35. Physics

B.Sc. Physics-II **Total Mark: 100**

Appendix 'A'

(Outlines of Tests)

Paper-A:	(Written)	75 Marks
Section-I:	Electricity and Magnetism (4 Q)	
Section II:	Modern Physics, Atomic and Nuclear Physics (3 Q)	
Section III:	Electronics (3 Q)	
Paper-B:	Electricity and Magnetism, Electronics, Modern Physics, and Nuclear Physics (Practical)	25 Marks

Note:

"Out of the Whole Syllabus (for a paper) there will be 10 questions as usual and the candidate will have to attempt 5 out of 10 questions. However;

There will be three Sections. Section I will be of four questions while remaining two sections will have three questions each. The candidate will have to attempt five (5) questions selecting not more than two (2) questions from each section.

Furthermore there will be 2 to 3 parts of question in each Section. One of the parts will be either numerical or a question related to the Physical significance of the topic (conceptual question)."

Appendix 'B'

(Syllabi and Courses of Reading)

Paper-A: Written (Time: 3 Hours) **75 Marks**

Note: Attempt five (5) questions selecting not more than two (2) questions from each section.

Sr. No.	Section	Subject
1	Section-1	Electricity and Magnetism
2	Section-1I	Modern Physics, Atomic and Nuclear Physics
3	Section-1II	Electronics

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. 5th)
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.
	Potential and field inside and outside an isolated conductor. Equipotential surfaces.
Suggested level	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. 5th)
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. 5th)
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. 5th)
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. 5th)
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. 5th)
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. 5th)
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. 5th)
Section-I: **Modern Physics, Atomics and Nuclear Physics**	
MODERN PHYSICS	
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. 5th)
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. 5th)
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. 5th)
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. 5th)
Section-III:	

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.

Paper-B: **Electricity and Magnetism, Electronics, Modern Physics, and Nuclear Physics** **25 Marks**

Sr. No.	Subject
1	Electricity and Magnetism
2	Modern Physics,
3	Atomic and Nuclear Physics
4	Electronics

List of Experiments for Practical Paper "B".

1. Electricity and Magnetism:

1. To measure the unknown resistance using neon flash bulb and capacitor.
2. To study the I-H Curve by Magnetometer.
3. To study the conversion of a pointer galvanometer into a voltmeter and an ammeter.
4. To calibrate an ammeter and a voltmeter by potentiometer.
5. To determine low resistance by Carey Foster bridge.
6. To determine the charge sensitivity of a ballistic galvanometer taking into account logarithmic decrement.
7. To comparison the capacitances of two capacitors by ballistic galvanometer.
8. To study the Acceptor circuit.
9. To study the Rejector circuit.
10. To measure measurement of magnetic field by flux meter or by search coil method.
11. To measure the value of horizontal component ‘H’ of earth’s magnetic field by an earth inductor.

2. Modern Physics, Atomic and Nuclear Physics:

12. To study the variation of photoelectric current with the intensity of light.
13. To determine the Planck's constant using spectrometer.
14. To determine e/m of an electron by deflection method.
15. To determine the ionization potential of mercury.
16. To study the characteristic curves of a Geiger–Müller (G. M.) tube.
17. To determine the range of Alpha particles.
18. To study the stopping power of alpha particles in air, Mica, Ag, Cu and Al.
19. To study the absorption coefficient of Beta-particles, using a Geiger–Müller (G. M.) tube.

3. Electronics:

20. To Set up half-wave and full-wave rectifier circuits and observe the wave shapes on the oscilloscope screen. To study the effect of smoothing circuits on the ripple voltage.
21. To set up a transistor oscillator circuit and measure its frequency by using an oscilloscope.
22. To draw the characteristics of a semiconductor diode.
23. To set up a single stage transistor amplifier circuit and measure its voltage gain.
24. To set up a high frequency oscillator and measure its frequency with a wave meter.

Note: Minimum 30 experiments should be performed, at least 12 from List of Experiments for Practical Paper "C" and 18 from List of Experiments for Practical Paper "B ".