hexadecimal – vice versa and Decimal to Hexadecimal vice versa.

   Logic gates: OR,AND,NOT gates, truth tables, realization of these gates using discrete components. NAND, NOR as universal gates, Exclusive – OR gate, De Morgan's Laws – statement and proof, Half and Full adders. Parallel adder circuits.

NOTE: Problems should be solved from every chapter of all units.

Textbooks

1. **Modern Physics** by R. Murugeshan and Kiruthiga Siva Prasath – *S. Chand & Co.* for semi conductor & Digital Principles)
2. **Fundamentals of Physics**- Halliday/Resnick/Walker - *Wiley India Edition 2007.*
3. Berkeley Physics Course – Vol. II - **Electricity and Magnetism** – Edward M Purcell –*The McGraw-Hill Companies*.
4. **Electricity and Magnetism** – D.N. Vasudeva. *S. Chand & Co.*
5. **Electronic devices and circuits** – Millman and Halkias. *Mc.Graw-Hill Education.*
6. **Electricity and Magnetism** Brijlal and Subramanyam. *Ratan Prakashan Mandir.*
7. **Digital Principles and Applications** by A.P. Malvino and D.P. Leach. *McGraw Hill Education.*

Reference Books

1. **Electricity and Electronics** – D.C. Tayal. *Himalaya Publishing House.*
2. **Electricity and Magnetism** – C.J.Smith. *Edward Arnold Ltd.*
3. **Electricity, Magnetism with Electronics** – K K Tewari. *R.Chand & Co.*
4. **Third year Physics** – *Telugu Akademy*
5. **Principles of Electronics** by V.K. Mehta – *S. Chand & Co.*

B.Sc. (Physics)

(For the Batch of students admitted in 2008)

Paper IV

Modern Physics **90 hrs**

(3 hrs / week)

Unit – I **25 hrs**

Atomic Spectra

Introduction – Drawbacks of Bohr's atomic model - Sommerfeld's elliptical orbits – relativistic correction (no derivation). Stern & Gerlach experiment Vector atom model and quantum numbers associated with it. L-S and j-j coupling schemes. Spectral terms, selection rules, intensity rules. Spectra of alkali atoms, doublet fine structure. Alkaline earth spectra, singlet and triplet fine structure. Zeeman Effect, Paschen-Back Effect and Stark Effect (basic idea).

Molecular Spectroscopy:

Types of molecular spectra, pure rotational energies and spectrum of diatomic molecule, determination of internuclear distance. Vibrational energies and spectrum of diatomic molecule. Raman effect, Classical theory of Raman effect. Experimental arrangement for Raman effect and its applications.

Unit – II: **25 hrs**

Quantum Mechanics

Inadequacy of classical Physics: (Discussion only)

Spectral radiation – Planck's law. Photoelectric effect – Einstien's photoelectric equation. Compton's effect (quantitative) experimental verification. Stability of an atom – Bohr's atomic theory. Limitations of old quantum theory.

Matter Waves:

de Broglie's hypothesis – wavelength of matter waves, properties of matter waves. Phase and group velocities. Davisson and Germer experiment. Double slit experiment. Standing de Brogile waves of electron in Bohr orbits.

Uncertainty Principle:

Heisenberg's uncertainty principle for position and momentum (x and p_x), Energy and time (E and t). Gamma ray microscope. Diffraction by a single slit. Position of electron in a Bohr orbit. Particle in a box. Complementary principle of Bohr.

Schrodinger Wave Equation:

Schrodinger time independent and time dependent wave equations. Wave function properties – Significance. Basic postulates of quantum mechanics.

Operators, eigen functions and eigen values, expectation values. Application of Schrodinger wave equation to particle in one and three dimensional boxes, potential step and potential barrier.

Unit – III **15 hrs**

Nuclear Physics

Nuclear Structure:

Basic properties of nucleus – size, charge, mass, spin, magnetic dipole moment and electric quadrupole moment. Binding energy of nucleus, deuteron binding energy, p-p and n-p scattering (concepts), nuclear forces. Nuclear models – liquid drop model, shell model.

Alpha and Beta Decays: Range of alpha particles, Geiger – Nuttal law. Gammow's theory of alpha decay. Geiger – Nuttal law from Gammow's theory. Beta spectrum – neutrino hypothesis, Fermi's theory of β-decay (qualitative).

Nuclear Reactions: Types of nuclear reactions, channels, nuclear reaction kinematics. Compound nucleus, direct reactions (concepts).

Nuclear Detectors – GM counter, proportional counter, scintillation counter, Wilson cloud chamber and solid state detector

Unit – IV **25 hrs**

Solid State Physics

Crystal Structure: Crystalline nature of matter. Cystal lattice, Unit Cell, Elements of symmetry. Crystal systems, Bravais lattices. Miller indices. Simple crystal structures (S.C., BCC, CsCl, FCC, NaCl diamond and Zinc Blends)

X-ray Diffraction: Diffraction of X –rays by crystals, Bragg's law, Experimental techniques - Laue's method and powder method.

Nanomaterials: Introduction, nanoparticles, metal nanoclusters, semiconductor nanoparticles, carbon clusters, carbon nanotubes, quantum nanostructures – nanodot, nanowire and quantum well. Fabrication of quantum nanostructures.

Bonding in Crystals: Types of bonding in crystals – characteristics of crystals with different bindings. Lattice energy of ionic crystals – determination of Medelung constant for NaCl crystal, calculation of Born coefficient and repulsive exponent. Born – Haber cycle.

Magnetism: Magnetic properties of dia, para and ferromagnetic materials. Langevin's theory of paramagnetism. Weiss' theory of ferromagnetism – Concepts of magnetic domains, antiferromagnetism and ferrimagnetism ferrites and their applications.

Superconductivity:

Basic experimental facts – zero resistance, effect of magnetic field, Meissner effect, persistent current, Isotope effect Thermodynamic properties, specific heat, entropy. Type I and Type II superconductors.

Elements of BCS theory-Cooper pairs. Applications. High temperature superconductors (general information)

NOTE: Problems should be solved from every chapter of all units.

Textbooks

1. **Modern Physics** by G. Aruldhas & P. Rajagopal. *Eastern Economy Edition*.
2. **Concepts of Modern Physics** by Arthur Beiser. *Tata McGraw-Hill Edition*.
3. **Modern Physics** by R. Murugeshan and Kiruthiga Siva Prasath. *S. Chand & Co.*
4. **Nuclear Physics** by D.C. Tayal, *Himalaya Publishing House.*
5. **Molecular Structure and Spectroscopy** by G. Aruldhas. *Prentice Hall of India, New Delhi.*
6. **Spectroscopy –Atomic and Molecular** by Gurdeep R Chatwal and Shyam Anand – *Himalaya Publishing House.*
7. **Third Year Physics** - *Telugu Academy*.
8. **Elements of Solid State Physics** by J.P. Srivastava. (for chapter on nanomaterials)- *Prentice-hall of India Pvt. Ltd.*

Reference Books

1. **University Physics with Modern Physics** by Young & Freedman. *A. Lewis Ford. Low Price Edition (Eleventh Edition).*
2. **Quantum Physics** by Eyvind H. Wichman. Volume.4. *The McGraw-Hill Companies.*
3. **Quantum Mechanics** by Mahesh C. Jani. *Eastern Economy Edition.*
4. **Nuclear Physics** Irving Kaplan – *Narosa Publishing House.*
5. **Introduction to Solid State Physics** by Charles Kittel. *John Wiley and Sons.*
6. **Solid State Physics** by A.J. Dekker. *Mac Millan India*

Practical Paper – II

90 hrs
(3 hrs / week)

SECOND YEAR PRACTICALS

1. Co-efficient of thermal conductivity of a bad conductor by Lee's method.
2. Measurement of Stefan's constant.
3. Specific heat of a liquid by applying Newton's law of cooling correction.
4. Heating efficiency of electrical kettle with varying voltages.
5. Thickness of a wire-wedge method.
6. Determination of wavelength of light –Biprism.
7. Determination of Radius of curvature of a given convex lens- Newton's rings.
8. Resolving power of grating.
9. Study of optical rotation-polarimeter.
10. Dispersive power of a prism
11. Determination of wavelength of light using diffraction grating minimum deviation method.
12. Wavelength of light using diffraction grating – normal incidence method.
13. Resolving power of a telescope.
14. Refractive index of a liquid and glass (Boys Method).
15. Pulfrich refractometer – determination of refractive index of liquid.
16. Wavelength of Laser light using diffraction grating.

Practical Paper - III

90hrs
(3 hrs / week)

THIRD YEAR PRACTICALS

1. Carey Foster's Bridge – comparison of resistances.
2. Internal resistance of a cell by potentiometer.
3. Figure of merit of a moving coil galvanometer.
4. Voltage sensitivity of a moving coil galvanometer.
5. Determination of time constant using RC .
6. LCR circuit series/parallel resonanace – Q factor
7. Power factor of an A.C. circuit
8. Determination of ac-frequency-sonometer.
9. Design and construction of multimeter.
10. Determination of Ripple factor –Half wave. Full wave and Bridge rectifier.
11. Determination of Ripple factor – L Section filter, π section filters.
12. Characteristics of a Junction diode
13. Characteristics of Transistor
14. Characteristics of Zener diode
15. Verification of Kirchoff's laws.

Practical Paper - IV

90 hrs
(3 hrs / week)

THIRD YEAR PRACTICALS

1. e/m of an electron by Thomson method.
2. Energy gap of semiconductor using a junction diode
3. Temperature characteristics of thermistor
4. R.C. coupled amplifier
5. Verification of Logic gates AND, OR NOT, X-OR gates (Using discrete componenets)
6. Verification of De Morgan's theorems
7. Construction and verification of truth tables for half and full adders.
8. Phase shift Oscillator
9. Hysteresis curve of transformer core
10. Determination of Planck's constant (photocell)
11. Characteristics of G M Counter.
12. Study of absorption of β and γ rays using G M Counter.
13. Hall-probe method for measurement of magnetic field.
14. Determination of Magnetic susceptibility – Capillary rise method.
15. Study of alkaline earth spectra using a concave grating.

Not for examination:

Servicing of domestic appliances – Electric Iron, immersion heater, fan, hot plate grinder, emergency lamp, battery charger, micro-oven, loud speaker, eliminator, cell-phones, servicing of refrigerator.

Suggested Books for Practicals

1. **A textbook of Practical Physics** by M.N. Srinivasan. *S. Chand & Co.*
2. **Practical Physics** by M. Arul Thakpathi by *Comptek Publishers.*
3. **A. Laboratory manual for Physics Course** by B.P. Khandelwal.
4. **B.Sc. Practical Physics** – C.L. Arora – *S. Chand & Co*.
5. **Viva-voce in Advanced Physics** – R.C. Gupta and Saxena P.N. – *Pragathi Prakashan, Meerut.*
6. **Viva-Voce in Physics – R.C. Gupta*, Pragathi Prakashan, Meerut.***

MODEL PAPER

SECTION – A
(Essay type questions - 4 x 15 = 60)

1. One question from each unit with internal choice.

SECTION – B
(Short questions 4x 5 = 20)

Two questions from each unit
Total questions = 8
Answer any FOUR questions

SECTION – C
Problems
(4 x 5 = 20)

Answer any FOUR questions
Two problems from each unit.
Total: Eight problems

Practical scheme of valuation [For Examiner use only]

1.	Formula and explanation of symbols	- (5 marks)
2.	Tabular forms with circuit diagram wherever necessary	- (5 marks)
3.	Observations	- (15 marks)
4.	Calculations and graphs	- (8 marks)
5.	Result	- (2 marks)
6.	Viva-voce	- (5 marks)
7.	Practical Record	- (10 marks)
	Total Marks	- (50 marks)