B.Sc. Physics Course
Part (I & II)

The B.Sc. Physics course is comprised of the following papers

Part – I

Paper A- Mechanics	(Theory)	35 Marks
Paper B – Waves & oscillations, Optics and Thermodynamics	(Theory)	35 Marks
Paper C- Mechanics	(Practical)	15 Marks
Paper D – Waves & oscillations, Optics and Thermodynamics	(Practical)	15 Marks

Note:

- Each paper of theory carries 35 marks. The Candidate will have to attempt 5 questions out of 8 questions.
- Each practical paper carries 15 marks.

Curriculum for B.Sc. (Physics)
(Part-I)

➢ **Paper-A: Mechanics**

The candidate will have to attempt 5 out of 8 questions. Total Marks will be 35.

1. **Vector Operations:**

Topic	Scope
▪ Vector in 3 dimensions	Introduction, Direction Cosines, Spherical polar coordinates, Applications
▪ Vector Products	Scalar and vector triple products, Characteristics
▪ Vector Derivatives and Operations	Scalar & vector field, Scalar point function & vector point function, Gradient of a scalar point function, Divergence and curl of a vector point function, Physical significance of each type, Curl and line integral, Mutual relation
▪ Vector Integrations	Line, Surface and volume integrals
▪ Divergence Theorem	Derivation, Physical importance and application to specific cases, Converting from differential to integral forms
▪ Stoke's Theorem	Derivation, Physical significance and application to specific cases
Suggested Level: Vector Analysis by Muhammad Afzal & Vector Analysis by Dr. S.M. Yousaf	

2. **Particle Dynamics:**

Topic	Scope
▪ Advanced Applications of Newton's Laws	Frictional forces, Microscopic basis of this force
▪ Dynamics of Uniform Circular Motion	Conical pendulum, The rotor, The banked curve
▪ Equations of Motion	Deriving kinematics equations x(t), v(t) using integrations, Constant and non-constant forces with special examples

▪ Time Dependent Forces	Obtaining x(t), v(t) for this case using integration method
▪ Effect of Drag Forces on Motion	Applying Newton's laws to obtain v(t) for the case of motion with time dependent drag (viscous) forces, Terminal velocity, Projectile motion under air resistance
▪ Non Inertial Frames and Pseudo Forces	Qualitative discussion to develop Pseudo forces, Calculation of pseudo forces for simple Cases (linearly accelerated reference frame), Centrifugal forces as an example of Pseudo force, Carioles force
▪ Limitations of Newton's Laws	Discussion
Suggested Level: HRK (Volume- I, 5th Edition) Chapter no.5	

3. <u>Work & Energy:</u>

Topic	Scope
▪ Work Done by a Constant Force, Work Done by a Variable Force 1-Dimension	Essentially a review of grade-XII concepts, Use of integration technique to calculate work done (e.g. Vibration of a spring obeying Hook's law)
▪ Work Done by a Variable Force (2-Dimemsional Case)	Obtaining general expression of force and applying to simple cases (e.g. Pulling of a mass at the end of a fixed string against gravity)
▪ Work Energy Theorem	General proof, Qualitative review, Derivation using integral calculus, Basic formula and applications
▪ Power	Definition, General formula
Suggested Level: HRK (Volume -I, 5th Edition) Chapter no.11	

4. <u>Conservation of Energy:</u>

Topic	Scope
▪ Conservative and Non conservative Forces	Definition of either type of force with examples, Work done in a closed path,1-dimensional conservative system, Force as the gradient of potential energy, Applications in the case of a

	spring and force of gravity
▪ One-Dimensional Conservative System	Obtaining velocity in terms of U and E, Stable, unstable and neutral equilibrium, Analytic solution for x(t)
▪ 2 &3-Dimensional Conservative Systems	Change in P.E. for motion in 3-d, Work done in 2 & 3-dimensional motion
▪ Conservation of Energy in a System of Particles	Law of conservation of total energy of an isolated system
Suggested Level: HRK (Volume-I, 5th Edition) Chapter no.12 & 13	

5. <u>Systems of Particles:</u>

Topic	Scope
▪ Two Particle Systems and Generalization to many Particle Systems	Centre of mass, Its position, velocity & equation of motion
▪ Centre of Mass of Solid Objects	Calculation of centre of mass of solid Objects using integral calculus, Calculating C.M. of uniform rod, Solid cylinder & sphere
▪ Momentum Changes in a System of Variable Mass	Derivation of basic equation, Application to motion of rocket (determination of its mass as a function of time)
Suggested Level: HRK (Volume -I, 5th Edition) Chapter no.7	

6. <u>Collision:</u>

Topic	Scope
▪ Elastic Collision, Conservation of Momentum during Collision	One dimension, Two dimensions (Oblique collisions)
▪ Inelastic Collision, Collision in C.M. Reference Frame	One and two dimensions, Simple applications obtaining velocities in C. M. Frame
Suggested Level: HRK (Volume -I, 5th Edition) Chapter no.6	

7. <u>Rotational Dynamics:</u>

Topic	Scope

▪ Overview of Rotational Dynamics	Relationships between linear & angular variables, Scalar and vector form, Rotational Kinetic energy, Moment of inertia
▪ Parallel Axis Theorem	Prove and Illustrate, Apply to simple cases
▪ Determination of Moment of Inertia of Various Shapes	Equations of rotational motion and effects of applications of torques
▪ Rotational Dynamics of Rigid Bodies	
▪ Combined Rotational and Translational Motion	Rolling without slipping
Suggested Level: HRK (Volume-I, 5th Edition) Chapter no.8 & 9	

8. Angular Momentum:

Topic	Scope
▪ Angular Velocity	Definition, Conservation of angular momentum, Effects of torque on angular momentum
▪ Stability of Spinning Objects	Discussion with examples
▪ The Spinning Top	Effects of torque on the angular momentum, Precessional motion
Suggested Level: HRK (Volume-I, 5th Edition) Chapter no.10	

9. Gravitation:

Topic	Scope
▪ Review of Basic Concepts of Gravitation, Gravitational Effects of a Spherical Mass Distribution	Mathematical treatment

▪ Gravitational Potential Energy	Develop equation using integration techniques, Calculation of escape velocity
▪ Gravitational Field & Potential	Develop the idea of field of force
▪ Universal Gravitational Law	Motion of planets and Kepler's Laws, (Derivation & explanation), Motion of satellites, Energy considerations in planetary and satellite motion, Qualitative discussion on application of gravitational law to the Galaxy
Suggested Level: HRK (Volume-I, 5th Edition) Chapter no.14	

10. <u>Bulk Properties of Matter:</u>

Topic	Scope
▪ Elastic Properties of Matter	Stress, Strain, Physical basis of elasticity, Compression & shearing, Elastic modulus, Elastic limit & plastic limit
▪ Fluid Statistics	Variation of pressure in fluid at rest and with height in earth's atmosphere
▪ Surface Tension	Physical basis, Its role in the formation of drops and bubbles
▪ Fluid Dynamics	General concepts of fluid flow, Stream line flow, Equation of continuity
▪ Bernoulli's Equation	Derivation and some applications such as dynamic lift thrust on a rocket
▪ Viscosity	Physical basis, Obtaining the coefficient of viscosity, Practical examples of viscosity, Fluid flow through a cylindrical pipe [Poisenille's law]
Suggested Level: HRK (Volume-I, 5th Edition) Chapter no.15 & 16	

11. Special Theory of Relativity:

Topic	Scope
▪ Troubles Faced by Classical Mechanics	Qualitative discussion of the inadequacy or paradoxes in classical ideas of time, length and velocity
▪ Postulates of Relativity	Statements and discussion
▪ The Lorentz Transformation, Inverse Lorentz Transformation	Derivation, Assumptions on which derived, Application of the same transformation of velocities.
▪ Consequences of Lorentz Transformation	Relativity of time, Relativity of length
▪ Relativistic Momentum	Derivation & discussion
▪ Relativistic Energy	Rest mass energy, Derivation of $E = mc^2$, Relativistic K.E
Suggested Level: HRK (Volume-I, 5th Edition) Chapter no.20	

Curriculum for B.Sc. (Physics)

(Part-I)

➢ **Paper-B: Waves & Oscillations, Optics and Thermodynamics**

The candidate will have to attempt 5 out of 8 questions. Total Marks will be 35.

Topic	Scope
Mechanical waves, Traveling waves	Phase velocity of traveling waves: sinusoidal
	waves: Group speed and dispersion.
Waves Speed	Mechanical analysis
Waves equation	Discussion of solution
Power and intensity in wave motion	Derivation & discussion
Principle of superposition, (basic ideas).	Interference of waves, standing waves, Phase changes on reflection, natural frequency and resonance.
Suggested level	Ch: 19 of H.R. K

Oscillations

Topic	Scope
Simple harmonic oscillation (SHM)	Obtaining and solving the basic equation of motion x(t). v(t). Energy consideration in SHM (viscous) forces, terminal velocity. Projectile motion/air resistance.
Application of SHM	Torsional Oscillator. Physical pendulum, simple pendulum.
SUM and uniform circular motion combinations of harmonic motions	Lissajous patters
Damped Harmonic Motion	Equation of damped harmonic motion discussion of its solution.
Suggested level	Chapter 15 of RHK

OPTICS

Topic	Scope
Interference	Coherent sources. Double slit interference (analytical treatment).
Adding of electromagnetic waves (Phasor method)	
Interference from thin films	Newton's rings (analytical treatment)
Michelson Interferometer	Discussion to include the use of a compensating plate. Michelson interferometer and its use in determining the velocity of light.
Fresnel Biprism	Basic ideas and usage.
Suggested level	Ch: 45 of H.R.K.
Diffraction	Diffraction at single slit. Intensity in single slit, diffraction using Phasor treatment, analytical treatment using addition of waves. Slit interference & diffraction combined. Diffraction at a circular aperture
Diffraction from multiple slits	Discussion including width of the maxima
Diffraction grating	Discussion, use in spectrographs. Dispersion and resolving power of gratings.
Suggested level	Ch: 46. 47 of H.R.K.
Holography	Qualitative discussion
Polarization	Basic definition production of polarization by polarizing sheets by reflection, by double refraction and double scattering.
Description of polarization states	Linear, Circular and elliptic polarization.

Rotation of plane of polarization	Use of polarimeter.
Suggested level	Ch. 48 of H.R.K

Thermodynamics and Kinetic Theory of Cases:
Temperature:

Topic	Scope
Concept of temperature and Zeroth law of thermodynamics	
Kinetic theory of the ideal gas. work done on/by an ideal gas	Review of previous concepts
Internal energy of an ideal gas	To include the equipartition of energy
Intermolecular forces	Van der Waals equation of state
Quantitative discussion.	
Suggested level	Ch. 21.22 of H.R.K (Vol-1)

Statistical Mechanics

Topic	Scope
Statistical distribution and mean values	Mean free path and microscopic calculations of mean free path.
Distribution of molecular speeds	Maxwell distribution; Maxwell-Boltzmann energy distribution, internal energy of an ideal gas.
Brownian motion	Qualitative description, Diffusion, Conduction and Viscosity.
Suggested level	Ch:22 of H.R.K. Vol-I

Heat

Topic	Scope
Review of previous concepts. First law of thermodynamics, transfer of heat	First law of thermodynamics & its applications, cyclic and free expansion.
Suggested level	Ch:23 of H.R.K Vol.I

Entropy and Second Law of Thermodynamics

Topic	Scope
Reversible and irreversible process	Definition and discussion
Second Law	Definition, Heat engine, Refrigerators and Second
Cycle: Carnot engines	Calculation of efficiency of heat engines.
Thermodynamic temperature scale	Absolute zero, negative temperature (discussion)
Entropy	Entropy in reversible process.
	Entropy in irreversible process.
	Entropy and second law of thermodynamics.
	Entropy & probability.
Suggested level	Ch:24 of H.R.K

B.Sc. Physics (Part-I)
PRACTICAL PAPERS

Paper C- Mechanics: **15 marks**

1. To determine the value of „g‟ by compound pendulum.
2. To determine the Modulus of rigidity of the material of a spiral spring.
3. To determine the Young‟s Modulus of the material of a spiral spring.
4. To determine the Modulus of rigidity of a wire by solid cylindrical rod.
5. To determine the Modulus of rigidity of a wire by Static Method (Barton‟s Apparatus).
6. To determine the Modulus of rigidity of a wire by Dynamic Method (Maxwell needle).
7. Surface tension of water by capillary tube method.
8. Projectile motion: (a) To determine the range as a function of the angle of inclination.

(b) To determine the maximum height of projectile as a function of angle of inclination.

(c) To determine the range / height as a function of initial velocity of projectile.

Paper D- Waves & Oscillations, Optics and Thermodynamics: **15 marks**

1. To determine the frequency of A.C supply by Melde‟s experiment.
2. To verify the law by Melde‟s experiment.
3. To determine the frequency of A.C supply using a sonometer.
4. To study the Lissajous figures by using C.R.O.
5. To determine velocity of sound by Kundt's tube.
6. To study the principle of sextant and measure the vertical distance b/w two points (accessible and inaccessible).
7. To determine wavelength of light by Fresnel‟s biprism.
8. To determine wavelengths of sodium D lines by Newton's rings.
9. To determine wavelength of light by diffraction grating.
10. To determine the resolving power of a diffraction grating.
11. To determine the specific rotation of cane-sugar solution with Laurent‟s half shade polarimeter.
12. To determine the mechanical equivalent of heat, “J” by Electrical Method (Calendar and Barnes Method) with compensation for heat loss.
13. To study the principle of thermocouple, thermal e.m.f. and temperature diagram.
14. To determine the temperature coefficient of resistor. (Resistance of Platinum wire)
15. To determine the Stefan‟s Constant (σ).

Curriculum for B.Sc. (Physics)
(Part-II)
Part – II

Paper A – Electricity & Magnetism	(Theory)	35 Marks
Paper B – Modern Physics and Electronics	(Theory)	35 Marks
Paper C – Electricity & Magnetism	(Practical)	15 Marks
Paper D – Modern Physics and Electronics	(Practical)	15Marks

➢ **Paper-A Electricity & Magnetism**

The candidate will have to attempt 5 out of 8 questions. Total Marks will be 35.

EELCTROSTATICS	
TOPIC	**SCOPE**
Electric charge: Conductors and insulators	Review of previous concepts, Coulomb's law for point charges.
Vector form of coulomb's Law	
Electric Field	Field due to point charges; due to several point charges, electric dipole.
Electric field of continuous charge distribution	For example, ring of charge, disc of charge, infinite line
	of charge.
Point charge in an electric field	
Dipole in an electric field	Torque and energy of a dipole in uniform field.
Gauss's Law	Electric flux, Gauss's law (integral and different form)
Application of Gauss's law (integral form)	Charged isolated conductors, conductor with a cavity, field near a charged conducting sheet, field of infinite line of charge, field of infinite sheet of charge, field of spherical shell and field of spherical charge distribution.
Suggested level	Ch: 26& 27 of H.R.K (Vol-2, Ed. 5)
EELCTRIC POTENTIAL **TOPIC**	**SCOPE**
Electric Potential	Electric potential energy
	Potential due to point charge. Potential due to collection of point charges. Potential due to dipole. Electric potential of continuous charge distribution.
Calculating the potential from the field and vice versa	Field as the gradient or derivative of potential.
Suggested level	Potential and field inside and outside an isolated conductor. Equipotential surfaces. Ch: 28 of H.R.K (Vol-2, Ed. 5th)
CAPACITORS AND DIELECTRICS **TOPIC** Capacitors and dielectrics	**SCOPE** Capacitance, calculate the electric field in capacitors of various shapes (including atomic view)
	Application of Gauss's law to capacitor with dielectrics and Gauss's Law for dielectrics.
	Ch: 30 of H.R.K V2 (E5)
ELECTRIC CURRENT & THE ELECTRICAL PROPERTIES OF MATERIALS	

TOPIC	SCOPE
Electric current	Current density and drift speed, resistance, resistivity, conductivity (microscopic view of resistivity).
Ohm’s law	Basic definition, analogy between current and heat

	flow, and microscopic view of Ohm's law.
Energy transfers in the electric circuit	
Semiconductors and superconductors	Descriptive (giving basic idea).
Suggested level	Ch; 29 of H.R.K (Vol-2, Ed. 5)
DC CIRCUIT	
TOPIC	**SCOPE**
Calculating the current in a single loop, multiple loops and voltages at various elements of a loop	Use of Kirchhoff's voltage and current laws.
RC circuit	Growth and decay of current in an RC circuit. Analytical treatment
Suggested level	Ch; 31 of H.R.K (Vol-2, Ed. 5)
MAGNETIC FIELD EFFECTS	
TOPIC	**SCOPE**
Magnetic field **(B)**	Basic idea
Magnetic force on a charged particle	Recall the previous results.
Magnetic force on a current carrying wire	
Torque on a current loop	Discuss mathematical treatment
Magnetic dipole	Discuss quantitatively
	Ch: 32 of H.R.K (Vol-2, Ed. 5)
AMPERE'S LAW	
TOPIC	**SCOPE**
Bio-Savart Law	Analytical treatment and applications to a current loop, force on two parallel current carrying conductors.
Amper's Law	Integral and differential forms, application to solenoids and toroids (integral form)
Suggested level	Ch: 33 of H.R.K (Vol-2, Ed. 5)
FARADAY'S LAW OF ELECTROMAGNETIC INDUCTION	
TOPIC	**SCOPE**
Faraday's law	Magnetic flux, consequences of Faraday's law
Lenz law	Discussion, Eddy current etc.
Motional E.M.F	Quantitative analysis
Suggested level	Ch; 34 of H.R.K (Vol-2, Ed. 5)
MAGNETIC PROPERTIES OF MATTER	
TOPIC	**SCOPE**
Magnetic dipole (μ)	Energy & torque of magnetic dipole in field
Gauss law for magnetism	Discussion and developing concepts of conservation of magnetic flux and mono poles. Differential form of Gauss' law.
Origin of atomic and nuclear magnetization	Definition and relationship of M, B and μ
Magnetic Materials	Paramagnetism, diamagnetism and ferromagnetism

	Discussion, hysteresis in ferromagnetic materials
Suggested level;	Ch; 35 of H.R.K (Vol-2, Ed. 5)
INDUCTANCE	
TOPIC	**SCOPE**
Generating and electromagnetic wave	
Travelling waves and Maxwell's equations	Analytical treatment, obtaining differential form, Maxwell's equations, obtaining the velocity of light from Maxwell's equations.
Energy transport and the Poynting vector	Analytical treatment and discussion of physical concepts
Suggested level	Ch: 38 of H.R.K (Vol-2, Ed. 5)

Curriculum for B.Sc. (Physics)
(Part-II)

Paper-B Modern Physics and Electronics

The candidate will have to attempt 5 out of 8 questions. Total Marks will be 35.

QUANTUM PHYSICS	
TOPIC	**SCOPE**
Thermal Radiations (Black Body Radition)	Stefan Boltzmann, Wien and Plank's law (Consequences)
The quantization of Energy	Quantum Numbers, correspondence principle.
The Photoelectric effect.	Explanation of Photoelectric effect.
Einsten's photon theory	Discussion
The Compton effect	Analytical treatment
Line spectra	Quantitative discussion, explanation using quantum theory.
Suggested level	Ch; 49 of H.R.K (Vol-2, Ed. 5)
WAVE NATURE OF MATTER	
TOPIC	**SCOPE**
Wave behavior of particles	de Broglie hypothesis
Testing de Broglie's hypothesis	Davission-Germer Experiment and explanation.
Waves, waves packets and particles	Localizing a wave in space and time.
Heisenberg's uncertainty principle (HUP)	H.U.P for momentum-position and energy time,
	H.U.P applied to single slit diffraction.
Wave function	Definition, relation to probability of particle.
Schrodinger Equation	To be presented without derivation (and application)
	To specific cases e.g., step potentials, and free particle, Barrier tunneling (basic idea).
STATES AND ENERGY LEVELS	
TOPIC	**SCOPE**
Trapped Particles and probability densities.	Particles in a well, probability density using wave function of states. Discussion of particle in a well. Barrier tunneling
The correspondence principles	Discussion
Dual nature of matter (waves and particles)	Discussion.

Suggested level	Ch: 50 of H.R.K (Vol-2, Ed. 5)
ATOMIC AND NUCLEAR PHYSICS	
ATOMIC STRUCTURE OF HYDROGEN	
TOPIC	**SCOPE**
Bohr's theory	Derivation and quantitative discussion; Franck
	Hertz experiment. Energy levels of electrons.
	Atomic Spectrum
Angular momentum of electrons.	Vector atomic model, orbital angular momentum,
	space quantization. Orbital angular momentum & magnetism, Bohr's magneton.
Electron spin	Dipole in no uniform field, Stern-Gerlach experiment, discussion of experimental results.
X-Ray spectrum	Continuous and discrete spectrum (explanation)
X-Ray & atomic number	Mosley's Law
Development of periodic table	Pauli exclusion principle and its use in developing the periodic table.
Laser	Definition, basic concepts of working of He-Ne laser.
Suggested Level	Ch: 51 of H.R.K (Vol-2, Ed. 5)
NUCLEAR PHYSICS	
TOPIC	**SCOPE**
Discovering the nucleus	Review, Rutherford's experiment and interpretation
Some nuclear properties	Nuclear systematics (Mass No. Atomic No. Isotopes)
	Nuclear Force (Basic ideas)
	Nuclear radii
	Nuclear masses, Binding energies, Mass defect.
	Nuclear spin and magnetism.
Radioactive decay	Law of decay; half -life , mean life
Alpha decay	Basic ideas.
Beta decay	Basic idea.
Measuring ionizing radiation (units)	Curie, Rad, etc.
Natural Radioactivity	Discussion, radioactive dating.
Nuclear reactions.	Basic ideas e.g. reaction energy, Q value
	Exothermic endothermic (some discussion on reaction energies in contact with nuclear stationer states).
Energy from the nucleus, Nuclear fission	Basic process; Liquid drop model, description,
	Theory of nuclear fission.
Nuclear reactors	Basic principles.
Thermonuclear fusion (T.N.F)	Basic process; T.N.F in stars.
Controlled thermonuclear fusion	Basic ideas and requirements for a T.N. reactor
Suggested level.	Ch; 54 of H.R.K (Vol-2, Ed. 5)

Electronics	
TOPIC	**SCOPE**
Semiconductor materials	Idea of energy bands and energy gaps
	(Qualitative). P-type, N-type materials.
Junction diode	Structure, characteristics and applications as rectifiers
Transistor	Basic structure and operation.
Transistor, biasing and transistor as an amplifier	Biasing for amplifiers, characteristics of common base, common emitter, common collector, load line, operating point, hybrid parameters. Common emitter mode (Explanation).
Amplification with feedback	Positive and negative feedbacks.
Oscillators	Oscillators, Multivibrators.
Login gates	OR, AND, NOT, NAND, NOR and their basic applications.
Suggested level	Basic Electronics by B. Grob.

B.Sc. Physics (Part-II)
PRACTICAL PAPERS

Paper C- Electricity & Magnetism (Practical) 15 Marks

1. To study the conversion of a pointer galvanometer into an ammeter reading upto 0.1 amperes.
2. To study the conversion of a pointer galvanometer into a voltmeter reading upto 3 volts.
3. To calibrate an ammeter and a voltmeter by potentiometer.
4. To comparison the capacitances of two capacitors by ballistic galvanometer.
5. To measure the unknown resistance using neon flash bulb and capacitor.
6. To determine unknown small resistance by using Carey Foster bridge.
7. To determine the charge sensitivity of a ballistic galvanometer taking into account logarithmic decrement.
8. To study the Acceptor circuit and determination of its resonance frequency.
9. To study the Rejecter circuit and determination of its resonance frequency.
10. To measure measurement of magnetic field by flux meter or by search coil method.
11. To study the I-H Curve for steel by the Magnetometer and calculate the energy loss.
12. To measure the value of horizontal component „H" of earth"s magnetic field by an earth inductor.
13. Investigation of induced current and voltage in secondary coil of a transformer as a function of number of turns and current flowing in the primary coil.

Paper D- Modern Physics and Electronics (Practical) 15 Marks

1. To determine the ionization potential of mercury.
2. To determine the charge to mass ratio (e/m) of an electron.
3. To determine the Planck's constant (*h*) by using Photocell method.
4. To determine the Planck's constant (*h*) by using spectrometer method.
5. To study the variation of photoelectric current with the intensity of light.
6. To study the Characteristic curves of a solar cell.
7. To study the characteristic curves of a Geiger–Müller (G. M.) tube.
8. To determine the range of Alpha particles.
9. To study the stopping power of alpha particles in air, Mica, Ag, Cu and Al.
10. To study the absorption coefficient of Beta-particles, using a Geiger–Müller (G. M.) tube.
11. To design a half-wave rectifier circuits and observe the wave shapes on the Oscilloscope.
12. To design a full-wave rectifier circuits and observe the wave shapes on the Oscilloscope.
13. To study the effect of smoothing circuits on the ripple voltage.
14. To study the characteristics of a semiconductor diode (PN junction).
15. To study the characteristics of a transistor (NPN and PNP).

16. To set up a single stage transistor amplifier circuit and measure its voltage gain.
17. To set up a transistor oscillator circuit and measure its frequency by using an oscilloscope.
18. To design circuits for logic gates (NOT, OR, NOR, AND, NAND, XOR) using discrete components.