



**Government Degree College for Women (Autonomous)**

**Begumpet, Hyderabad-500016**

Affiliated to Osmania University, Re-Accredited with 'B+' Grade by NAAC



**CHOICE BASED CREDIT SYSTEM (CBCS)**

# **DEPARTMENT OF PHYSICS (PO`S,CO`S)**

**SYLLABUS**

**2020-21**

## **B.Sc. Physics Year course structure**

Paper	Semester	Hours week	per	Hours per week		Max Marks		Credits
				Theory	Practicals	Theory	Practicals	
B.Sc-I	I,II	6		4	3	100	50	5
B.Sc-II	III,IV	6	4		3	100	50	5
B.Sc-III (2018-20)	V (P5,P6), VI(P7,P8)	6		3	3	100	50	4
		6		3	3	100	50	4

Practical's for each 20 students per batch

## B.Sc. PHYSICS SYLLABUS-2016-2019

### UNDER CBCS SCHEME (SCHEME OF INSTRUCTION)

B.Sc. PHYSICS SYLLABUS UNDER CBCS SCHEME  
SCHEME OF INSTRUCTION

Semester	Paper [ Theory and Practical ]	Instructions Hrs/week	Marks	Credits
I sem	Paper – I : Mechanics	4	100	4
II sem	Practicals – I : Mechanics	3	50	1
	Paper – II: Waves and Oscillations	4	100	4
III sem	Practicals – II : Waves and Oscillations	3	50	1
	Paper – III : Thermodynamics	4	100	4
IV sem	Practicals – III : Thermodynamics	3	50	1
	Paper – IV : Optics	4	100	4
V sem	Practicals – IV : Optics	3	50	1
	Paper – V : Electromagnetism	3	100	3
	Practicals – V: Electromagnetism	3	50	1
	Paper – VI : Elective – I Solid state physics/ Quantum Mechanics and Applications	3	100	3
VI sem	Practicals – VI : Elective – I Practical Solid state physics/ Quantum Mechanics and Applications	3	50	1
	Paper – VII : Modern Physics	3	100	3
VI sem	Practical – VII : Modern Physics Lab	3	50	1
	Paper – VIII : Elective – II Basic Electronics/ Physics of Semiconductor Devices	3	100	3
	Practicals – VIII : Elective – II Practical Basic Electronics/ Physics of Semiconductor Devices	3	50	1

Total Credits

36

**B.Sc. PHYSICS SYLLABUS UNDER CBCS SCHEME  
SCHEME OF INSTRUCTION  
(Revised and effective from academic year 2019-2020)**

Semester	Paper [ Theory and Practical ]	Instructions Hrs/week	Marks	Credits
I	Paper – I : Mechanics & Oscillations	4	100	4
	Practicals – I : Mechanics & Oscillations	3	50	1
II	Paper – II: Thermal Physics	4	100	4
	Practicals – II : Thermal Physics	3	50	1
III	Paper – III : Electromagnetic Theory	4	100	4
	Practicals – III : Electromagnetic Theory	3	50	1
IV	Paper – IV : Waves & Optics	4	100	4
	Practicals – IV :Waves & Optics	3	50	1
V	Paper –V : A. Modern Physics B. Computational Physics	4	100	4
	Practicals – V: A. Modern Physics B. Computational Physics	3	50	1
VI	Paper – VI : A. Electronics B. Applied Optics	4	100	4
	Practicals VI: A. Electronics B. Applied Optics	3	50	1

Total credits: 30


**Skill Enhancement Courses**

1. Experimental methods and Errors analysis
2. Electrical circuits and Networking
3. Basic Instrumentation
4. Biomedical Instrumentation
5. Digital Electronics

**Generic Elective:**

1. Renewable Energy & Energy Harvesting

**Project work /Optional (Nano science)**

  
**HEAD**  
 Department of Physics  
 University College of Science  
 Osmania University, Hyd.

  
**CHAIRMAN**  
 Board of Studies in Physics  
 Osmania University, Hyd.

1-26 Pages

**Government Degree College for Women, Begumpet, (Autonomous)  
Hyderabad  
Department of Physics AND Electronics  
PHYSICS-SEMESTER I,II ,III ,IV(2020-21)**

**MODULE:**

**THEORY : Max.Marks :100**

**Split**

**End Semester: 60M**

**Internal Assesment: 40M**

**PHYSICS-SEMESTER -V,VI(2016-2018)**

**MODULE:**

**THEORY : Max.Marks :100**

**Split**

**End Semester:75M**

**Internal Assesment: 25M**

**Government Degree College for Women (Autonomous) Begumpet, Hyderabad**

**Model Question Paper for B.Sc I Year, II Year (Semester I, II, III & IV)**

**Time: 2 ½ hrs**

**Max Marks: 60**

**Section-A**

**Note: Answer any 5 of the following - Each question carries 4 Marks**

**5 X 4=20 Marks**

- Q1 Unit I
- Q2 Unit I
- Q3 Unit II
- Q4 Unit II
- Q5 Unit III
- Q6 Unit III
- Q7 Unit IV
- Q8 Unit IV

**Section-B**

**Note: Answer all the questions -Each question carries 10 Marks**

**4 X 10=40 Marks**

- Q9 a) Unit-I  
or  
b) Unit I
- Q10 a) Unit-II  
Or  
b) Unit-II
- Q11 a) Unit-III  
Or  
b) Unit-III
- Q12 a) Unit-IV  
Or  
b) Unit-IV

**Government Degree College for Women(Autonomous), Begumpet, Hyderabad**

**Pattern of Examination**

**Internal and Semester Evaluation pattern for first and second year is given here under:**

**Internal Assessment**

- . Two internals of **20 Marks** each. Average of the two internals is considered for computation of marks
  - 10 Marks** for Unit-wise exams (20 objective type questions X ½ Mark = 10 Marks)
  - 5 Marks** for seminar and group discussion
  - 5 Marks** for assignment
  
- b. Internal exam consists of **20 Marks**
  - In **Section A** (Two short answer Questions of 5 marks to be answered out of 4 (2 X 5M=10M)
  - In **Section-B** ( **one** question is to be answered with **internal choice** and carries **10 M**)
  
- c. Internals shall be held at the end of every **9<sup>th</sup> week** and **14<sup>th</sup> week** of each semester
  
- d. The duration of the internals shall be **45 minutes**

## Semester Examination

Semester Exams will be conducted in October and April of every year

- . 60 marks are allotted for each paper per semester
- a. Section-A (5 questions out of 8 questions have to be attempted – each question carries 4 marks -5 X 4 = 20M)
- b. Section-B (4 questions with internal choice are to be attempted- each question carries 10 M- 4 X 10=40 M)

Resolved to accept the above pattern of examinations for B.Sc I & II Year

## • COURSE OBJECTIVES

- The course should enable the students to
  - Understand basic principles of Mechanics, Optics, Thermal Physics, Waves & Oscillations, Modern Physics, Electromagnetism, Solid state Physics and Electronics
  - Gain the knowledge of free electron theory of metals and mobility mechanism of semi conductor materials which leads to the application in Electronics and concepts of shell model, liquid drop model for determining the stability of nucleus of an atom, structure of an atom and its spectroscopy.
  - Learn and gain knowledge about various types of Electronic devices, Abberations in Spherical Lens, Interference, diffraction, Polarisation and Optical fibre mechanism for communication system.
  - Know about various types of lasers and significance of super conductivity in Industrial, Medical fields etc.
  - Learn about Material properties like Magnets, digital Electronics and Network theorems, Harmonic oscillations in strings, bars and damped vibrations.

## COURSE OUTCOMES

- By the end of the course students will be able
- To make careful experimental observations and draw conclusions from such data
- To distinguish between inferences based on theory and the outcomes of experiments

To write a technical report which communicates scientific information in a clear and concise manner.

## PHYSICS COURSE OBJECTIVES

- To provide an experimental foundation for the theoretical concepts introduced in the lectures
- To teach how to make careful experimental observations and how to think about draw conclusions from such data
- To help students understand the role of direct observations in physics and to distinguish between interferences based on theory and the outcomes of experiments.
- To introduce the concepts and techniques which have a wide application in experimental science but have not been introduced in the standard courses
- To teach how to write a technical report which communicates scientific information in a clear and concise manner;

## SYLLABUS

### Course Outcome:

Students who have completed this course should be able to:

CO1. Deliberate the characteristics of Mechanics of a system of particles

CO2. Write down in details with application, if applicable, Mechanics of rigid bodies

CO3. Learn the characteristics of small oscillations of mechanical system

**B.Sc. (Physics) Semester I-Theory Syllabus  
Paper – I : Mechanics**

56 hrs

(W.E.F the academic year 2016-2017)  
(CBCS)

**Unit – I**

**1. Vector Analysis (14)**

Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and curl of a vector field and related problems. Vector integration, line, surface and volume integrals. Stokes, Gauss and Greens theorems-simple applications.

**Unit – II**

**2. Mechanics of Particles (07)**

Laws of motion, motion of variable mass system, motion of a rocket, multi-stage rocket, conservation of energy and momentum. Collisions in two and three dimensions, concept of impact parameter, scattering cross-section.

**3. Mechanics of rigid bodies (07)**

Definition of Rigid body, rotational kinematic relations, equation of motion for a rotating body, angular momentum and inertial tensor. Euler's equation, precession of a top, Gyroscope.

**Unit – III**

**4. Central forces (14)**

Central forces – definition and examples, conservative nature of central forces, conservative force as a negative gradient of potential energy, equation of motion under a central force, gravitational potential and gravitational field, motion under inverse square law, derivation of Kepler's laws, Coriolis force and its expressions.

**Unit – IV**

**5. Special theory of relativity (14)**

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

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



### Textbooks

1. Berkeley Physics Course. Vol.1, **Mechanics** by C. Kittel, W. Knight, M.A. Ruderman - *Tata-McGraw hill Company Edition 2008*.
2. **Fundamentals of Physics**. Halliday/Resnick/Walker *Wiley India Edition 2007*.
3. **First Year Physics - Telugu Academy**.
4. **Introduction to Physics for Scientists and Engineers**. F.J. Ruche. *McGraw Hill*.

### Reference Books

1. **Fundamentals of Physics** by Alan Giambattista et al *Tata-McGraw Hill Company Edition, 2008*.
2. **University Physics** by Young and Freeman, *Pearson Education, Edition 2005*.
3. **Sears and Zemansky's University Physics** by Hugh D. Young, Roger A. Freedman *Pearson Education Eleventh Edition*.
4. **An introduction to Mechanics** by Daniel Kleppner & Robert Kolenkow. *The McGraw Hill Companies*.
5. **Mechanics**. Hans & Puri. *TMH Publications*.
6. **Engineering Physics**. R.K. Gaur & S.L. Gupta. *Dhanpat Rai Publications*.
7. R P Feynman, RB Lighton and M Sands - The Feynman Lectures in Physics, Vol.-1, BI Publications.
8. J.C. Upadhyay - Mechanics.
9. P.K. Srivastava - Mechanics, New Age International.

### • B.SC LABORATORY COURSE OBJECTIVES

- To provide an experimental foundation for the theoretical concepts introduced in the lectures
- To teach how to make careful experimental observations and how to think about draw conclusions from such data
- To help students understand the role of direct observations in physics and to distinguish between interferences based on theory and the outcomes of experiments.
- To introduce the concepts and techniques which have a wide application in experimental science but have not been introduced in the standard courses
- To teach how to write a technical report which communicates scientific information in a clear and concise manner;

### • LAB OUT COMES

- By the end of the course students will be able
- To make careful experimental observations and draw conclusions from such data

- To distinguish between inferences based on theory and the outcomes of experiments
- To write a technical report which communicates scientific information in a clear and concise manner.

### FIRST SEMESTER PRACTICALS

42 hrs  
(3 hrs / week)

#### Practical Paper – I : Mechanics

1. Study of a compound pendulum determination of 'g' and 'k'.
2. Y by uniform Bending
3. Y by Non-uniform Bending.
4. Moment of Inertia of a fly wheel.
5. Measurement of errors –simple Pendulum.
6. 'Rigidity moduli by torsion Pendulum.
7. Determine surface tension of a liquid through capillary rise method.
8. Determination of Surface Tension of a liquid by different methods.
9. Determine of Viscosity of a fluid.

**Note:** Minimum of eight experiments should be performed. Maximum of 15 students per batch and maximum of three students per experiment should be allotted in the regular practical class of three hours per week.

#### **Text and reference books**

1. D.P. Khandelwal, "A laboratory manual for undergraduate classes" (Vani Publishing House, New Delhi).
2. S.P. Singh, "Advanced Practical Physics" (Pragati Prakashan, Meerut).
3. Worsnop and Flint- Advanced Practical physics for students.
4. "Practical Physics" R.K Shukla, Anchal Srivastava

#### **Course Outcome:**

Students who have completed this course should be able to:

- CO1. Deliberate the characteristics of oscillations of a system of particles
- CO2. Write down in details with application, if applicable, strings and rods vibrations
- CO3. Learn the characteristics of small oscillations of mechanical system

**B.Sc. (Physics) Semester II-Theory Syllabus  
Paper – II : Waves and Oscillations**

56 hrs

(W.E.F the academic year 2016-2017)  
(CBCS)

**Unit – I**

**1. Fundamentals of vibrations (14)**

Simple harmonic oscillator, and solution of the differential equation– Physical characteristics of SIIM, 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**

**2. Damped and forced oscillations (14)**

Damped harmonic oscillator, solution of the differential equation of damped oscillator. Energy considerations, comparison with undamped harmonic oscillator, logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution, amplitude resonance, velocity resonance. Coupled Oscillators.

**Unit – III**

**3. Vibrating Strings (14)**

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, energy transport, transverse impedance

**Unit – IV**

**4. Vibrations of bars (14)**

Longitudinal vibrations in bars- wave equation and its general solution. Special cases (i) bar fixed at both ends ii) bar fixed at the mid point iii) bar free at both ends iv) bar fixed at one end. Transverse vibrations in a bar- wave equation and its general solution. Boundary conditions, clamped free bar, free-free bar, bar supported at both ends, Tuning fork.

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

### Textbooks

1. **Fundamentals of Physics.** Halliday/Resnick/Walker *Wiley India Edition 2007.*
2. **First Year Physics - Telugu Academy.**
3. **Introduction to Physics for Scientists and Engineers.** F.J. Ruche. *McGraw Hill.*
4. **Fundamentals of Acoustics by Kinsler and Fray, Meer publishers.**

### Reference Books

1. **Fundamentals of Physics** by Alan Giambattista et al *TMH Company* Edition, 2008.
2. **University Physics** by Young and Freeman. *Pearson Education, Edition 2005.*
3. **An introduction to Mechanics** by Daniel Kleppner & Robert Kolenkow. *The McGraw Hill Companies.*
4. **Engineering Physics.** R.K. Gaur & S.L. Gupta. *Dhanpat Rai Publications.*

**SECOND SEMISTER PRACTICALS****Practical Paper – II : Waves and Oscillations**

1. Study of damping of an oscillating disc in Air and Water logarithmic decrement.
2. Study of Oscillations under Bifilar suspension.
3. Study of oscillations of a mass under different combination of springs.
4. Verification of Laws of a stretched string (Three Laws).
5. Determination of frequency of a Bar-Melde's experiment.
6. Observation of Lissajous figures from CRO.
7. Volume Resonator –determination of frequency of a tuning fork.
8. Velocity of Transverse wave along a stretched string.
9. Study of damping of a bar pendulum
10. Study of coupled oscillator.

**Note:** Minimum of eight experiments should be performed. .

Maximum of 15 students per batch and maximum of three students per experiment should be allotted in the regular practical class of three hours per week.

**Text and reference books**

1. D.P. Khandelwal, "A laboratory manual for undergraduate classes" (Vani Publishing House, New Delhi).
2. S.P. Singh, "Advanced Practical Physics" (PragatiPrakashan, Meerut).
3. Worsnop and Flint- Advanced Practical physics for students.
4. "Practical Physics" R.K Shukla, AnchalSrivastava

**Course Outcome:**

Students who have completed this course should be able to:

**CO1.** Deliberate the characteristics of Thermodynamic potentials and parameters

**CO2.** Write down in details with application, if low temperature and radiation pyrometers

**CO3.** Learn the characteristics of statistical distributions of MB,FD AND BE STATISTICAL system



**B.Sc. Semester III-Theory Syllabus** **56 hrs**  
**Subject: Physics** **Paper – III : Thermodynamics**  
**(W.E.F the academic year 2017-2018)**

**Unit – I**

**1. Kinetic theory of gases: (6)**

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

**2. Thermodynamics: (8)**

Basics of thermodynamics-Kelvin's and Clausius 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.

**Unit – II**

**3. Thermodynamic potentials and Maxwell's equations: (7)**

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.

**4. Low temperature Physics: (7)**

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.

**Unit – III**

**5. Quantum theory of radiation: (14)**

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 distribution law, Rayleigh-Jeans law, Stefan's law from Planck's law.

Measurement of radiation using pyrometers – Disappearing filament optical pyrometer – experimental determination – Angstrom pyroheliometer - determination of solar constant, effective temperature of sun.

#### Unit – IV

##### 6. Statistical Mechanics: (14)

Introduction, postulates of statistical mechanics. Phase space, concept of ensembles and some known ensembles, classical and quantum statistics and their differences, concept of probability, Maxwell-Boltzmann's distribution law -Molecular energies in an ideal gas- Maxwell-Boltzmann's velocity distribution law, Bose-Einstein Distribution law, Fermi-Dirac Distribution law, comparison of three distribution laws, Application of B-E distribution to Photons-planks radiation formula, Application of Fermi-Dirac statistics to white dwarfs and Neutron stars.

##### Textbooks

1. **Fundamentals of Physics.** Halliday/Resnick/Walker.C. *Wiley India Edition 2007.*
2. **Second Year Physics – Telugu Academy.**
3. **Modern Physics** by R. Murugesan and Kiruthiga Siva Prasath (for statistical Mechanics) S. Chand & Co.
4. **Heat and Thermodynamics** by Mark W.Zemansky 5<sup>th</sup> edition Mc Graw - Hill
5. **Heat and Thermodynamics** by D.S. Mathur.

##### Reference Books

1. **Modern Physics** by G. Aruldas 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. **Thermodynamics** by R.C. Srivastava, Subit K. Saha&Abhay K. *Jain Eastern Economy Edition.*
5. **Modern Engineering Physics** by A.S. Vasudeva. *S.Chand& Co. Publications.*
6. **Feynman's Lectures on Physics** Vol. 1,2,3& 4. *Narosa Publications.*
7. **Fundamentals of Optics** by Jenkins A. Francis and White E. Harvey, *McGraw Hill Inc.*
8. B.B. Laud **"Introduction to statistics Mechanics"**(Macmillan 1981)
9. F.Reif: **"Statistical Physics "**(Mcgraw-Hill,1998)
- 10.K.Haung: **"Statistical Physics "**(Wiley Eastern 1988)



**III SEMESTER Practicals Paper – III :**  
**Thermodynamics**

**42 hrs**  
(3 hrs / week)

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. Determination of Thermo emf
6. Cooling Curve of a metallic body (Null method)
7. Resistance thermometer. To Determine temp coeff resistance
8. Thermal expansion of solids
9. Study of mechanical energy to heat.
10. Determine the Specific of a solid (graphite rod )
11. Thermistor Characteristics. Calculation of A and B

**Note:** Minimum of eight experiments should be performed. Maximum of 15 students per batch and maximum of three students per experiment should be allotted in the regular practical class of three hours per week.

**Text and reference books**

1. D.P. Khandelwal, "A laboratory manual for undergraduate classes" (Vani Publishing House, New Delhi).
2. S.P. Singh, "Advanced Practical Physics" (PragatiPrakashan, Meerut).
3. Worsnop and Flint- Advanced Practical physics for students.
4. "Practical Physics" R.K Shukla, AnchalSrivastava

**Course Outcome:**

Students who have completed this course should be able to:

- CO1. Deliberate the characteristics of GEOMETRICAL OPTICS
- CO2. Write down in details with application, in Interference ,Diffraction and polarization and optical fibers
- CO3. Learn the characteristics of interference ,diffraction and polarisation

**B.Sc. Semester IV-Theory Syllabus**  
**Subject : (Physics) Paper – IV : Optics**  
**(W.E.F the academic year 2017-2018)**

56 hrs

**Unit I**

**1 Interference: (14)**

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 II:**

**2 Diffraction: (14)**

Introduction – Distinction between Fresnel and Fraunhofer diffraction Fraunhofer diffraction:- Diffraction due to single slit and circular aperture – Limit of resolution – Fraunhofer diffraction due to double slit – Fraunhofer 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.

### Unit III:

#### 3 Polarization (14)

Polarized light : Methods of Polarization, Polarization 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.

### Unit IV:

#### 4 Aberrations and Fiber Optics : (14)

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.

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

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

#### Textbooks

1. **Optics** by AjoyGhatak. *The McGraw-Hill companies.*
2. **Optics** by Subramaniam and Brijlal. *S. Chand & Co.*
3. **Fundamentals of Physics.** Halliday/Resnick/Walker. *C. Wiley India Edition 2007.*
4. **Optics and Spectroscopy.** R. Murugesan and Kiruthiga Siva Prasath. *S. Chand & Co.*
5. **Second Year Physics – Telugu Academy.**

#### Reference Books

1. **Modern Engineering Physics** by A.S. Vasudeva. *S.Chand & Co. Publications.*
2. **Feynman's Lectures on Physics** Vol. 1,2,3& 4. *Narosa Publications.*
3. **Fundamentals of Optics** by Jenkins A. Francis and White E. Harvey, *McGraw Hill Inc.*
4. K. Ghatak, **Physical Optics'**
5. D.P. Khandelwal, **Optical and Atomic Physics'** (Himalaya Publishing House, Bombay,1988)
6. Jenkins and White: **'Fundamental of Optics'** (McGraw-Hill)
7. Smith and Thomson: **'Optics'** (John Wiley and sons)

**IV SEMESTER Practicals Paper – IV :**  
**Optics**

1. Thickness of a wire using wedge method.
2. Determination of wavelength of light using Biprism.
3. Determination of Radius of curvature of a given convex lens by forming Newton's rings.
4. Resolving power of grating.
5. Study of optical rotation-polarimeter.
6. Dispersive power of a prism
7. Determination of wavelength of light using diffraction grating minimum deviation method.
8. Wavelength of light using diffraction grating – normal incidence method.
9. Resolving power of a telescope.
10. Refractive index of a liquid and glass (Boys Method).
11. Pulfrich refractometer – determination of refractive index of liquid.
12. Wavelength of Laser light using diffraction grating.

**Note:** Minimum of eight experiments should be performed .

Maximum of 15 students per batch and maximum of three students per experiment should be allotted in the regular practical class of three hours per week.

**Text and reference books**

1. D.P. Khandelwal, "A laboratory manual for undergraduate classes" (Vani Publishing House, New Delhi).
2. S.P. Singh, "Advanced Practical Physics" (Pragati Prakashan, Meerut).
3. Worsnop and Flint- Advanced Practical physics for students.
4. "Practical Physics" R.K Shukla, AnchalSrivastava

**Course Outcome:**

Students who have completed this course should be able to:

**CO1.** Deliberate the characteristics of Electrostatics, magnetostatics and flectromagnetism

**CO2.** Write down in details with application, in Electrostatics, magnetostatics and flectromagnetism

CO3. Learn the characteristics of Electrostatics, magnetostatics and flectromagnetism

**B.Sc. Semester V-Theory Syllabus**  
**Subject : (Physics) Paper – V : Electromagnetism**  
**(DSE- Compulsory)**

42 hrs

(W.E.F the academic year 2018-2019)

**Unit I :**

**Electrostatics (11 hrs)**

Electric Field:- Concept of electric field lines and electric flux, Gauss's law (Integral and differential forms), application to linear, plane and spherical charge distributions. Conservative nature of electric field  $E$ , irrotational field. Electric Potential:- Concept of electric potential, relation between electric potential and electric field, potential energy of a system of charges. Energy density in an electric field. Calculation of potential from electric field for a spherical charge distribution.

**Unit II :**

**Magnetostatics (12 hrs)**

Concept of magnetic field  $B$  and magnetic flux, Biot-Savart's law,  $B$  due to a straight current carrying conductor. Force on a point charge in a magnetic field. Properties of  $B$ , curl and divergence of  $B$ , solenoidal field. Integral form of Ampere's law, applications of Ampere's law: field due to straight, circular and solenoidal currents. Energy stored in magnetic field. Magnetic energy in terms of current and inductance. Magnetic force between two current carrying conductors. Magnetic field intensity. Ballistic Galvanometer:- Torque on a current loop in a uniform magnetic field, working principle of B.G., current and charge sensitivity, electromagnetic damping, critical damping resistance.

**Unit III:**

**Electromagnetic Induction (9 hrs)**

Faraday's laws of induction (differential and integral form), Lenz's law, self and mutual Induction. Continuity equation, modification of Ampere's law, displacement current, Maxwell equations

**Unit IV :**

**Electromagnetic waves (10 hrs)**

Maxwell's equations in vacuum and dielectric medium, boundary conditions, plane wave equation: transverse nature of EM waves, velocity of light in vacuum and in medium, polarization, reflection and transmission. Polarization of EM waves, Brewster's angle, description of linear, circular and elliptical polarization.

**Text Books**

1. Fundamentals of electricity and magnetism By Arthur F. Kip (McGraw-Hill, 1968)
2. Electricity and magnetism by J.H.Fewkes & John Yarwood. Vol. I (Oxford Univ. Press, 1991).
3. Introduction to Electrodynamics, 3rd edition, by David J. Griffiths, (Benjamin Cummings,1998).

**Reference Books**

4. Electricity and magnetism By Edward M. Purcell (McGraw-Hill Education, 1986)
5. Electricity and magnetism. By D C Tayal (Himalaya Publishing House,1988)
6. Electromagnetics by Joseph A.Edminister 2nd ed.(New Delhi: Tata Mc Graw Hill, 2006).

**V SEMISTER Practicals Paper – V : Electromagnetism**

## PHYSICS LABORATORY

Marks: 50

1. To verify the Thevenin Theorem
2. To verify Norton Theorem
3. To verify Superposition Theorem
4. To verify maximum power transfer theorem.
5. To determine a small resistance by Carey Foster's bridge.
6. To determine the (a) current sensitivity, (b) charge sensitivity, and (c) CDR of a B.G.
7. To determine high resistance by leakage method.
8. To determine the ratio of two capacitances by De Sauty's bridge.
9. To determine self-inductance of a coil by Anderson's bridge using AC.
10. To determine self-inductance of a coil by Rayleigh's method.
11. To determine coefficient of Mutual inductance by absolute method.

**Note:** Minimum of eight experiments should be performed.

Maximum of 15 students per batch and maximum of three students per experiment should be allotted in the regular practical class of three hours per week.

**Course Outcome:**

Students who have completed this course should be able to:

**CO1.** Deliberate the characteristics of space lattice, XRD SEMICONDUCTORS

**CO2.** Write down in details with application, in SUPERCONDUCTIVITY AND LASERS

**CO3.** Learn the characteristics of SEMICONDUCTOR PHYSICS

**B.Sc. Semester V-Theory Syllabus** 42 hrs  
(DSE- Elective-I)  
**Paper-VI-A – Solid State Physics**

**Subject : (Physics)**

**Unit-I (11hrs )**

Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Types of Lattices, Reciprocal Lattice. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor.

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T<sub>3</sub> law

**Unit-II (11 hrs)**

Magnetic Properties of Matter: Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia- and Paramagnetic Domains. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss.

Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability.

**Unit-III (10 hrs )**

Elementary band theory: Kronig Penny model. Band Gap. Brillouin zones, effective mass of electron. Conductor, Semiconductor (P and N type) and insulator. Conductivity of Semiconductor, mobility, Hall Effect, Electric Conductivity by four probe method & Hall coefficient.

**UNIT IV (10hrs )**

Lasers: Einstein's A and B coefficients. Metastable states. Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser.

Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory. D.C and A.C Josephson effects.

**Text Books:**

1. Solid-state Physics, H. Ibach and H. Luth, 2009, Springer
2. Elementary Solid State Physics, I/e M. Ali Omar, 1999, Pearson India
3. Solid State Physics, M.A. Wahab, 2011, Narosa Publications
4. Solid State Physics – S. O. Pillai (New Age Publication)
5. Modern Physics by R.Murugesham



**V SEMISTER Practicals Paper – VI A**  
**Solid State Physics**

1. Measurement of susceptibility of paramagnetic solution (Quinck's Tube Method)
2. To measure the Magnetic susceptibility of Solids.
3. To determine the Coupling Coefficient of a Piezoelectric crystal.
4. To measure the Dielectric Constant of a dielectric Materials with frequency
5. To study the PE Hysteresis loop of a Ferroelectric Crystal.
6. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis.
7. To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method (room temperature to 150<sup>0</sup> C) and to determine its band gap.
8. To determine the Hall coefficient of a semiconductor sample.
9. Calculation of d-values of a given Laue's pattern.
10. Calculation of d-values of powder diffraction method.
12. To study the spectral characteristics of a Photo- Voltaic cell.
13. Verification of Bragg's equation.

**Reference Books**

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India

**Course Outcome:**

Students who have completed this course should be able to:

**CO1.** Deliberate the characteristics of Plancks theory of radiaton,Photo electric effect,Compton effect

**CO2.** Write down in details with application, in Modern Physics (SWE,LHO)

**CO3.** Learn the characteristics of Nuclear physics,radioactive decay and Elementary particles.

**Subject : (Physics)**

**B.Sc. Semester VI-Theory Syllabus  
(DSC- Compulsory)  
Paper-VII – MODERN PHYSICS**

**42 hrs**

**UNIT-I (11hrs)**

**Atomic Spectra and Models Inadequacy of classical physics:**

Brief Review of Black body Radiation , Photoelectric effect, Compton effect, dual nature of radiation, wave nature of particles. Atomic spectra, Line spectra of hydrogen atom, Ritz Rydberg combination principle. Alpha Particle Scattering, Rutherford Scattering Formula, Rutherford Model of atom and its limitations, Bohr's model of H atom, explanation of atomic spectra, correction for finite mass of the nucleus, Bohr correspondence principle, limitations of Bohr model, discrete energy exchange by atom, Frank Hertz Expt. Sommerfeld's Modification of Bohr's Theory.

**UNIT-II (11hrs)**

Wave Particle Duality de Broglie hypothesis, Experimental confirmation of matter wave, Davisson Germer Experiment, velocity of de Broglie wave, wave particle duality, Complementarity. Superposition of two waves, phase velocity and group velocity , wave packets .Gaussian Wave Packet , spatial distribution of wave packet, Localization of wave packet in time. Time development of a wave Packet; Wave Particle Duality, Complementarity . Heisenberg Uncertainty Principle, Illustration of the Principle through thought Experiments of Gamma ray microscope and electron diffraction through a slit. Time independent and time dependent Schrodinger wave equation. Estimation of ground state energy of harmonic oscillator and hydrogen atom, non-existence of electron in the nucleus. Uncertainty and Complementarities.

**UNIT-III (9 hrs)**

Nuclear Physics Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, Liquid Drop model: semi-empirical mass formula and binding energy, Nuclear Shell Model and magic numbers.

**Unit IV (11 hrs)**

Radioactivity: stability of the nucleus; Law of radioactive decay; Mean life and half-life; Alpha decay; Beta decay- energy released, spectrum and Pauli's prediction of neutrino; Gamma ray emission, energy-momentum conservation: electron-positron pair creation by gamma photons in the vicinity of a nucleus. Fission and fusion- mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions driving stellar energy (brief qualitative discussions), Classification of Elementary Particles

**Text Books:**

1. Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
2. Modern Physics ---Murugesan and Sivaprasad --(S. Chand Higher Academics)
3. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill
4. Introduction to Quantum Mechanics, David J. Griffith, 2005, Pearson Education.
5. Physics for scientists and Engineers with Modern Physics, Jewett and Serway, 2010, Cengage Learning. •
6. Quantum Mechanics: Theory & Applications, A.K.Ghatak & S.Lokanathan, 2004, Macmillan

**Reference Books**

1. Modern Physics – Bernstein, Fishbane and Gasiorowicz (Pearson India) 2010
2. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles -- R. Eisberg (Wiley India) 2012 Additional Books for Reference
3. Modern Physics, J.R. Taylor, C.D. Zafiratos, M.A. Dubson, 2004, PHI Learning.
4. Theory and Problems of Modern Physics, Schaum's outline, R. Gautreau and W. Savin, 2nd Edn. Tata McGraw-Hill Publishing Co. Ltd.
5. Quantum Physics, Berkeley Physics, Vol.4. E.H.Wichman, 1971, Tata McGraw-Hill Co.
6. Basic ideas and concepts in Nuclear Physics, K.Heyde, 3rd Edn., Institute of Physics Pub.
7. Six Ideas that Shaped Physics: Particle Behave like Waves, T.A.Moore, 2003, McGraw Hill
8. Modern Physics-Serway (CENGAGE Learnings) 2014
9. Physics of Atoms and Molecules – Bransden (Pearson India) 2003

**VI SEMISTER Practicals Paper – VII :**  
**Modern Physics**

1. Measurement of Planck's constant using black body radiation and photo-detector
2. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
3. To determine the Planck's constant using LEDs of at least 4 different colors.
4. To determine the ionization potential of mercury.
5. To determine the absorption lines in the rotational spectrum of Iodine vapour.
6. To determine the value of  $e/m$  by (a) Magnetic focusing or (b) Bar magnet.
7. To setup the Millikan oil drop apparatus and determine the charge of an electron.
8. To show the tunneling effect in tunnel diode using I-V characteristics.
9. To determine the wavelength of laser source using diffraction of single slit.
10. To determine the wavelength of laser source using diffraction of double slits.
11. To determine (1) wavelength and (2) angular spread of He-Ne laser using plane diffraction grating
12. To determine the value of  $e/m$  for electron by long solenoid method.
13. Photo Cell – Determination of Planck's constant.
14. To verify the inverse square law of radiation using a photo-electric cell.
15. To find the value of photo electric work function of a material of the cathode using a photo-electric cell.
16. Measurement of magnetic field – Hall probe method.
17. To determine the dead time of a given G.M. tube using double source.
18. Hydrogen spectrum – Determination of Ridge berg's constant
19. Energy gap of intrinsic semi-conductor
20. G. M. Counter – Absorption coefficients of a material.
21. To draw the plateau curve for a Geiger Muller counter.
22. To find the half-life period of a given radioactive substance using a G.M. Counter.

**Reference Books**

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers

### Course Outcome:

Students who have completed this course should be able to:

CO1. Deliberate the characteristics of NETWORK THEOREMS, SEMICONDUCTOR PHYSICS

CO2. Write down in details with application, in Material sciences

CO3. Learn the Digital electronics using Gates..

**Subject : (Physics)** **B.Sc. Semester VI-Theory Syllabus** **42 hrs**  
(DSE- Elective-II)  
**Paper-VIII-A : Basic Electronics**

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

**Network Elements and Network Theorems**

Passive elements, Power sources, Active Elements, Network Models: T and  $\pi$  Transformations, Superposition theorem, Thevenin's Theorem, Norton's theorem. Reciprocity Theorem and Maximum power transfer theorem (Simple problems).

Two-port Networks – Introduction- Z-parameters, Y-parameters, h-parameters and ABCD-parameters (Simple problems).

**Unit – II: (10 hrs)**

**Band theory of P-N junction**

1. Energy band in solids (band theory), valence band, conduction band and forbidden energy gap solids, Insulators, semi conductors and, pure or intrinsic semiconductors and impurity or extrinsic semi-conductors. N-type extrinsic semi-conductors, P-type extrinsic semi-conductors, Fermi level, continuity equation.

2. **Diodes:** P-N junction diode, Bridge rectifier. Zener diode & its Characteristics. Zener diode as voltage regulator.

**Unit III: (11hrs)**

1. **Bipolar Junction Transistor (BJT)** – p-n-p and n-p-n transistors, current components in transistors, CB, CE and CC configurations transistor as an amplifier -RC coupled amplifier. (Qualitative analysis)

2. **Feedback Concept & Oscillators:** Feedback, General theory of feedback–Concepts of a Oscillators, Barkhausen's criteria, Phase shift Oscillator.

**Unit-IV: (11 hrs)**

**1. Digital Electronics**

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.

### **1. Logic gates:**

OR, AND, NOT gates, truth tables, realization of these gates using discrete components. NAND, NOR as universal gates, Exclusive – OR gate (EX-OR). De Morgan's Laws – Statement and proof.

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

### **Textbooks**

1. Electronic devices and circuits – Millman and Halkias. *Mc.Graw-Hill Education*.
2. Principles of Electronics by V.K. Mehta – *S. Chand & Co.*
3. Basic Electronics (Solid state) – B. L. Theraja , *S. Chand & Co.*
4. A First Course in Electronics- Anwar A. Khan& Kanchan K. Dey, *PHI.*

### **Reference Books**

1. Basic Electronics – Bernod Grob.
2. Third year Electronics – Telugu Academy
3. Digital Principles & Applications – A.P. Malvino and D.P. Leach
4. Circuit theory- Umesh.

**VI SEMESTER Practicals Paper – VIII A :**  
**Basic Electronics**

1. AND, OR, NOT, gates – Truth table Verification
  2. AND, OR, NOT – gates constructions using universal gates – Verification of truth tables.
  3. NAND and NOR gates truth table verification
  4. Characteristics of a Transistor in CE configuration
  5. R.C. coupled amplifier – frequency response.
  6. Verification of De Morgan's Theorem.
  7. Zener diode V-I characteristics.
  8. Verification Thevenin's theorem.
  9. Maximum Power Transfer theorem
  10. P-n junction diode V- I characteristics.
  11. Zener diode as a voltage regulator
  12. Construction of a model D.C. power supply
  13. R C phase shift Oscillator –determination of output frequency
- ❖ Every student should complete minimum 06 experiments.

**Text Books for LAB (Practical 6)**

1. B.Sc. Practical Physics – C. L. Arora – S. Chand & Co.
2. Viva-voce in Physics – R.C. Gupta, Pragathi Prakashan, Meerut.
3. Laboratory manual for Physics Course by B.P. Khandelwal.
4. Practical Physics by M. Arul Thakpathi by Comptex Publishers.
5. B.Sc. practical physics – Subbi Reddy.



**B.Sc. (Physics)- I Year**  
**Semester – I**  
**Paper – I: Mechanics and Oscillations**  
**(DSC - Compulsory)**

**Unit – I**

**1. Vector Analysis (10)**

Scalar and Vector fields, Gradient of a Scalar field and its physical significance. Divergence and Curl of a Vector field and related problems. Vector integration, line, surface and volume integrals. Stokes', Gauss's and Green's theorems- simple applications.

**Unit – II**

**2. Mechanics of Particles (6)**

Laws of motion, motion of variable mass system, motion of a rocket, multi-stage rocket, conservation of energy and momentum. Collisions in two and three dimensions, concept of impact parameter, scattering cross-section.

**3. Mechanics of Rigid Bodies (6)**

Definition of Rigid body, rotational kinematic relations, equation of motion for a rotating body, angular momentum and inertial tensor. Euler's equation, precession of a top, Gyroscope.

**Unit – III**

**4. Central Forces (7)**

Central forces – definition and examples, conservative nature of central forces, conservative force as a negative gradient of potential energy, equation of motion under a central force, gravitational potential and gravitational field, motion under inverse square law, derivation of Kepler's laws.

**5. Special theory of Relativity (7)**

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


**Unit – IV**

**6. Oscillations(12)**

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.

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

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

  
**HEAD**  
Department of Physics  
University College of Science  
Osmania University, Hyd.

2

  
**CHAIRMAN**  
Board of Studies in Physics  
Osmania University, Hyd.

### Suggested books

1. Berkeley Physics Course. Vol.1, **Mechanics** by C. Kittel, W. Knight, M.A. Ruderman - *Tata-McGraw Hill Company Edition 2008.*
2. **Fundamentals of Physics.** Halliday/Resnick/Walker *Wiley India Edition 2007.*
3. **First Year Physics** - *Telugu Academy.*
4. **Introduction to Physics for Scientists and Engineers.** F.J. Ruche. *McGraw Hill.*
5. **Sears and Zemansky's University Physics** by Hugh D. Young, Roger A. Freedman *Pearson Education Eleventh Edition.*
6. **Theory of relativity** - **Resnick**
  
7. **Fundamentals of Physics** by Alan Giambattista et al *Tata-McGraw Hill Company Edition, 2008.*
8. **University Physics** by Young and Freeman, *Pearson Education, Edition 2005.*
9. **An introduction to Mechanics** by Daniel Kleppner & Robert Kolenkow. *The McGraw Hill Companies.*
10. **Mechanics.** Hans & Puri. *TMH Publications.*

**B.Sc. (Physics)- I Year**  
**Semester – II**  
**Paper – II: Thermal Physics**  
**(DSC - Compulsory)**

**Unit – I**

**1. Kinetic theory of gases: (4)**

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

**2. Thermodynamics: (8)**

Basics of Thermodynamics- Carnot's engine (qualitative)-Carnot's theorem -Kelvin's and Clausius 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.

**Unit – II**

**3. Thermodynamic potentials and Maxwell's equations: (6)**

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.

**4. Low temperature Physics: (6)**

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.

**Unit – III**

**5. Quantum theory of radiation: (12)**

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, Stefan's law from Planck's law. Measurement of radiation using pyrometers – Disappearing filament optical pyrometer – experimental determination – Angstrom pyro heliometer - determination of solar constant, effective temperature of sun.

**Unit – IV**

**6. Statistical Mechanics: (12)**

Introduction, postulates of statistical mechanics. Phase space, concept of ensembles and some known ensembles ,classical and quantum statistics and their differences, concept of probability, Maxwell-Boltzmann's distribution law -Molecular energies in an ideal gas- Maxwell-Boltzmann's velocity distribution law, Bose-Einstein Distribution law, Fermi-Dirac Distribution law, comparison of three distribution laws.

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

### Suggested books

1. **Fundamentals of Physics.** Halliday/Resnick/Walker, *C. Wiley India Edition 2007.*
2. **Second Year Physics – Telugu Academy.**
3. **Modern Physics** by R. Murugesan and Kiruthiga Siva Prasath (for statistical Mechanics) *S. Chand & Co.*
4. **Modern Physics** by G. Aruldas and P. Rajagopal, *Eastern Economy Education.*
5. Berkeley Physics Course. Volume-5. **Statistical Physics** by F. Reif. *The McGraw-Hill Companies.*
6. **An Introduction to Thermal Physics** by Daniel V. Schroeder. *Pearson Education Low Price Edition.*
7. **Thermodynamics** by R.C. Srivastava, Subit K. Saha & Abhay K. *Jain Eastern Economy Edition.*
8. **Modern Engineering Physics** by A.S. Vasudeva, *S.Chand & Co. Publications.*
9. B.B. Laud “**Introduction to statistics Mechanics**”(Macmillan 1981)

**B.Sc. (Physics) – I year**  
**Semester - II**  
**Paper – II: Thermal Physics Practicals**  
**(DSC - Compulsory)**

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. Calibration of thermo couple
6. Cooling Curve of a metallic body
7. Resistance thermometer
8. Thermal expansion of solids
9. Study of conversion of mechanical energy to heat.
10. Determine the Specific of a solid ( graphite rod )

*Note: Minimum of eight experiments should be performed. Maximum of 15 students per batch and maximum of three students per experiment should be allotted in the regular practical class of three hours per week.*

**Suggested Books**

1. D.P. Khandelwal, "A laboratory manual for undergraduate classes" (Vani Publishing House, New Delhi).
2. S.P. Singh, "Advanced Practical Physics" (Pragati Prakashan, Meerut).
3. Worsnop and Flint- Advanced Practical physics for students.
4. "Practical Physics" R.K Shukla, Anchal Srivastava

**B.Sc. (Physics)- II Year**  
**Semester – III**  
**Paper – III:: Electromagnetic Theory**  
**(DSC - Compulsory)**

**Unit I : Electrostatics (11 hrs)**

Electric Field:- Concept of electric field lines and electric flux, Gauss's law (Integral and differential forms), application to linear, plane and spherical charge distributions. Conservative nature of electric field 'E', Irrotational field. Electric potential:- Concept of electric potential, relation between electric potential and electric field, potential energy of a system of charges. Energy density in an electric field. Calculation of potential from electric field for a spherical charge distribution.

**Unit II : Magnetostatics (12 hrs)**

Concept of magnetic field 'B' and magnetic flux, Biot-Savart's law, B due to a straight current carrying conductor. Force on a point charge in a magnetic field. Properties of B, curl and divergence of B, solenoidal field. Integral form of Ampere's law, Applications of Ampere's law: field due to straight, circular and solenoidal currents. Energy stored in magnetic field. Magnetic energy in terms of current and inductance. Magnetic force between two current carrying conductors. Magnetic field intensity. Ballistic Galvanometer:- Torque on a current loop in a uniform magnetic field, working principle of B.G., current and charge sensitivity, electromagnetic damping, critical damping resistance.

**Unit III: Electromagnetic Induction and Electromagnetic waves (13)**

Faraday's laws of induction (differential and integral form), Lenz's law, self and mutual Induction. Continuity equation, modification of Ampere's law, displacement current, Maxwell equations. Maxwell's equations in vacuum and dielectric medium, boundary conditions, plane wave equation: transverse nature of EM waves, velocity of light in vacuum and in medium. Poynting's theorem.

**UNIT IV:**

**Varying and alternating currents (6)**

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).

**Network Theorems(6):**

Passive elements, Power sources, Active elements, Network models: T and  $\pi$  Transformations, Superposition theorem, Thevenin's theorem, Norton's theorem. Reciprocity theorem and Maximum power transfer theorem (Simple problems).

**Text Books**

1. Fundamentals of electricity and magnetism By Arthur F. Kip (McGraw-Hill, 1968)
2. Telugu Academy
3. Electricity and magnetism by J.H.Fewkes& John Yarwood. Vol.I (Oxford Univ. Press, 1991).
4. Introduction to Electrodynamics, 3rd edition, by David J. Griffiths, (Benjamin Cummings,1998).
5. Electricity and magnetism By Edward M. Purcell (McGraw-Hill Education, 1986)
6. Electricity and magnetism. By D C Tayal (Himalaya Publishing House,1988)
7. Electromagnetics by Joseph A.Edminister 2nd ed.(New Delhi: Tata McGraw Hill, 2006).

**B.Sc. (Physics) – II year**  
**Semester - III**  
**Paper – III:: Electromagnetic Theory Practicals**  
**(DSC - Compulsory)**

**PHYSICS LABORATORY**

1. To verify the Thevenin Theorem
2. To verify Norton Theorem
3. To verify Superposition Theorem
4. To verify maximum power transfer theorem.
5. To determine a small resistance by Carey Foster's bridge.
6. To determine the (a) current sensitivity, (b) charge sensitivity, and (c) CDR of a B.G.
7. To determine high resistance by leakage method.
8. To determine the ratio of two capacitances by De Sauty's bridge.
9. To determine self-inductance of a coil by Anderson's bridge using AC.
10. To determine self-inductance of a coil by Rayleigh's method.
11. To determine coefficient of Mutual inductance by absolute method.

**Note:** Minimum of eight experiments should be performed.

Maximum of 15 students per batch and maximum of three students per experiment should be allotted in the regular practical class of three hours per week.

**B.Sc. (Physics) - II Year**  
**Semester - IV**  
**Paper - IV:: Waves and Optics**  
**(DSC - Compulsory)**

**Unit-I Waves(12)**

Fundamentals of Waves - 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, energy transport, transverse impedance.

Longitudinal vibrations in bars- wave equation and its general solution. Special cases (i) bar fixed at both ends ii) bar fixed at the mid point iii) bar free at both ends iv) bar fixed at one end.

Transverse vibrations in a bar- wave equation and its general solution. Boundary conditions, clamped free bar, free-free bar, bar supported at both ends, Tuning fork.

**Unit II: Interference: (12)**

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 III: Diffraction: (12)**

Introduction - Distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction:- Diffraction due to single slit and circular aperture - Limit of resolution - Fraunhofer diffraction due to double slit - Fraunhofer 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.

**Unit IV: Polarization (12)**

Polarized light : Methods of Polarization, Polarization by reflection, refraction, Double refraction, selective absorption , scattering of light - Brewster's 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.

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

**Suggested books**

1. **Optics** by Ajoy Ghatak. *The McGraw-Hill companies.*
2. **Optics** by Subramaniam and Brijlal. *S. Chand & Co.*
3. **Second Year Physics - Telugu Academy.**
4. **Modern Engineering Physics** by A.S. Vasudeva. *S.Chand & Co. Publications.*
5. **Fundamentals of Optics** by Jenkins A. Francis and White E. Harvey, *McGraw Hill Inc.*
6. K. Ghatak, **Physical Optics'**
7. D.P. Khandelwal, **Optical and Atomic Physics'** (Himalaya Publishing House, Bombay, 1988)
8. Jenkins and White: **'Fundamental of Optics'** (McGraw-Hill)
9. Smith and Thomson: **'Optics'** (John Wiley and sons).



**B.Sc. (Physics) – II year**  
**Semester - IV**  
**Paper – IV:: Waves and Optics Practicals**  
**(DSC - Compulsory)**

1. Thickness of a wire using wedge method.
2. Determination of wavelength of light using Biprism.
3. Determination of Radius of curvature of a given convex lens by forming Newton's rings.
4. Resolving power of grating.
5. Study of optical rotation-polarimeter.
6. Dispersive power of a prism
7. Determination of wavelength of light using diffraction grating minimum deviation method.
8. Wavelength of light using diffraction grating – normal incidence method.
9. Resolving power of a telescope.
10. Refractive index of a liquid and glass (Boys Method).
11. Pulfrich refractometer – determination of refractive index of liquid.
12. Wavelength of Laser light using diffraction grating.
13. Verification of Laws of a stretched string (Three Laws).
14. Velocity of Transverse wave along a stretched string
15. Determination of frequency of a bar-Melde's experiment

**Suggested Books**

1. D.P. Khandelwal, "A laboratory manual for undergraduate classes" (Vani Publishing House, New Delhi).
2. S.P. Singh, "Advanced Practical Physics" (Pragati Prakashan, Meerut).
3. Worsnop and Flint- Advanced Practical physics for students.
4. "Practical Physics" R.K Shukla, Anchal Srivastav.

After the completion of the course Student will be familiar with

- CO1. Understand in depth The wave function and uncertainty Principle
- CO2. Specify in depth Formalism of quantum mechanics
- CO3. Understand the details of Schrodinger equation in one dimension
- CO4. Deliberate the details of Angular Momentum
- CO5. Understand in depth Schrodinger equation in three dimensions

**B.Sc. (Physics)- III Year**  
**Semester – V**  
**Paper – V :: (A) Modern Physics**  
**(DSE – Elective I)**

**UNIT - 1 : SPECTROSCOPY (12)**

**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, 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 inter nuclear 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 : Quantum Mechanics (14)**

Inadequacy of classical Physics; Spectral radiation - Planck's law (only discussion). Photoelectric effect - Einstein's photoelectric equation. Compton's effect - experimental verification.

**Matter waves & Uncertainty principle:** 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 Broglie waves of electron in Bohr orbits. 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. 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.

**Unit - III : Nuclear Physics (10)**

**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, n-n, 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, Gamow's theory of alpha decay, Geiger - Nuttal law from Gamow's theory. Beta spectrum - neutrino hypothesis,

**Particle Detectors:** GM counter, proportional counter, scintillation counter.

**UNIT: IV: Solid State Physics & Crystallography (12)**

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

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

**Bonding in Crystals:** Types of bonding in crystals - characteristics of crystals with different bondings. Lattice energy of ionic crystals- determination of Madelung constant for NaCl crystal. Calculation of Born Coefficient and repulsive exponent, Born-Haber cycle.

### Suggested books

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. Murugesan 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.

**B.Sc. (Physics Practical) – III year**  
**Semester – V**  
**Paper: V:: A. Modern Physics Practicals**  
**(DSE)**

1. Measurement of Planck's constant using black body radiation and photo-detector
2. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
3. To determine the Planck's constant using LEDs of at least 4 different colors.
4. To determine the ionization potential of mercury.
5. To determine the absorption lines in the rotational spectrum of Iodine vapour.
6. To determine the value of  $e/m$  by (a) Magnetic focusing or (b) Bar magnet.
7. To setup the Millikan oil drop apparatus and determine the charge of an electron.
8. To show the tunneling effect in tunnel diode using I-V characteristics.
9. To determine the wavelength of laser source using diffraction of single slit.
10. To determine the wavelength of laser source using diffraction of double slits.
11. To determine (1) wavelength and (2) angular spread of He-Ne laser using plane diffraction grating
12. To determine the value of  $e/m$  for electron by long solenoid method.
13. Photo Cell – Determination of Planck's constant,
14. To verify the inverse square law of radiation using a photo-electric cell.
15. To find the value of photo electric work function of a material of the cathode using a photo-electric cell.
16. Measurement of magnetic field – Hall probe method.
17. To determine the dead time of a given G.M. tube using double source.
18. Hydrogen spectrum – Determination of Rydberg's constant
19. Energy gap of intrinsic semi-conductor
20. G. M. Counter – Absorption coefficients of a material.
21. To draw the plateau curve for a Geiger Muller counter.
22. To find the half-life period of a given radioactive substance using a G.M. Counter.

**Reference Books:**

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal

