Andhra Pradesh State Council of Higher Education

**B.Sc. PHYSICS SYLLUBUS UNDER CBCS**

w.e.f. 2015-16 (Revised in April 2016)

**First Semester**

Paper I : Mechanics& Properties of Matter

Practical I (Lab-1)

**Second Semester**

Paper II: Waves & Oscillations

Practical 2 (Lab2)

**Third Semester**

Paper III: Wave Optics

Practical 3.(Lab 3)

**Fourth Semester**

Paper IV: Thermodynamics & Radiation Physics

Practical 4.(Lab 4)

**Fifth Semester**

Paper V: Electricity, Magnetism& Electronics

Paper VI: Modern Physics

Practical 5.(Lab 5)

Practical 6.(Lab 6)

**Sixth Semester**

PaperVII:Elective (One)

Paper VIII:Cluster Electives (Three)

Practical 7(Lab 7)

Practical 8.(Lab 8- A-1, A-2 & A-3).

## Elective in Semester - VI

Paper VII-(A): Analog and Digital Electronics

Paper – VIII ( clusters) (A-1,2,3)

Clusters :

Paper VIII-A-1. Electronic devices and circuits

Paper VIII-A-2. Computational Methods and Programming

Paper VIII-A-3. Electronic Instrumentation

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

1. Each theory paper is of 100 marks and practical paper is also of 50 marks.
   Each theory paper is 75 marks University Exam (external) + 25 marks mid Semester Exam (internal). Each practical paper is 50 marks external
2. The teaching work load per week for semesters I to VI is 4 hours per paper for theory and2 hours for all laboratory (practical) work.
3. The duration of the examination for each theory paper is 3.00 hrs.
4. The duration of each practical examination is 3 hrs with 50 marks, which are to be distributed as30 marks for experiment
   10 marks for viva
   10 marks for record

| **Practicals** | **50 marks** |
|---|---|
| Formula & Explanation | 6 |
| Tabular form +graph +circuit diagram | 6 |
| Observations | 12 |
| Calculation, graph, precautions & Result | 6 |
| Viva-Voce | 10 |
| Record | 10 |

***NOTE: Practical syllabus is same for both Mathematics and Non Mathematics combinations**

## B.Sc. (Physics) (Maths Combinations)

Scheme of instruction and examination to be followed w.e.f. 2015-2016

| S. No | Semester | Title of the paper | Instruc-tion hrs/week | Duration of exam(hrs) | Max Marks (external) |
|---|---|---|---|---|---|
| | | **Thoery** | | | |
| 1 | First | Paper I: Mechanics& Properties of Matter | 4 | 3 | 75 |
| 2 | Second | Paper II: Waves & Oscillations | 4 | 3 | 75 |
| 3 | Third | Paper III: Wave Optics | 4 | 3 | 75 |
| 4 | Fourth | Paper IV: Thermodynamics & Radiation Physics | 4 | 3 | 75 |
| 5 | Fifth | Paper V:Electricity, Magnetism& Electronics<br>Paper VI: Modern Physics | 4<br>4 | 3<br>3 | 75<br>75 |
| 6 | Sixth | PaperVII :Elective (One)<br>Paper VIII: Cluster Electives (Three) | 4<br>4 | 3<br>3 | 75<br>75 |
| | | **Practicals** | | | |
| 1 | First | Practical 1 | 2 | 3 | 50 |
| 2 | Second | Practical II | 2 | 3 | 50 |
| 3 | Third | Practical III | 2 | 3 | 50 |
| 4 | Fourth | Practical IV | 2 | 3 | 50 |
| 5 | Fifth | Practical V | 2 | 3 | 50 |
| 6 | | Practical VI | 2 | 3 | 50 |
| 7 | Sixth | Practical VII | 2 | 3 | 50 |
| 8 | | Practical VIII | 2 | 3 | 50 |

**Model question Paper for all theory papers**

**Time : 3 hrs** **Max marks : 75**

**Section-A (Essay type)**

**Answer All questions with internal choice from all units Marks :10x5 = 50**

**(Two questions are to be set from each unit with either or type)**

**Section-B (Short answer type)**

**Answer any Five out of 8 questions from all units (I to V) Marks: 5 x5 = 25**

**At least one question should be set from each unit.**

**B.Sc. PHYSICS SYLLUBUS UNDER CBCS**

w.e.f. 2015-16 (Revised in April 2016)

**For Mathematics Combinations**

**B.Sc. 1st Semester Physics**

**Paper I: Mechanics& Properties of Matter**

**Work load:60 hrs per semester** **4 hrs/week**

**UNIT-I (10 hrs)**

**1. Vector Analysis**

Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and curl of a vector field with derivations and physical interpretation. Vector integration (line, surface and volume), Statement and proof of Gauss and Stokes theorems.

**UNIT-II (10 hrs)**

**2. Mechanics of particles**

Laws of motion, motion of variable mass system, Equation of motion of a rocket. Conservation of energy and momentum, Collisions in two and three dimensions, Concept of impact parameter, scattering cross-section, Rutherford scattering-derivation.

**UNIT-III (16 hrs)**

**3. Mechanics of Rigid bodies**

Definition of rigid body, rotational kinematic relations, equation of motion for a rotating body, angular momentum, Euler equations and its applications, precession of a top, Gyroscope, precession of the equinoxes.

**4. Mechanics of continuous media**

Elastic constants of isotropic solids and their relations, Poisson's ratio and expression for Poisson's ratio in terms of y, n and k. Classification of beams, types of bending, point load, distributed load.

**UNIT-IV (12hrs)**

**5. Central forces**

Central forces, definition and examples, characteristics of central forces, conservative nature of central forces, conservative force as a negative gradient of potential energy, equation of motion under a central force, Derivation of Kepler's laws. Motion of satellites.

**UNIT-V (12 hrs)**

**6. Special theory of relativity**

Galilean relativity, absolute frames.Michelson-Morley experiment, negative result.Postulates of special theory of relativity.Lorentz transformation, time dilation, length contraction, addition of velocities, mass-energy relation.

**REFERENCE BOOKS:**


1. B. Sc. Physics, Vol.1, Telugu Academy, Hyderabad
2. Fundamentals of Physics Vol. I - Resnick, Halliday, Krane ,Wiley India 2007
3. Unified Physics, Vol. 1, S.L. Gupata & S. Guptha, Jai Prakash Nath & Co, Meerut.
4. College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.
5. University Physics-FW Sears, MW Zemansky& HD Young,Narosa Publications, Delhi
6. Mechanics, S.G.Venkatachalapathy, Margham Publication, 2003.


## Practical paper 1: Mechanics & Properties of Matter

**Work load: 30 hrs per semester** **2 hrs/week**

**Minimum of 6 experiments to be done and recorded**

1. Viscosity of liquid by the flow method (Poiseuille's method)
2. Young's modulus of the material of a bar (scale) by uniform bending
3. Young's modulus of the material a bar (scale) by non- uniform bending
4. Surface tension of a liquid by capillary rise method
5. Determination of radius of capillary tube by Hg thread method
6. Viscosity of liquid by Searle's viscometer method
7. Bifilar suspension – moment of inertia of a regular rectangular body.
8. Determination of moment of inertia using Fly-wheel
9. Determination of the height of a building using a sextant.
10. Rigidity modulus of material of a wire-dynamic method (torsion pendulum)

**Suggested student activities**

Student seminars, group discussions, assignments, field trips, study project and experimentation using virtual lab

.

**Examples**

Seminars - A topic from any of the Units is given to the student and asked to give a brief seminar presentation.

Group discussion - A topic from one of the units is given to a group of students and asked to discuss and debate on it.

Assignment - Few problems may be given to the students from the different units and asked them to solve.

Field trip - Visit to Satish Dhawan Space Centre, Sriharikota / Thermal and hydroelectric power stations / Science Centres, any other such visit etc.

Study project - Web based study of different satellites and applications.

**Domain skills:**

Logical derivation, experimentation, problem solving, data collection and analysis, measurement skills

***** Documental evidence is to be maintained for the above activities.**

## Paper II: Waves & Oscillations
## (For Maths Combinations)
## II SEMESTER

**Work load: 60 hrs per semester** **4 hrs/week**

**UNIT-I (12 hrs)**

**1. Simple Harmonic oscillations**

Simple harmonic oscillator and solution of the differential equation-Physical characteristics of SHM, torsion pendulum-measurements of rigidity modulus, compound pendulum- measurement of 'g', combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies. Lissajous figures.

**UNIT-II (12 hrs)**

**2. Damped and forced oscillations**

Damped harmonic oscillator, solution of the differential equation of motion of damped oscillator, logarithmic decrement, relaxation time and quality factor, differential equation of motion of forced oscillator and its solution, amplitude resonance and velocity resonance.

**UNIT-III (10 hrs)**

**3. Complex vibrations**

Fourier theorem and evaluation of the Fourier coefficients, analysis of periodic wave functions-square wave, triangular wave, saw tooth wave, simple problems on evolution of Fourier coefficients.

**UNIT-IV (17hrs)**

**4. Vibrating strings: 8 hrs**

Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at ends, overtones and harmonics.

**5. Vibrations of bars: 9 hrs**

Longitudinal vibrations in bars-wave equation and its general solution. Special cases (i) bar fixed at both ends (ii) bar fixed at the midpoint (iii) bar fixed at one end. Tuning fork.

**UNIT-V (9 hrs)**

**6. Ultrasonics:**

Ultrasonics, properties of ultrasonic waves, production of ultrasonics by piezoelectric and magnetostriction methods, detection of ultrasonics, determination of wavelength of ultrasonic waves.Applications of ultrasonic waves.

**REFERENCE BOOKS:**


1. BSc Physics Vol.1, Telugu Academy, Hyderabad.
2. Waves and Oscillations. N. Subramanyam and Brijlal, Vikas Pulications.
3. Unified Physics Vol., Mechanics, Waves and Oscillations, Jai Prakash Nath&Co.Ltd.
4. Fundamentals of Physics. Halliday/Resnick/Walker ,Wiley India Edition 2007.
5. Waves & Oscillations. S.Badami, V. Balasubramanian and K.R. Reddy,Orient Longman.
6. College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.
7. Science and Technology of Ultrasonics- Baldevraj, Narosa, New Delhi,2004
8. Introduction to Physics for Scientists and Engineers. F.J. Buche. McGraw Hill.

## Practical Paper II: Waves & Oscillations

**Work load: 30 hrs per semester** **2 hrs/week**

**Minimum of 6 experiments to be done and recorded**

1. Volume resonator experiment
2. Determination of 'g' by compound/bar pendulum
3. Simple pendulum normal distribution of errors-estimation of time period and the error of the mean by statistical analysis
4. Determination of the force constant of a spring by static and dynamic method.
5. Determination of the elastic constants of the material of a flat spiral spring.
6. Coupled oscillators
7. Verification of laws of vibrations of stretched string –sonometer
8. Determination of frequency of a bar –Melde's experiment.
9. Study of a damped oscillation using the torsional pendulum immersed in liquid-decay constant and damping correction of the amplitude.
10. Formation of Lissajous figures using CRO.

**Suggested student activities**

Student seminars, group discussions, assignments, field trips, study project and experimentation using virtual lab

.

**Examples**

Seminars - A topic from any of the Units is given to the student and asked to give a brief seminar presentation.

Group discussion - A topic from one of the units is given to a group of students and asked to discuss and debate on it.

Assignment - Few problems may be given to the students from the different units and asked them to solve.

Field trip - Visit to Satish Dhawan Space Centre, Sriharikota / Thermal and hydroelectric power stations / Science Centres, any other such visit etc.

Study project - Web based study of different satellites and applications.

**Domain skills:**

Logical derivation, experimentation, problem solving, data collection and analysis, measurement skills

*** **Documental evidence is to be maintained for the above activities.**

## Paper III: Wave Optics
## (For Maths Combinations)
## III SEMESTER

**Work load:60 hrs per semester** **4 hrs/week**

**UNIT-I (8 hrs)**

**1. Aberrations:**

Introduction – monochromatic aberrations - spherical aberration, coma, astigmatism, curvature of field and distortion- explanation and methods of elimination, Chromatic aberration - the achromatic doublet. Achromatism for two lenses ( i )in contact and (ii) separated by a distance.

**UNIT-II (14hrs )**

**2. Interference**

Principle of superposition, coherence, conditions for interference of light. Fresnel's biprism-determination of wavelength of light, change of phase on reflection. Oblique incidence of a plane wave on a thin film due to reflected light (cosine law), colors of thin films, Interference by a film with two non-parallel reflecting surfaces (Wedge shaped film) - Determination of diameter of wire, Newton's rings in reflected light. Michelson interferometer - Determination of wavelength of monochromatic light using Newton's rings and Michelson Interferometer.

**UNIT-III (14hrs )**

**3. Diffraction**

Introduction,distinction between Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction –Diffraction due to (i) single slit, (ii) double slit and (iii) N slits (diffraction grating), Resolving power of grating, Determination of wavelength of light in normal incidence and minimum deviation methods using diffraction grating,

Fresnel's half period zones - area of the half period zones, zone plate – construction and theory, comparison of zone plate with convex lens - difference between interference and diffraction.

**UNIT-IV(10 hrs )**

**4.Polarisation:**

Polarized light: methods of polarization polarization by reflection, refraction, double refraction, scattering of light, Brewster's law, Malus law, Nicol prism - polarizer and analyzer, Quarter wave plate, Half wave plate, optical activity- determination of specific rotation by Laurent's half shade polarimeter, Babinet's compensator.

**UNIT-V (14hrs )**

**5. Lasers :**

Lasers: introduction, spontaneous emission, stimulated emission. Population inversion, Laser principle, Einstein coefficients, Types of lasers - He-Ne laser and Ruby laser, Applications of lasers.

**6. Fiber Optics**

Introduction- different types of fibers, rays and modes in an optical fiber, fiber material, principles of fiber communication (qualitative treatment only), advantages of fiber optic communication.

**REFERENCE BOOKS:**


1. BSc Physics, Vol.2, Telugu Akademy, Hyderabad
2. A Text Book of Optics-N Subramanyam, L Brijlal, S.Chand& Co.
3. Unified Physics Vol.II Optics & Thermodynamics – Jai Prakash Nath&Co.Ltd., Meerut
4. Optics,F..A. Jenkins and H.G. White, Mc Graw-Hill
5. Optics, AjoyGhatak,Tata Mc Graw-Hill.
6. Introduction of Lasers – Avadhanulu, S.Chand& Co.
7. Principles of Optics- BK Mathur, Gopala Printing Press, 1995


## Practical Paper III: Wave Optics

**Work load:30 hrs** **2 hrs/week**

**Minimum of 6 experiments to be done and recorded**

1. Determination of radius of curvature of a given convex lens-Newton's rings.
2. Resolving power of grating.
3. Study of optical rotation –polarimeter.
4. Dispersive power of a prism.
5. Determination of wavelength of light using diffraction grating-minimum deviation method.
6. Determination of wavelength of light using diffraction grating-normal incidence method.
7. Resolving power of a telescope.
8. Refractive index of a liquid-hallow prism
9. Determination of thickness of a thin wire by wedge method
10. Determination of refractive index of liquid-Boy's method.

**Suggested student activities**

Student seminars, group discussions, assignments, field trips, study project and experimentation using virtual lab

**Examples**

Seminars - A topic from any of the Units is given to the student and asked to give a brief seminar presentation.

Group discussion - A topic from one of the units is given to a group of students and asked to discuss and debate on it.

Assignment - Few problems may be given to the students from the different units and asked them to solve.

Field trip - Visit to Satish Dhawan Space Centre, Sriharikota / Thermal and hydroelectric power stations / Science Centres, any other such visit etc.

Study project - Web based study of different satellites and applications.

**Domain skills:**Logical derivation, experimentation, problem solving, data collection and analysis, measurement skills

***** Documental evidence is to be maintained for the above activities.**

## Paper IV: Thermodynamics &Radiation Physics
## (For Maths Combinations)
## IV SEMESTER

**Work load: 60 hrs per semester** **4 hrs/week**

**UNIT-I (10 hrs)**

**1. Kinetic theory of gases**

Introduction, Deduction of Maxwell's law of distribution of molecular speeds, experimental verification. Transport phenomena - Viscosity of gases - thermal conductivity and diffusion of gases.

**UNIT-II(12 hrs)**

**2. Thermodynamics**

Introduction, Isothermal and adiabatic processes, Reversible and irreversible processes, Carnnot's engine and its efficiency, Carnot's theorem, Second law of thermodynamics - Kelvin's and Claussius statements, Entropy - physical significance – Change in entropy in reversible and irreversible processes, Entropy of Universe, Temperature-Entropy (T-S) diagram and its uses - Change of entropy of a perfect gas.

**UNIT-III(12 hrs)**

**3. Thermodynamic potentials and Maxwell's equations**

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 Vander waal's gas.

**UNIT-IV(12 hrs)**

**4. Low temperature Physics**

Introduction, Joule Kelvin effect - 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, applications of substances at low temperature.

**UNIT-V(14 hrs)**

**5. Quantum theory of radiation**

Blackbody-Ferry's black body, distribution of energy in the spectrum of black body, Wein's law, Rayleigh-Jean's law, Quantum theory of radiation- Planck's law, Types of pyrometers- Disappearing filament optical pyrometer - experimental determination, Angstrom pyroheliometer - determination of solar constant, Temperature of Sun.

**REFERENCE BOOKS:**


1. BSc Physics, Vol.2, Telugu Akademy, Hyderabad
2. Thermodynamics, R.C.Srivastava, S.K.Saha& Abhay K.Jain, Eastern Economy Edition.
3. Unified Physics Vol.2, Optics & Thermodynamics, Jai Prakash Nath&Co.Ltd., Meerut
4. Fundamentals of Physics. Halliday/Resnick/Walker.C. Wiley India Edition 2007
5. Heat, Thermodynamics and Statistical Physics-N Brij Lal, P Subrahmanyam, PS Hemne, S.Chand& Co.,2012
6. Heat and Thermodynamics- MS Yadav, Anmol Publications Pvt. Ltd, 2000
7. University Physics, HD Young, MW Zemansky,FW Sears, Narosa Publishers, New Delhi

## Practical Paper IV: Thermodynamics & Radiation Physics

**Work load: 30 hrs** **2 hrs/week**

**Minimum of 6 experiments to be done and recorded**

1. Specific heat of a liquid –Joule's calorimeter –Barton's radiation correction
2. Thermal conductivity of bad conductor-Lee's method
3. Thermal conductivity of rubber.
4. Measurement of Stefan's constant.
5. Specific heat of a liquid by applying Newton's law of cooling correction.
6. Heating efficiency of electrical kettle with varying voltages.
7. Thermoemf- thermo couple - potentiometer
8. Thermal behavior of an electric bulb (filament/torch light bulb)
9. Measurement of Stefan's constant- emissive method
10. Study of variation of resistance with temperature - thermistor.

**Suggested student activities**

Student seminars, group discussions, assignments, field trips, study project and experimentation using virtual lab

**Examples**

Seminars - A topic from any of the Units is given to the student and asked to give a brief seminar presentation.

Group discussion - A topic from one of the units is given to a group of students and asked to discuss and debate on it.

Assignment - Few problems may be given to the students from the different units and asked them to solve.

Field trip - Visit to Satish Dhawan Space Centre, Sriharikota / Thermal and hydroelectric power stations / Science Centres, any other such visit etc.

Study project - Web based study of different satellites and applications.

**Domain skills:**

Logical derivation, experimentation, problem solving, data collection and analysis, measurement skills

*** **Documental evidence is to be maintained for the above activities.**

## Paper V: Electricity, Magnetism& Electronics
## (For Maths Combinations)
## V Semester

**Work load: 60 hrs per semester** **4 hrs/week**

**UNIT-I (12 hrs)**

1. **Electric field intensity and potential:**
   Gauss's law statement and its proof- Electric field intensity due to (1) Uniformly charged sphere and (2) an infinite conducting sheet of charge. Electrical potential – potential due to i) a point charge, ii) charged spherical shell, Equipotential surfaces.
2. **Dielectrics:**
   Electric dipolemoment and molecular polarizability- Electric displacement D, electric polarization P – relation between D, E and P- Dielectric constant and susceptibility.

**UNIT-II (12 hrs)**

3. **Electric and magnetic fields**
   Biot-Savart's law, explanation and calculation of B due to long straight wire and solenoid, Hall effect – determination of Hall coefficient and applications.
4. **Electromagnetic induction**
   Faraday's laws, Lenz's law, Self and mutual inductances, coefficient of coupling, calculation of self inductance of a long solenoid, Energy Stored in magnetic field , Transformer - energy losses - efficiency.

**UNIT-III (12 hrs)**

5. **Alternating currents and electromagnetic waves**
   Alternating current - Relation between current and voltage in LR and CR circuits - vector diagrams, LCR series and parallel resonant circuits, Q –factor.
6. **Maxwell's equations**
   Idea of displacement current - Maxwell's equations (integral and differential forms) (no derivation), Maxwell's wave equation (with derivation), Transverse nature of electromagnetic waves, production of electromagnetic waves (Hertz experiment).

**UNIT-IV (12 hrs)**

7. **Basic electronics:**
   PN juction diode and Zener diode - I-V characteristics, PNP and NPN transistors, CB, CE and CC configurations, transistor (CE) characteristics, Determination of hybrid parameters, Transistor as an amplifier.

**UNIT-V: (12 hrs)**

8. **Digital electronics :**
   Number systems - Conversion of binary to decimal system and vice versa, Laws of Boolean algebra, De Morgan's laws - statement and proof, Basic logic gates, NAND and NOR as universal gates, exclusive-OR gate, Half and full adders.

**REFERENCE BOOKS**


1. BSc Physics, Vol.3, Telugu Akademy, Hyderabad.
2. Electricity and Magnetism, D.N. Vasudeva. S. Chand & Co.
3. Electricity, Magnetism with Electronics, K.K.Tewari, R.Chand& Co.,
4. Principles of Electronics, V.K. Mehta, S.Chand& Co.,
5. Digital Principles and Applications, A.P. Malvino and D.P.Leach, Mc GrawHill Edition.


**Practical Paper V:Electricity, Magnetism & Electronics**

**Work load: 30 hrs** **2 hrs/week**

**Minimum of 6 experiments to be done and recorded**

1. Figure of merit of a moving coil galvonometer.
2. LCR circuit series/parallel resonance, Q factor.
3. Determination of ac-frequency –sonometer.
4. Verification of Kirchoff's laws and maximum power transfer theorem.
5. Field along the axis of a circular coil carrying current.
6. PN Junction Diode Characteristics
7. Zener Diode Characteristics
8. Transistor CE Characteristics- Determination of hybrid parameters
9. Logic Gates- OR,AND,NOT and NAND gates. Verification of Truth Tables.
10. Verification of De Morgan's Theorems.

**Suggested student activities**

Student seminars, group discussions, assignments, field trips, study project and experimentation using virtual lab

**Examples**

Seminars - A topic from any of the Units is given to the student and asked to give a brief seminar presentation.

Group discussion - A topic from one of the units is given to a group of students and asked to discuss and debate on it.

Assignment - Few problems may be given to the students from the different units and asked them to solve.

Field trip - Visit to Satish Dhawan Space Centre, Sriharikota / Thermal and hydroelectric power stations / Science Centres, any other such visit etc.

Study project - Web based study of different satellites and applications.

**Domain skills:**

Logical derivation, experimentation, problem solving, data collection and analysis, measurement skills

***** Documental evidence is to be maintained for the above activities.**

## Paper VI: Modern Physics
## (For Maths Combinations)
## V Semester

**Work load: 60 hrs per semester** **4 hrs/week**

**UNIT-I (12 hrs)**

**1. Atomic and molecular physics**

Introduction, Drawbacks of Bohr's atomic model, Sommerfeld's elliptical orbits - relativistic correction (no derivation). Vector atom model- quantum numbers associated with it, Stern-Gerlach experiment, Zeeman effect and its experimental arrangement.

Raman effect - hypothesis, Stokes and Anti Stokes lines, Quantum theory of Raman effect, Experimental arrangement, Applications of Raman effect.

**UNIT-II (12 hrs)**

**2. Matter waves & Uncertainty Principle**

Matter waves, de Broglie's hypothesis - wavelength of matter waves, Properties of matter waves, Davisson and Germer experiment.

Heisenberg's uncertainty principle for position and momentum (x and p), energy and time (E and t). Experimental verification.

**UNIT-III (12 hrs)**

**3. Quantum (wave) mechanics**

Basic postulates of quantum mechanics, Schrodinger time independent and time dependent wave equations - derivations. Physical interpretation of wave function, Application of Schrodinger wave equation to particle in one dimensional potential infinite box.

**UNIT-IV(12 hrs)**

**4. General Properties of Nuclei**

Basic ideas of nucleus - size, mass, charge, density, angular momentum, magnetic moment, electric quadrupole moments, binding energy of nucleus, Liquid drop model and Shell model (qualitative aspects only).

**5. Radioactivity decay:**

**Alpha decay:** α-decay - Gamow's theory, Geiger Nuttal law, β-decay- electron emission, positron emission, electron capture and neutrino hypothesis of β-decay.

**UNIT-V (12 hrs)**

**6. Crystal Structure**

Amorphous and crystalline materials, unit cell, Miller indices, Bragg's law , diffraction of X-rays by crystals- experimental techniques of Laue's method and powder diffraction method.

**7. Superconductivity:**

Introduction, experimental facts, critical temperature, critical field, Meissner effect, Isotope effect , Type I and type II superconductors, applications of superconductors.

**REFERENCE BOOKS**


1. BSc Physics, Vol.4, Telugu Akademy, Hyderabad
2. Molecular Structure and Spectroscopy by G. Aruldhas. Prentice Hall of India, New Delhi.
3. Modern Physics by R. Murugeshan and Kiruthiga Siva Prasath. S. Chand & Co.
4. Modern Physics by G. Aruldhas & P. Rajagopal. Eastern Economy Edition.
5. Concepts of Modern Physics by Arthur Beiser. Tata McGraw-Hill Edition.
6. Quantum Mechanics, Mahesh C Jain, Eastern Economy Edition.
7. Nuclear Physics, Irving Kaplan, Narosa publishing House.
8. Nuclear Physics, D.C.Tayal, Himalaya Publishing House.
9. Elements of Solid State Physics, J.P.Srivastava, Prentice Hall of India Pvt., Ltd.
10. Solid State Physics, A.J. Dekker, McMillan India.


## Practical Paper VI: Modern Physics

**Work load: 30 hrs** **2 hrs/week**

**Minimum of 6 experiments to be done and recorded**

1. e/m of an electron by Thomson method.
2. Determination of Planck's Constant (photocell).
3. Verification of inverse square law of light using photovoltaic cell.
4. Study of absorption of α-rays.
5. Study of absorption of β-rays.
6. V-I Characteristics of photo cell.
7. Determination of M & H.
8. V-I Characteristics of thermister.
9. Energy gap of a semiconductor using junction diode.
10. Energy gap of a semiconductor using thermister.
11. V-I Characteristics of photovoltaic cell (solar cell)

Note: For all the above 8 practical papers the book "B.Sc Practical Physics" by C.L. Arora

Published by S.Chand & Co, New – Delhi may be followed.

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

**Suggested student activities**

Student seminars, group discussions, assignments, field trips, study project and experimentation using virtual lab

**Examples**

Seminars - A topic from any of the Units is given to the student and asked to give a brief seminar presentation.

Group discussion - A topic from one of the units is given to a group of students and asked to discuss and debate on it.

Assignment - Few problems may be given to the students from the different units and asked them to solve.

Field trip - Visit to Satish Dhawan Space Centre, Sriharikota / Thermal and hydroelectric power stations / Science Centres, any other such visit etc.

Study project - Web based study of different satellites and applications.

**Domain skills:**

Logical derivation, experimentation, problem solving, data collection and analysis, measurement skills

***** Documental evidence is to be maintained for the above activities.**

## Paper–VII-(A) Elective(Electronics)

## Semester –VI

## Elective Paper –VII-(A): Analog and Digital Electronics

**No. of Hours per week: 04** **Total Lectures:60**

**Unit-I (14 Hours)**

1. **FET**-Advantages of FET over BJT ,FET-Construction, Working, characteristics and uses; MOSFET-enhancement MOSFET, depletion MOSFET, construction and working , drain and transfer characteristics of MOSFET, applications of MOSFET.

**Unit-II (12Hours)**

2. **Operational Amplifiers**: Characteristics of ideal and practical Op-Amp (IC 741), Basic differential amplifiers, Op-Amp supply voltage, IC identification, Internal blocks of Op-Amp, its parameter -off set voltages and currents, CMRR, slew rate.

**Unit-III (12 Hours)**

3. **Applications of Op-Amp**: Op-Amp as voltage amplifier, Inverting amplifier, Non-inverting amplifier, voltage follower, summing amplifier, difference amplifier, comparator, integrator, differentiator.

**Unit-IV(10 Hours)**

4. **IC 555 Timer** -Its pin diagram,internal architecture, Application as astable-multivibrator and mono stable multivibrator, Applications of mono stable multivibrator-a) frequency divider b) pulse stretcher, Applications of astable multivibrator-a) square wave oscillator b)Free-running ramp generator .

**Unit-V (12 Hours)**

5. **Sequential digital circuits**: Flip-flops, RS, Clocked SR, JK, D, T, Master-Slave Flip-flops, Conversion of Flip flops.

**Reference Books**


1. Digital Electronics by G.K.Kharate Oxford University Press
2. Unified Electronics by Agarwal and Agarwal. Vol I,II&III
3. Op- Amp and Linear ICs by Ramakanth A Gayekwad, 4th edition PHI
4. Digital Principles and Applications by Malvino and Leach, TMH, 1996, 4th edition.
5. Digital Circuit design by Morris Mano,PHI
6. Switching Theory and Logic design by A.AnandKumar ,PHI
7. operations amplifier by SV Subramanyam.


**Elective Paper-VII Practical: Analog and Digital Electronics**

**2hrs/Week**

Minimum of 6 experiments to be done and recorded

1) Characteristics of FET
2) Characteristics of MOSFET
3) Characteristics of Op-amp.(IC741)
4) Op-Amp as amplifier/inverting amplifier
5) Op-Amp as integrator/differentiator
6) Op-Amp as summing amplifier/difference amplifier
7) IC 555 as astable multivibrator
8) IC 555 as monostable amplifier
9) Master slave flip-flop
10) JK flip-flop

**Semester –VI**
**Cluster Electives VIII-A**
**Paper – VIII-A-1: Electronic devices and circuits**

**No. of Hours per week: 04** **Total Lectures : 60**

**UNIT-I : (10hrs)**

**1.Networks Theorems:**

Statement and proofs of Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power transfer theorem, Milliman's theorem and Reciprocity theorem.

**UNIT-II : (12 hrs)**

**2.UJT & SCR:**

UJT construction-working, V-I characteristics, Experimental determination of UJT parameters, UJT as a Relaxation oscillator.

Silicon Controlled Rectifier (SCR), Structure and working of SCR. Two transistor representation, Characteristics of SCR. Experimental set up to study the SCR characteristics, Application of SCR for power control.

**UNIT-III : (12 hrs)**

**3.Rectifiers and Power Supplies :**

Half wave, full wave and bridge rectifiers-Efficiency-ripple factor- Regulation, Types of filter-choke input(inductor) filter, L-section & π-section filters. Three terminal fixed voltage I.C(78 XX). regulators - Principle and working of SMPS(switch mode power supplies).

**UNIT-IV : (12hrs)**

**4.Photo electric devices**: Structure and operation, characteristics, spectral response and application of photo diode, multiple junction photo diode, LDR and LED, Photovoltaic cell.

**Unit– V (14 Hours)**

**5. CRO** : Block diagram of basic CRO, construction of CRT, electron gun, electrostatic focusing and acceleration(only explanation) , time base operation, synchronization, front panel controls.

**6. Applications CRO**: Measurements of dc and ac voltages, ac frequency, time period, special features of dual trace.

**REFERENCE BOOKS:**


**1.** Electric Circuit Analysis- **S.R. Paranjothi**- New Age International.

**2.** Networks and Systems – **D.Roy Chowdary.**

3. Unified Electronics (Circuit Analysis and Electronic Devices) **by Agarwal-Arora.** Vol- I

**4.** A text book in electrical technology by B.L.Thereja (S.Chand&Co).Vol- IV

**5.** Electronic devices and circuits by Milman and Halkias.

## Elective Paper-VIII-A-1 Practical: Electronic devices and circuits 2hrs/Week

Minimum of 6 experiments to be done and recorded

1. Characteristics of LDR
2. Verification of Thevenin's theorem
3. Verification of Norton's theorem
4. V-I Characteristics of photo diode
5. V-I Characteristics of UJT
6. V-I Characteristics of SCR
7. Bridge Rectifier – L-section & π-section filters
8. IC regulated power supply
9. CRO – measurements of voltage and phase difference.
10. CRO – measurements of time period and frequency.
11. UJT – relaxation oscillator.

## Semester –VI
## Cluster Elective Paper VIII-A-2: Computational Methods and Programming

**No. of Hours per week: 04** **Total Lectures:60**

**UNIT-I (12hrs)**

1. **Fundamentals of C language**: C character set-Identifiers and Keywords-Constants - Variables-Data types-Declarations of variables-Declaration of storage class-Defining symbolic constants- Assignment statement.
2. **Operators**: Arithmetic operators-Relational operators-Logic operators-Assignment operators- Increment and decrement operators-Conditional operators.

**UNIT-II (12hrs)**

3. **Expressions and I/O Statements**: Arithmetic expressions-Precedence of arithmetic operators-Type converters in expressions-Mathematical (Library) functions - Data input and output-The getchar and putchar functions-Scanf-Printf simple programs.

**UNIT-III (12hrs)**

4. **Arrays**: One dimensional and two dimensional arrays - Initialization - Type declaration - Inputting and outputting of data for arrays - Programs of matrices addition, subtraction and multiplication

**UNIT-IV (12hrs)**

5. **Linear and Non - Linear equations**: Solution of Algebra and transcendental equations-Bisection, Falsi position and Newton-Rhapson methods-Basic principles-Formulae-algorithms

**UNIT-V (12hrs)**

6.**Numerical differentiation and integration**: Numerical differentiation-algorithm for evaluation of first order derivatives using formulae based on Taylor's series-Numerical integration-Trapezoidal and Simpson's 1/3 rule- Formulae-Algorithms.

**Reference books:**

1. Introductory methods of Numerical Analysis: Sastry
2. Numerical Methods: Balaguruswamy
3. Programming in ANSI C (TMH) : Balaguruswamy
4. Programming with 'C'- Byron Gottafried, Tata Mc Graw Hill

**Elective PaperVIII-A-2: Practical: Computational Methods and Programming**
**2hrs/Week**

Minimum of 6 experiments to be done and recorded

1. Write a program that reads an alphabet from keyboard and display in the reverse order.
2. Write a program to read and display multiplication of tables.
3. Write a program for converting centigrade to Fahrenheit temperature and Fahrenheit temperature centigrade.
4. Write a program to find the largest element in an array.
5. Write a program based on percentage calculation, the grade by entering the subject marks. (If percentage > 60 I class, if percentage between 50&60 II class, if percentage between 35&50 III class, if percentage below 35 fail).
6. Write a program for generation of even and odd numbers up to 100 using while, do-while and for loop.
7. Write a program to solve the quadratic equation using Bisection method.
8. Write a program for integration of function using Trapezoidal rule.
9. Write a program for solving the differential equation using Simpson's $1/3^{rd}$ rule.
10. Write a program for addition of matrices.

**Semester –VI**

**Cluster Elective Paper –VIII-A-3: Electronic Instrumentation**

**No. of Hours per week: 04** **Total Lectures:60**

**Unit – I (12Hours)**

1. **Basics of measurements**: Instrument, accuracy, precision, sensitivity, resolution, range, errors in measurement, Multi meter - principle- measurement of dc voltage and dc current, ac voltage and resistance, Operating instructions of multi meter.

**Unit -11 (10 Hours)**

2. **Electronic Voltmeter**: Advantages over conventional multi meter, considerations in selecting voltmeter, Basic volt meter (TVM), Differential voltmeter, Solid state voltmeter AC voltmeter using rectifiers and their significances.

**Unit– III (14 Hours)**

3. **Digital Multi meter**: Block diagram, working and specifications of digital multi meter, Universal counter and Frequency counter- Block diagram, frequency and time period measurement & accuracy and resolution.

**Unit – IV (12 Hours)**

4. **Digital instruments**: Comparision of analog and digital instruments, Principle and working of digital instruments - Tacho meter, $P^H$ meter, Capacitance meter and phase meter. Digital voltmeter- advantages, Performance parameters, Block diagram and working.

**Unit – V (12 Hours)**

5. **Signal generators**: Block diagram explanation, specifications of low frequency signal generators(AF Sine and square wave generator, RF Signal Generator), pulse generator, function generator-working, Brief idea for testing, specifications. Distortion factor meter, wave analysis.

**Reference Books**


1. A text book in electrical technology by B.L.Thereja (S.Chand&Co)-Vol IV
2. Digital circuits and systems by Venugopal 2011 (Tata Mcgraw Hill)
3. Digital Electronics by SubrathaGhoshal 2012 (Cengage Learning)
4. Electronic measurements and instrumentation by U.A.Bakshi, A.V.Bakshi K.A.Bakshi
5. Electronic instrumentation by H. S. Kalsi.


**Elective Paper-VIII-A-3: Practical: Electronic Instrumentation**
**2hrs/Week**

Minimum of 6 experiments to be done and recorded

1. Study the loading effect of a multimeter by measuring voltage across a low and high resistance.
2. Study the limitations of a multimeter for measuring high frequency voltage and currents.
3. Measurement of time period and frequency using universal counter.
4. Sensitivity of electronic Voltmeter.
5. Measurement of distortion of a RF signal generator using distortion factor meter.
6. Multimeter – Measurements of DC voltage, DC current, AC current and resistance.
7. Time period and frequency measurements using frequency counter.
8. Digital $P^H$ meter-measurement of $P^H$ Value.
9. Conversion of basic meter into a multi range Ammeter.
10. onversion of basic meter into a multi range Volt meter.
11. Calibration of Shunt type Ohmmeter/Series type ohmmeter